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Letterform Research Needs Definition and Direction

A Report from the Editor

With this its tenth issue, the total number of pages published in *The Journal of Typographic Research* passes 1,000. This milestone would seem to provide the opportunity for a report on the *Journal* and on current letterform research.

The most obvious fact about letterform research today is its proliferation. Research has been going on since at least the early nineteenth century; a few scholar-printers and the occasional psychologist have over the past century and a half been interested (almost exclusively) in the history and legibility of printing types. Today, developments in a variety of areas are revealing implications for investigation undreamed of only a generation ago. Research on letterform problems is flourishing in areas of education, psychology, engineering, bibliography, linguistics, archeology, highway safety, electronics, cartography, architecture, graphic design, documentation, mass communications, aesthetics, the visually handicapped, poetry, art history, advertising/journalism, painting & sculpture.

Encouraging as this "twigging phenomenon" may be in the expansion of over-all envolvement by science & technology, the humanities, and the arts in letterform investigation, it is not without its problems. In an effort to provide some perspective on these problems, imagine that we were to ask an outside scientist—one who is unaware that our nebulous research area even exists—to examine and to report on the current "state of the art." We would guess that his first question might be: "Just how is your research effort *organized*?" Our response would have to be, "As a matter of fact, it isn't!"

There are two obvious indications of our lack of organization: first, letterform research is an academic orphan. Second, letterform research has no professional research body (such as the International Reading Association).

Perhaps the most damaging effect of our not having an established academic home is that the direction and progress of letterform research has remained completely dependent on other disciplines. The choice of research problems has been left to chance interest by individuals whose major concern is oriented elsewhere. The psychologist, the engineer, and the reading specialist when investigating letterform problems are not, in a very real sense, working in letterform research per se. They are working in psychology, in electronics, and in education. Understandably, members of an established research discipline are primarily interested in communicating directly with their peers within that discipline. The result, however, is frustration for any attempt to bring these interests together into some form of over-all organization of letterform research. Because the research tends to be directed internally within separate disciplines, results go unreported and unrecorded as *letterform* research, and their significance for us is lost. The *Journal* has a file of articles from psychological journals that report on experimental work in which letterforms were an integral part of the study but were ignored as a specific topic of research interest. (The responsibility for establishing the essential difference between psychological research on letterforms and letterform research in psychology does not rest with psychology; it rests with us.)

Equally disturbing is the fact that as separate satellite research areas develop—with no over-all organization of letterform research to refer to for a review of pertinent literature—each one, in turn, begins anew. Following prescribed scientific methodology, each area concentrates first on the most obvious, most easily approached problem areas; research multiplies on obsolete and overworked problems. The sophisticated, theoretical problems which would develop naturally out of a co-operative "multi-disciplinary" attack on letterform research are delayed indefinitely. In so diverse a field, the problem becomes one of establishing a research priority, of seeking out the right *questions*:

"A society of change influences its patterns of inquiry by putting a premium on the formulation of new questions and, in general, on the synthetic aspects of knowing. Such a society is by description one that probes at scientific and intellectual frontiers, and a scientific frontier (according to the biologist C. H. Waddington) is where 'we encounter problems about which we cannot yet ask sensible questions.' When change

is prevalent, in other words, we are frequently in the position of not knowing just what we need to know. A goodly portion of the society's intellectual effort must then be devoted to formulating new research questions or reformulating old ones in the light of changed circumstances and needs so that inquiry can remain pertinent to the social problems that knowledge can alleviate.

Three consequences follow. First, there is a need to re-examine the knowledge already available for its meaning in the context of the new questions. This is the synthetic aspect of knowing. Second, the need to formulate new questions coupled with the problem-orientation, as distinct from the discipline-orientation, requires that answers be sought from the intersection of several disciplines. This is the impetus for current emphasis on the importance of interdisciplinary or cross-disciplinary inquiry as a supplement to the academic research aimed at expanding knowledge and training scientists. Third, there is a need for further institutionalization of the function of transferring scientific knowledge to social use. . . ."[1]

One of the unfortunate results of the parochialism discussed above is the damper it puts on constructive criticism among the research areas. There is a lack of scientific excitement, no cross-fertilization of insights, no clash of ideas. The yeast is missing!

A recent article in *The New York Times* reported that interanimal memory transfer is "a subject of burning dispute and hot pursuit in psychological laboratories everywhere." While we certainly do not have any theoretical breakthroughs to match interanimal memory transfer, can you recall a single theory or problem that caused even the slightest ripple across letterform research? There is a lack of the excitement one would expect to find rampant in an expanding, under-developed research area where pioneering could be an every-month occurrence. Lack of organization is partly responsible, but we suspect there are other more deep-seated reasons.

The *Journal* is unique in at least one respect: a fairly large percentage of its readership appears to be unfamiliar both with the role of a scholarly journal and with the concept of scholarly research as an intellectual battleground. A recent letter to the editor began, "Today arrived the October issue of the *Journal* and offered again a few hours of interesting information. . . ." While we appreciate these kind words, a scholarly journal survives not as a source of interesting information but as an opportunity to *participate* in a process. Participation requires more than curiosity, and it demands an understanding

of the plodding, careful accretion of scientific progress. It is sometime difficult, for example, to convince authors from the design area that what did *not* work may sometimes be as important as what *did*. And our understanding must be broad enough to encompass research that, on first consideration, seems to be totally irrelevant:

"The support of science must not solely depend upon its immediate and visible use for profit. We have had lately a rash of ridicule directed at research projects that seem utterly unrelated to practical life. I recall the mixture of amusement and scorn that, some time around 1920, greeted the news that scientists at Johns Hopkins were working on a proper diet for rats. Yet this was a pioneer study on vitamins, and many of us who today are free from rickets and blessed with sound teeth owe their good fortune to this seemingly frivolous enterprise."[2]

Criticism is a vital part of this participation. But from the *Journal*'s vantage point we seem to detect confusion between two definitions:

"*Criticism.* [1] the act of criticizing unfavorably; faultfinding; censure. . . . [3] the art of judging or evaluating with knowledge and propriety the soundness of scientific hypothesis and procedures."[3]

Criticism [3] is science's most effective cohesive force. Ignored or confused with Criticism [1], participation is stifled, which in turn stifles progress within the discipline. For example, letterform research (particularly strict typographic research) is divided and confused today largely for the lack of criticism which surrounded the late Stanley Morison.

We have implied: first, that there is a natural connection—however tenuous—between the various areas of letterform research; and second, that there may be some mutual benefit to the areas involved in pursuing that connection. We trust, also, that the *Journal*'s motives over the past two and one-half years have been obvious: to identify and encourage letterform research but also, indirectly, to see if the ideas are substantial enough and the research extensive enough to support a general theory of letterform research. We believe they are. But granted the importance of these ideas and granted the benefit of organizing, could we convince the constituent parts of the advantages in their considering a new group of peers in letterform research? Would it be possible to bring together interests from such a wide variety of disciplines into a structure that these disciplines cannot or

will not themselves singly support? Consider the contemporary example of linguistics:

"Linguistics as a separate subject is comparatively new. In most universities in the United States a department of linguistics consists mostly of an interdisciplinary committee formed of members of the departments of English, classics, romance languages, German, etc., and members of other departments who happen to take an interest in or have made contributions to the theory of language from an over-all point of view. It is only in recent years that there have been departments of linguistics operating on independent budgets, with full-time members on the staff. Candidates for a Ph.D. in linguistics are often advised to keep an eye on some special related field—literature, history, area studies—so that they can find openings for jobs other than in linguistics as such. All this is, of course, no new story. At the time I was concentrating on physics, people could not understand what one could do with physics except teach. In the 1910's there was such a profession as a chemist (in the American sense), but not as a physicist. The *Encyclopaedia Britannica*, which was then in its ninth edition, had no article 'Physics'; it had only 'Natural Philosophy.'"[4]

Linguistics is in the organizational processes of bringing together a conglomerate academic interest in our *oral* language. As we have been suggesting in the *Journal* for several years, we might very well consider bringing together a conglomerate interest in our *visible* language.

To return to our outside scientist's examination, his second question might well be, "If your research effort lacks organization, how do the various elements—research, technology, and design—*communicate* with one another?" And our reply would again have to be, "As a matter of fact, they don't!"

Traditionally, typography has had to live with a vague misunderstanding between those who *work* with letterforms and those who are interested in studying the effects and history of these letterforms. Typographers and other graphic designers have continued to hold research at arm's length, with an odd mixture of awe and distrust. They do this not without reason. For example, Miles A. Tinker, who has spent a lifetime in legibility research, is concerned exclusively with the psychological phenomena. The relation of his work to other letterform research problems doesn't interest him, and he has made it quite plain that typographic designers only confuse the issue. As

Fernand Baudin pointed out in his review of Dr. Tinker's latest book, "While the current methods, opinions, and practices of teachers are implicitly and explicitly accepted as sound, as expert and beyond any question; all typographers *en bloc*, whether expert or not, are presented merely as introspective esthetes deserving, on the whole, of contempt [references added]."[5]

At the same time, our art and design schools, although producing most of our typographic designers, have until quite recently concentrated on the practice of design to the almost total exclusion of letterform history and research. Yet each year instructors and advanced students produce a wealth of visual experimentation on communication problems. These experiments are now mostly meant only as personal or institutional projects, and the results are rarely documented for outside access. Granted, design schools are not research institutions; yet, as with any other universal search for answers to human problems, there is a natural association of all this experimental work that could be encouraged through the development of an experimental design methodology. There are several heartening developments toward this goal, especially in European schools; see, for example, the excellent report on England's Working Party for Typographic Teaching in the last number of the *Journal*.[6]

Entry of the design schools into the research/experimentation arena is encouraging for another reason: it may portend one way out of an old dilemma in letterform research: the people who could do the research have not been particularly interested in broad letterform problems; the people who are interested in letterform problems could not do the research. This is an over simplification, of course, but it pinpoints an educational alternative we have. Should we attempt to provide (force feed!) the psychologists, engineers, and educators with basic understanding of the creative elements of letterform application? Or, should we concentrate on indoctrinating our design students with electronic technology and scientific methodology? We obviously need both, but it is becoming increasingly clear that a student going into research in *any* field—in design especially but also in liberal arts, social science, or natural science—will be severely handicapped without the ability to program a computer and understand its application for research work.

Today there is increasing uneasiness about the invasion of electronics. Indeed, at this time, we *encourage* your uneasiness!

Item: About five years ago the Standards Institute of the United States gathered together a committee to direct the development of the United States standard optical character recognition typeface. Not one of the 25-man committee had any connection with typography or type design. And although "a USA Standard implies a consensus of those substantially concerned with its scope and provisions," to our knowledge no notice of its consideration appeared in any typographic/graphic arts publication.[7]

Item: Less than two years ago *Automatic Typographic-quality Typesetting Techniques: A State-of-the-Art Review*, was published; it had developed, according to Director A. V. Astin, out of "a continuing program to collect information and maintain current awareness about research and development activities in the field of information processing and retrieval."[8] Even with this commendable program to guide them, the authors demonstrated their total ignorance of the wealth of letterform research that has accumulated over the past century and a half. The following paragraph, for example, was used to conclude the summary section of their monograph:

"[A. C.] McIntosh, for example, makes the following pertinent comments: '. . . I wonder whether a very small sum of money by comparison with the hundreds and thousands of pounds which are going into this technology at the moment might be devoted to some fundamental study of readability, typefaces, sizes, hyphenation, justification, and supposed standards of typography. If that study were undertaken on a national basis or an international basis—which, as far as I know, has never been attempted—it might eliminate a lot of the problems into which a tremendous amount of effort is going.' "[9]

We must admit to our failure to understand the reluctance of the electronics establishment to consider seriously the contribution 500 years of typographic heritage might make to basic engineering/electronic application of letterforms. One is tempted to write it off, as one wag put it, to being down on that which they are not up on; but there is a basic blindspot here that seems to defy normal rationalization. How did the essentially *practical* solutions of the type designer in adapting two-dimensional letterforms to three-dimensional slivers of

metal—through cold, hard application of "form follows function"—ever get preemptorily lumped under "aesthetics?" Engineer Gutenberg invented, perfected, and exploited both interchangeable parts and mass production techniques 350 years before Eli Whitney's muskets and 450 years before Henry Ford's Model T. Following an initial period of reproducing facsimile handwriting in metal, type designers have for 500 years (in anticipation of the best industrial design traditions) been combining the restrictions of the medium with the requirements of the subject matter. With the introduction of electronic phototypesetting, what have the engineers been doing? They have been going through an initial period of reproducing facsimile metal type in cathode ray tubes, slavishly following sixteenth-century Garamond, eighteenth-century Baskerville, and nineteenth-century Bodoni right out of the window.

The engineers have had it all their way, of course, because electronic type design has not been a critical factor in sales. However, there may be an interesting parallel here with the automobile industry. After the initial facsimile horse-and-buggy period and once the jockeying for superior hardware had settled down, it has been more-or-less a toss-up on engineering quality between comparable products from General Motors, Ford, Chrysler, *et al.* Today, what controls Detroit? Design.

If the above seems to indicate that type designers are beating down the engineers' door to co-operate, nothing could be further from the truth. Type designers have a similar hang-up: mention "computer" and "electronics" to them and they throw up their hands. Any attempt, or suspected attempt, to usurp their design prerogatives is immediately open to suspicion. For example:

The initial report on the computer graphic system ITSYLF (or Interactive Synthesizer of Letterforms) was, in our opinion, one of the most important articles the *Journal* has published.[10] ITSYLF has the potential of becoming a revolutionary new tool for type design and for typographic research, possibly the most important development since Benton's punch-cutting machine of 1885. ITSYLF, Drs. H. W. Mergler and Paul Vargo explained, was developed primarily to help the type designer "to use the data handling capabilities of modern computers . . . and to manipulate the letterforms based on the designer's concepts of them." Briefly, the type designer would be able

to synthesize any existing typeface or any hypothetical new typeface he may consider designing or want to experiment with. Connected with existing CRT systems, ITSYLF could show the type designer any proposed new typeface—almost instantaneously—in any size, and composed into paragraphs and pages.

Two responses, one solicited and one unsolicited, indicated in no uncertain terms that the authors' intentions of developing a new tool to *aid* the type designer was completely misinterpreted as a threat to *replace* the type designer. Type designers are understandably sensitive because of repeated attempts since the sixteenth century to establish a system of geometrically "perfect" letterforms.[11] Their current distrust of the mechanical-drawing approach by engineers, therefore, should not come as any surprise. Established preconceptions die hard, with type designers as with the engineers' "all type designers are esthetes."

Basic to meaningful communication among a variety of disciplines is a central body of research literature. Any attempt to round up letterform research today requires a journal-by-journal, number-by-number search through scores of periodicals and monographs. There is no systematic indexing under letterform/alphabetic topics either by the journals themselves or in general indexes and reference works. While the number of abstract services is mushrooming throughout the world, not one even superficially covers letterform research. (The *Journal* hopes to inaugurate such an abstract service during 1969 under the direction of Dr. Richard Wiggins of Louisiana State University.) There has been an occasional, selected list of research reports, but none of these have attempted to bring in all of the areas that impinge on letterform research, nor have any made an attempt to locate the research within the larger over-riding research questions or to evaluate critically the research methodology.

We are living on borrowed time; if our research categories are not keyed into the electronic documentation systems being developed today, any movement to bring together letterform research may find itself severely handicapped for the forseeable future.

The secret of medicine's successful communication network—both horizontally through basic supportive sciences such as biochemistry and vertically from research laboratory through medical schools to every practitioner—is the constant feedback of information.

We all fit in somewhere along the research-technology-design continuum of letterform research; ask yourself: how often have you received or written constructive criticism on a letterform research problem? In a recent *Journal*, John Seybold discussed the lack of co-operation on problem definition by *users* (e.g., typographic designers) of computerized photocomposition:

"What we most require is the sympathetic and imaginative interest of those whose calling it is to establish the yardsticks which measure the product and help to distinguish good from bad. They must learn, as we have had to learn, to move from the particular to the general. Instead of saying that 'in this case I don't like this solution because . . .,' they must be able to re-phrase their criticism so that we can draw from it the following: 'when these conditions occur, and these alternatives exist, this is the path you should follow.' Given this degree of assistance, the ultimate result will be not a deterioration of quality, in a mass production era, but greater style, vivacity, variety, and beauty than we have achieved in the practical world of book composition by the application of conventional methods."[12]

By far the most exciting communication activity between research areas today is at the boundary between the arts and sciences; for example, electronic music and computer art. Basic questions about structure, pattern, form, organization, order, and information are being asked on both sides, and *of* both sides. Is there a better testing ground for experimental collaboration among artists, engineers, and scientists than research on letterforms? Since its earliest beginnings, the alphabet has provided a meeting ground for the interaction between art and science. No educated person can look at letterforms without encountering two conflicting stimuli: the *meaning* of the letters (the underlying "g-ness" of differently-shaped letter g's) and the *form* of the letters (the presence of genius)—in other words, a convergence of reason and beauty.

We have yet to realize the potential benefit from establishing communication with letterform research of other language systems. A Japanese psychiatrist, for example, has pointed out that children learning to read Oriental characters have only a fraction of the reading problems affecting children who are learning to read roman characters—indicating that prevalent reading problems in Western countries (such as dyslexia) may be due less to the child's own physical and mental make-up than to problems inherent in the alphabet.[13]

In other words: basic letterform research! And a recent newspaper article reports a Russian proposal for partial reformation of the 33-letter Cyrillic alphabet. It is intended to thin down some of the bulkier letters (e.g., creating three different i's) thus "saving type metal, paper, . . . and space equivalent to two million books in Moscow's 20-million-volume library."[14]

There has never been (to our knowledge) a conference designed specifically to bring together the people actually *doing* letterform research, to exchange research findings and to compare notes on techniques and methodology. The value of such a meeting is reason enough to strengthen any development toward a strong professional research organization; indeed, such a meeting may be the initial step.

If our research efforts are to produce the information and understanding we expect of them, every area of letterform interest must be made to realize the present state of near-chaos in research organization and communication. We deceive ourselves and do our profession a grave disservice if our research effort is allowed to continue to drift, subject only to the uncertain whim of technological change and disinterested, outside research and experimentation.

Merald E. Wrolstad, *editor*

1. Emmanuel G. Mesthene, "How Technology Will Shape the Future." *Science*, CLXI (July 12, 1968), 138–39.

2. Paul B. Sears, "Telltale Dust," *The American Scholar*, XXXIII (Spring 1964), 201.

3. *Webster's New International Dictionary of the English Language*, 2nd ed. (Springfield, Mass.: G. & C. Merriam Co., 1961).

4. Yuen Ren Chao, *Language and Symbolic Systems* (Cambridge: Cambridge University Press, 1968), p. 4.

5. Book review: M. A. Tinker, *Bases for Effective Reading*, *Journal of Typographic Research*, I (April 1967), 204–5.

6. "Typographic Education. England: The Working Party on Typographic Teaching," III (January 1969), 91–102.

7. *USA Standard Character Set for Optical Character Recognition*, (New York: USA Standards Institute, 1967), p. 2. It should also be noted that, in contrast to the USA position, the equivalent European committee had the good sense to include Adrian Frutiger as consultant.

8. M. E. Stevens and John L. Little, National Bureau of Standards Monograph (Washinton: U.S. Government Printing Office, 1967). p. iii.

9. *Ibid.*, p. 89.

10. H. W. Mergler and Paul Vargo, "One Approach to Computer Assisted Letter Design," *Journal of Typographic Research*, II (October 1968), 299–322.

11. See: Hermann Zapf, "Changes in Letterforms Due to Technical Developments," *Journal of Typographic Research*, II (October 1968), 351–68; and Millard Meiss, "The First Alphabetical Treatises in the Renaissance," *Journal of Typographic Research*, III (January 1969), 3–30.

12. "Aesthetic Values in Computerized Photocomposition," II (October 1968), 350.

13. Kiyoshi Makita, "The Rarity of Reading Disability in Japanese Children," *American Journal of Orthopsychiatry*, XXXVIII (July 1968), 599–614. Reports indicate that Dr. Kiyoshi's study caused a flurry of discussion in the British press, but this has not been seen by the writer.

14. "Russian Proposes Alphabet Reform to Eliminate Thick Letters," *The New York Times*, 26 January 1969, p. 3.

Type Variation and the Problem of Cartographic Type Legibility

PART ONE: *Cartographic Typography as a Medium for Communication; The Cartographic View of Legibility*

Barbara S. Bartz

An analysis of the varied functions of lettering on the map suggests that typographic appearance and arrangement on the map may be viewed with respect to a symbolic-analogic continuum. Type is considered to be: 1. Symbolic; 2. Analogic—a. Locative analogy, b. Quality analogy, and c. Quantity analogy (or value analogy). A review of the cartographic literature having to do with the conception and treatment of "legibility" reveals that its content is derived primarily from typographic research done in non-cartographic context. Since it can be shown that type use on maps is unique in several ways, the applicability of that research is questioned.

Although problems in the selection and arrangement of lettering are among the most complex of those confronting the cartographer as he designs the map, there is a notable lack of literature on the subject to which he can turn for guidance. There is general agreement that above all, the lettering[1] must be "legible." Yet this term is not often defined, nor are objective, behavioral criteria given for assessing it. It seems clear that there is a need for consideration of several things.

In the first place, we need to understand better the purposes of cartographic typography as a medium for communication. We need to know in what ways the type employed on a map is similar to or different from type as it is used in other contexts, particularly that of running text. Success of typographic arrangements in both situations is now judged primarily in terms of what is called "legibility," but the criteria for success would appear to be quite different from what legibility ordinarily connotes.

Further, because the term itself is used in such a variety of ways, it seems that for all practical evaluation purposes, the term legibility must either be objectified or abandoned entirely and

replaced with a more useful terminology. In order to decide which of these alternatives to select, it is necessary to determine (a) what cartographers have thought and written about the legibility of type, and (b) what psychologists, educators, and typographers have produced on the subject of type legibility.

Finally, the definitions provided by these groups appear to provide inadequate grounds for assessing legibility in cartography; consequently a new rationale is developed to assist in cartographic choice. In order to determine how well the proposed rationale functions, its utility is examined in the experimental setting.

This sequence of ideas provides the basic structure for this series of four articles.

Cartographic Typography as a Medium for Communication

In ordinary language, certain sounds are used to represent objects. These sounds can then be represented by a series of conventionalized geometric forms arranged in a prescribed manner, that is, the letters of the alphabet and the words formed by grouping portions thereof. The objects represented can either be considered unique, and labeled accordingly (e.g., William L. Smith, Jr.), or they can be considered members of a class of objects which share certain agreed-upon characteristics and a general name (a man).

In cartography an arrangement of graphic elements (limiting ourselves here to the case of maps printed in ink on paper) represents some reality, where arrangement in space is of special concern or interest. Such an arrangement would be difficult or impossible to represent and convey in the word-sentence-paragraph sequence of everyday language. The set of possible graphic elements which can be used in cartography to do this is almost infinitely varied, and thus is considerably more complex than the usual 26-character alphabet of the English language. The lettering on a map (which is a sub-set of all the graphic elements) can be used in a far greater variety of ways than can the letters which make up conventional text, and the reasons for this will soon become apparent. We can refer to a few of the ways in which type "functions"[2] to illustrate this point.

The major distinctions which must be made between cartographic use of labels (or words) and the use of words in ordinary speech is that

while most speech is concerned with *classes* of objects (and ideas are here considered similar to a class of objects, since the notion of generality is inherent in the term "idea"), maps are usually not so concerned. Rather, the kind of reality depicted on maps has to do with specific, unique place-labeling. That is, we are concerned with "Chicago," not with "city." It would be exceedingly unhelpful to have a map which simply showed "city" and "road" and "river" in various places. While we do depict classes of information on a map (e.g., all cities are equated with a black dot symbol), we usually remove each place from its class by labeling it with a name which encodes its uniqueness in location and character.

Further, the place labels themselves have no essential connection with one another, nor can any of them be combined to form new "ideas." That is, while a word may take on different meanings and grammatical functions from its varying arrangements with other words, names are not so affected. Associations or verbalizations which different individuals might make about a city name would vary, but the essential referent is still unique and unchanged. Thus place labels (although they are words in the sense of being permitted, pronounceable sequences of letters) are conspicuously different from the more general labels (nouns and pronouns) found in ordinary speech and text.

In addition, both the physical characteristics of the letter shapes (type style) and the arrangement of the shapes on the map may encode considerable information. This is a rare occurrence in non-cartographic typography. The implications of this coding will be examined in more detail below.

While it may seem that we are belaboring the obvious, there is good reason for making these points. The applicability to cartographic problems of research into the legibility of letter, word, and text is plainly brought into question by the distinctions just drawn. This becomes even more apparent when the nature of the reading process is analyzed.

At the most basic level of consideration, the map type codes sounds (which are place names) in conventional arrangements of letters. In this respect it is identical with all other possible type uses. Note, too, that at this level one is very little concerned with the

physical form of the type; in a sense, it is "transparent" for we wish to sound out the name as a unit, but do not want to consciously dwell on the circularity of the O, on the straight line and curves of the B, and so on. In reading text, for example, if we are consistently conscious of the type, it must be poorly chosen.

In the following passage, Polanyi makes clear the transparency of both language and typography. He also makes a point about the nature of reading which seems to be directly relevant to a distinction which attains great importance in cartography. "Even *while* listening to a speech or reading a text, our focal attention is directed towards the meaning of the words, and not towards the words as sounds or as marks on paper. Indeed, to say that we read or listen to a text, and do not merely see it or hear it, is precisely to imply that we are attending focally to what is indicated by the words themselves. But words convey nothing except by a previously acquired meaning. . . . Thus the meaning of a text resides in a focal comprehension of all the relevant instrumentally known particulars, just as the purpose of an action resides in the co-ordinated innervation of its instrumentally used particulars. This is what we mean by saying that we *read* a text, and why we do not say that we *observe* it."[3]

The map user is not expected to look "through" the lettering; he frequently does, but the map maker does not expect him to. More accurately, perhaps, he is expected to look both *through* and *at* the lettering. The reason for this is obvious; names—that is, the type—on a map are expected to encode a great variety of information. The variety is such that we will even find it hard at times to generalize at the level of discussing "lettering in cartography"—and it may be useless, as well as difficult. For the purpose of the following analysis, let us consider a rather densely-lettered place name reference map, such as we might find in an atlas.

Map Type Characteristics Analogous to Reality: Location. The arrangement of the type on a map is physically analogous (in varying degrees) to the location of items on the surface of the earth. This is in contrast to the orderly and conventionalized arrangement of type in a linear sequence which is analogous to the manner in which it is spoken (a time analogy, not a spatial one). This restriction on cartographic

type naturally introduces complications in both the analysis and use of map type. One complication is that the same place name (that is, a real place on the earth's surface) will rarely, if ever, occur (a) in the same place relative to the map page edges, and (b) in exactly the same place relative to other names on the map, as one goes from map to map. Scale changes, projection changes, and extent of area mapped will all affect the location of the type. Though it may be very brief, *the locating of any name on a newly-encountered map will require a period of search.*

Although all name locations on a map are analogous to feature locations on the earth, some are considerably more so than others. The arrangements of the letters of a place name may indicate:
(1) point location
(2) linear and areal extent
(3) shape and orientation of a feature.

City names are usually compactly placed as closely as possible to the point symbol which represents the city itself. Numbers might be carefully placed on the point representing a spot elevation. Linear and areal extent are familiar to any map user, for country names are usually spread from border to border. Shape and orientation can be illustrated with the familiar example of "Appalachian Mountains." It would be quite unusual to find that name arranged any other way than along the southwest-to-northeast axis of the map page.

It is important to notice that we have not termed the above uses of cartographic type "symbolic." "Analogous" seems a better word, for there is a physical (rather non-arbitrary) resemblance between the real location and arrangement of the mapped feature and the location and arrangement of the cartographic type which names it on the map.

Map Type Characteristics Analogous to Reality: Quality and Quantity. There are additional ways in which type can be considered analogous to some characteristics of the reality it identifies. While the situations described above can be considered *locative analogy*, we can also observe other uses of type which might be called *quality analogy* and *quantity (or value) analogy*. What is meant by these terms will become clear from some examples.

Perhaps the most common use of a type characteristic which might be considered a quality analogy is the very traditional use of italic type for labeling various classes of hydrographic features. There seems to be fairly general agreement that this type came to be used in this fashion because it looks wavy and more "flowing" than other forms of type.[4] Very often, too, hydrographic type is not only italic, but is also blue.[5] Both of these choices of type characteristics are somewhat related to associations with or perceptions of physical reality characteristics, and thus are not completely arbitrary symbols. If the hydrography were depicted in fluorescent pink Times Roman type, it would be very difficult to imagine that this choice was analogous to any physical reality—it would therefore become purely symbolic, where arbitrary associations are made between the class of objects represented and the character of the physical representation system. In other words, type is often thought to have visible characteristics which are like those of the object or class of objects named; a physical, quality analogy is established. Such type variations are then used to distinguish one class of mapped data from another, and this can be considered to be a nominal scaling procedure, though it may introduce ordinal scaling as well.

Quantity or value analogies are very common in any map user's experience. One would be quite surprised, for example, to look at a map of the United States in any atlas, on which 24-point type had been used for Waupaca, Farmersville, and Suring, while 4-point type had been used for New York, Chicago, and Los Angeles. The height or boldness of city names is usually scaled relative to population. This is a simple example of quantity analogy.

Value Analogy. Value analogy is somewhat more complicated. In the terminology of scaling procedures, quantity analogy as used here would involve interval and ratio scaling; value analogy would involve primarily ordinal scaling procedures. In value analogy, the cartographer is concerned to give the map user some idea of relative importance, where the phenomena depicted are not strictly comparable in a numerical way. This will be clearer if we consider a practical example. For the purposes of a particular reference map, let us say, countries are more "important" than cities, which in turn

are more "important" than rivers. Thus the type used for country names is 24-point, that for cities 12-point, and that for rivers 4-point, though the type styles used might vary from category to category. Quantity analogy would be used to approximate variations *within* a class, where numerical comparisons would be possible, e.g., from one city population to another. But value analogy would occur when comparisons of magnitude are made *among* classes of information, or when arbitrary hierarchies of intellectual importance are established within a category, e.g., one could imagine a world map, made in Switzerland, where the name Switzerland would be set in the largest typeface, and all other country names would be smaller type.

Map Type Characteristics: Non-Analogous (Symbolic). But type can be used in far more arbitrary fashion than the ways just described; when it seems that the association between the appearance of the type and any perceptible physical characteristics of the class of information being mapped is completely arbitrary, we can consider the use of type to be purely *symbolic.* For example, in choosing a typeface into which the name United States will be set on a map, there would be no basis in physical analogy for selecting, say, 8-point Century Schoolbook over 8-point Times Roman. The arbitrary assignment of either face to the class of political unit names is considered *symbolic* in this discussion.

For our purposes of analysis here, then, we are establishing a continuum against which type selection can be evaluated. This continuum ranges from purely symbolic to purely analogic. There are certain type variations which are associated with positions near the ends of the continuum. Type arrangement, boldness, and height are usually used to indicate some sort of analogy between the features named and the type which names it. Type style and form (capitals, lower-case) are more often used in purely symbolic fashion. It seems more appropriate to illustrate this point than to discuss it further.

If a map shows five categories of city size, and if each of these categories is depicted in its own typeface, there are infinitely many ways in which the type for each category can be chosen. In practice, however, there would be two schemes which would illustrate the

range from *symbolic* at one extreme of the continuum to *analogic* at the other. In the case of the symbolic extreme, the largest cities (in population) could be labeled in 8-point Futura, the second largest in 8-point Optima, the third largest in 8-point Times Roman, the fourth largest in 8-point Baskerville, and the smallest in 8-point Bodoni, with there being no apparent physical connection or analogy between the type style chosen and the city population it represents. Assuming that all the styles had approximately equal visual weight, there would be no possible way for the map-user to determine which style represented which city-size class.

At the analogic end of the continuum, the largest city-size class could be depicted in 24-point Univers, the next largest in 20-point, the next in 16-point, the next in 12-point, and the smallest in 6-point. While the choice of the Univers type style for cities is symbolic, the choice of type size is analogic, since the population scale corresponds to the variation in the height of the type. In practice, of course, the cartographer usually combines these two possible kinds of variations, in more or less systematic ways. He is often aware of the scaling problems involved only at the intuitive level, and he can consequently do things which seem natural to him, but which are, in fact, quite arbitrary and even irrational.

Map Type as Scale-Indicator. There is one other way in which there is no apparent comparison between type as used on a map and type as it is used in text. The complex of type on a map somehow provides a crude sensation of scale. The relative sizes and weights of type appear to produce subtle cues of scale, and we become aware of the phenomenon only when we sense that there is something wrong with the way the map looks, in comparison to the approximate scale range in which we know it to be. There is no definitive research on this subject yet, though this author has conducted an informal research project which showed quite clearly that even for relatively unsophisticated map users, type is a possible scale-indicator.[6] It also showed that the matter warrants a great deal more investigation. The point is made here only to suggest that there is yet another variable which might affect comparisons made between type as it is used and evaluated in text material, and type as it is used in cartography.

Summary. The type on a map is similar to type in other uses in that the 26 letters of the alphabet are used to code sounds, which in turn are codes for unique or general referents. Map type, however, is normally concerned only with coding unique referents, that is, place names. Further, map type can represent arrangement in space of the referents, depending upon whether it is related to a point location, an areal or linear extent, or the shape and orientation of the named feature. In addition, the physical characteristics of the type itself may be thought to denote some characteristics of the mapped feature, and therefore can be considered to function in analogic fashion. The analogy may be of a qualitative or quantitative nature. If the type is used in a purely arbitrary fashion to code an aspect of the mapped feature, we consider that it functions then in a purely symbolic capacity. Additionally, map type seems to provide cues of scale.

The Cartographic View of Legibility

So far we have described only the ways in which map type *may* function, but have not considered the next logical step which is to ask a two-fold question: (1) Does the map type actually function for the map user as the cartographer imagines that it should? (2) Are there ways of assessing the *degree* of success the cartographer achieves as he uses type to convey a great variety of information? How can one ever say, "The lettering on this map is better than the lettering on that map?" and have it be anything other than a purely subjective opinion? Such statements are frequently made, but on what basis? If this question were to be answered, "Why, this type is more legible, of course," one would have then a tautology, not an explanation.

In common usage, legibility refers to a feeling that something can be read easily, or that one thing seems clearer than another. But reading, in the ordinary sense of the word, refers to the acquisition of meaning from continuous text. If one merely pronounced the word "wortuysak," with no comprehension of its meaning, the process would not be called reading. Yet in a sense, this is what happens with a newly encountered map, for unfamiliar names are nonsense words—pronounceable, but having no associations or meaning. From this example it should become quite apparent that the bases for evaluating typographic legibility of running text (most often with

speed-of-reading tests) and the bases cartographers might have for evaluating legibility of cartographic type must necessarily be different. Yet cartographers do not seem to have given the matter much attention, either philosophically or experimentally. This will become very clear as we review the cartographic literature which is relevant to lettering in general and legibility of lettering in particular. We shall find that there are no experimental data at all that we can use to answer either of the two major questions asked above.

This scarcity of material is somewhat concealed by two things: (a) rather assertive statements in the literature about what is *believed* to create cartographic type legibility, and (b) freely applied data from typographic research done in non-cartographic contexts, with no empirical verification of its applicability.

Though the following passage comes from a design journal, it is applicable to cartography as well. "As *Design* discovered in its own recent analysis of the Univers typeface, there is no real body of knowledge about graphic design—slogans substitute for fact; 'Sans serifs are unreadable,' 'Baskerville is best,' and so on."[7] How prevalent such slogans are in cartography is illustrated in a 1964 article called, "Map Design and Typography." "Scientific investigation has shown sans serif to be the worst of all type styles for word recognition."[8] This is a substitute for a fact, but is not a fact itself.

In cartographic literature, legibility is very often an Alice-in-Wonderland word, which can mean whatever one decides it should mean. It seems necessary here to point out that there are two broad and very different (yet often intermingled) senses in which the word is used. Neither is identical to the more common use of the word "legibility" in connection with printed text materials.

One use of the word has to do with the map as a total display, while the other is confined to the type which occurs on the map. When the term is used in reference to the entire map, it usually means that the map gives the viewer an impression of graphic and/or conceptual clarity. The complex relationships of figure-ground networks embedded in and superimposed upon one another which make up the graphic display that we call a map often provoke an mpression of clarity or lack of clarity. The map which is somehow clearer is referred to by the user as more legible. It seems to him that

the map would be easy to use, easy to "read," easy to make sense of.[9] We can cite some examples of the term as it has been used in cartographic literature to describe such a feeling.

In the English summary of an article by Eduard Imhof[10] there is the sentence: ". . . for legibility and clearness of a map essentially depend on a good position of names and spot elevations." Another such example is the following sentence from Arthur H. Robinson's *Elements of Cartography*: "A greater use of well-formed lower-case letters will improve the legibility of a map."[11] Both of these sentences illustrate the lack of distinction between the legibility of a map (as a whole) and the legibility of the type (as it might be assessed in text or display situations). Throughout the remainder of these articles, we will be concerned with the second notion of the legibility of cartographic type itself, rather than with the overall legibility or clarity of the map as a whole. It seems likely that increased type legibility would contribute to increased overall map legibility, but that is not part of this study.

With this general introduction in mind, we can proceed to an examination of the available cartographic literature on lettering, emphasizing particularly the treatment of the notion of type legibility.

Material in Books. The most complete summary of material to the year 1921 is contained in Eckert's *Die Kartenwissenschaft* (Volume One).[12] The chapter "Kartenschrift und Kartennamen" is only eighteen pages long (compared with the total 639 pages in the first volume), but it contains a variety of material.

Eckert tends to emphasize maps where accurate and detailed portrayal of the terrain is of major concern. His use of the word "clarity" can often be taken to mean that which does not obscure the terrain drawing.[13] Eckert does not agree with those who believe that the best map lettering is no lettering at all (a point of view we shall encounter in more recent times in the work of Erwin Raisz). Eckert notes: "Therefore the name is not an element which is strange to the map, but rather an integral part of it. . . ."[14] He quotes others who call the names on the map "a necessary evil," "an unpleasant necessity," and "a strange element." Eckert makes a great many pronouncements, but offers little in empirical evidence to support his

points of view. He offers a "rule" for the size of type in the map title (for example, $h=2.1\sqrt{I}$, where h=height of letters in mm., and I=paper surface in cm.^{2})[15] with absolutely no rationale for doing so.

Most recent textbooks in cartography offer very little on the subject of lettering. Hinks' *Maps and Survey*, for example, contains only seven pages on the subject of lettering, and the material simply consists of practical techniques and styles in hand-lettering.[16] He makes an interesting comment on the complexity of lettering as it is used on maps: "The student should examine carefully the characteristic sheet of the International Map . . . to learn how very much information can be conveyed by careful variation in the lettering of names; most of which escapes the uninstructed user of the map."[17] Since most map users in this country are relatively uninstructed, we can carry this one step further and assume that much careful variation in cartographic type does indeed escape the users.

Erwin Raisz is a cartographer best known for his carefully drawn landform maps. One would expect that he would be most interested in place-labeling which would not obscure his drawing. Such is indeed the case, and he is either famous or infamous for his statement, "The development of expressive cartography has been hindered more by lettering than by any other cause."[18] He would no doubt feel differently about the matter if he had worked for a road map company, where there would be very little to express if it were not for the place names.

Names and lettering are peripheral to maps in Raisz' view: "People are more critical of lettering and spelling than of the actual content of maps."[19] It seems difficult to believe that one could separate names and content in such a manner. He himself says at another point: "Map publishers have found by experience that maps without names do not sell. An unnamed feature will not be remembered easily."[20] If a feature were to be so unimportant to man as to never have received a name, it is unlikely that it would be important enough to be mapped in a recognizable way.

Two books by Robinson contain considerably more material on the subject of cartographic lettering. In *The Look of Maps*,[21] he treats lettering as one of the three visual components of cartographic technique—lettering, structure, and color. The book contains three

chapters, "The Importance of Lettering," "The Style of Lettering," and "The Employment of Lettering." He stresses the point that the lettering is an intrinsic part of the map, in contrast to the point of view noted above. "To put it simply, cartography is a medium of presentation for spatial data and it follows that when such data require identification, then the identification becomes an integral part of the map. The identification of data and locations has always assumed an important place in cartographic technique."[22] Not only are names an intrinsic part of the map, but he suspects that the lettering is one of the more striking visual aspects of the map: "Although no tests have been made, so far as we know,[23] it is reasonable to postulate that for most small-scale maps, the first reaction of the reader, consciously or unconsciously, is to the lettering."[24]

Robinson is the first cartographic textbook author to point out the value of and need for empirical research relating to cartographic type selection. He uses the term legibility to refer only to type, though he does not define it nor is he always consistent in using it. Within the following paragraph, for example, its meaning seems to shift somewhat. "The technique of lettering on maps covers a wide range. Perhaps the first question of choice facing the cartographer is that of the form of typeface. There are an infinite number of possibilities. . . . They vary in legibility, appropriateness, texture, and even in the general character or mood they represent. Next the cartographer must decide on size, for after all, the best typeface is of little concern if it cannot be read. The relative sizes are of great significance in a map in terms of comparative emphasis and legibility. Inherent in the above question is that of the color of the lettering and of the background on which it appears, for this constitutes one of the major controls of legibility."[25]

Type must surely be visible before it can be legible, but it does seem in the paragraph above that visibility and legibility are almost synonymous.

In *The Look of Maps* Robinson includes much of the traditional cartographic point of view on lettering, but he also introduces material from typographic and psychological literature and attempts to relate it to cartography. He stresses the need for research in cartographic typography. "Unfortunately the tests which have been made

are meager, although they show results of significance. They are not, in all cases, directly related to the problems of cartographic technique since legibility and perceptibility of maps are not the same as for ordinary reading practice."[26] He adds: "Although the above enumerated general bases for the evaluation of the lettering technique apparently are sound, the data necessary for detailed objective evaluations are meager. Further research is clearly necessary, *aimed at the special requirements of cartography*."[27] There has been no change in the "lack of data" situation since those words were written in 1952.

In his textbook, *Elements of Cartography*, Robinson includes more material on lettering than had any such textbook previously. He treats lettering as one of the symbol systems which are contained in the map, and as an important element of the design of the map. The terms "legibility," "visibility," and "perceptibility" occur throughout this book in connection with type selection, but they are not defined.[28]

Periodical Literature. Periodical literature relating to map typography is neither extensive nor original. It is largely a potpourri of oft-repeated conventions, personal opinions, and preferences on matters of artistic taste, and some casually interpreted versions of psychological and other literature on typographic legibility. There is some recognition of a need for new empirical research and validation of traditional procedures, but even a master's thesis in cartography which stresses such a need fails to produce experimentation which would contribute specifically to cartography. The following survey of the periodical literature is arranged in chronological order.

The oldest article on map lettering cited is also one of the most complete and interesting.[29] Captain Withycombe began with a brief history of lettering forms, and described the relation of typography to engraving and printing processes. Among the things which he finds are essential to aim at in map lettering is, "*Legibility*. The letters must not only be legible when standing alone but also when superimposed upon the detail of a map."[30] In another paragraph: "The subject of Lettering is inseparable from that of general decoration, for writing is one of the chief factors which distinguish a fine map having a distinct aesthetic value from a mere diagram. . . . There is no merit

in ugliness, and as I have tried to show, good lettering makes for legibility and efficiency. . . . Clear, readable type, harmonizing with the map itself should always be used. . . ."[31]

Although 26 years elapsed between Withycombe's article and one by Dawson in 1955, the articles are very close in the assumptions they share. Dawson pleads for a return to hand-lettering, and even concludes optimistically: ". . . and it may be that Captain Withycombe's dream of high quality freehand map lettering executed by trained draftsmen, using alphabets designed by penmen, for penmen, will at least be partially realized in future Australian cartography."[32] In the late 1960's such a remark appears almost medieval. To judge from the report of this Australian writer, there had been little cartographic research during the period from 1929 to 1955.

This lack of research is also noted by Keates in an article which appeared in 1958. He writes: "Despite the great development in the use of typeset names on maps, and the attention given to methods of type composition and stickup, relatively little interest has been shown by cartographers in the actual selection and control of suitable typefaces. On their part, professional typographers, schooled in the requirements of normal book and display work, do not seem to have contributed very much to the special problems of type on maps. In general, this aspect of cartographic design has been neglected, which is strange when one remembers the acrimonious arguments about the beauty of hand-lettering as opposed to type."[33]

Keates lists a few obvious differences between normal use of type in text and its use in cartography; for example, on maps the usual problem of leading does not exist; individual letters are more important, typefaces are used as classifying elements (and therefore the map must nearly always mix types), and the alignment of the type may be irregular. He goes on to list characteristics (on a subjective, analytical basis) which he would like to see incorporated in the design of a typeface strictly for map use.

So far we have considered only the literature that was primarily relevant to the question of selecting typefaces. A very practical, how-to article on positioning names on the map by Eduard Imhof appeared in 1962. He says (in translation): "The names should, in spite of their incorporation in the dense graphic structure of the other

map contents, be easily readable, easily discriminated, and easily and quickly located. *Legibility* depends not only on the type form, type size, and type color, but also considerably on the position or arrangement of the other names."[34] Of particular interest in this statement is the equating of legibility with the quality of being "easily and quickly located." This is often taken for granted, but is usually not explicitly mentioned.

A good source for establishing the variety of non-cartographic literature which might be applied to the problems of typography in cartography is a master's thesis by Saito.[35] This thesis makes no attempt to establish whether or not such literature does in fact have application in the cartographic context; it is useful as a summary of much that is conventional in cartographic type usage.

Summary. Cartography has not developed its own body of research findings which would assist the cartographer in making his type-selection decisions. To be sure, he is admonished that the type should be legible, but he is neither told precisely what this might mean, nor told how it might be objectively assessed. While there is a substantial body of experimental literature on the legibility of type in text usage, as well as considerable literature on the nature of reading itself, we must question the utilization of this material in cartography until it can be established that type functions in an equivalent manner on maps.

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1. Virtually all maps produced in this country today are mechanically lettered in one way or another, not hand-lettered as was the custom for most maps until the latter half of the nineteenth century. Consequently, it seems reasonable to use the terms "type" and "typography" throughout this article, interchangeably with the term "lettering."

2. It is not strictly correct to speak of type "functioning" on a map; the type itself does nothing at all but exist. However, certain of its visible characteristics and its spatial arrangement may enable the map user to draw various inferences from it. In that sense, the type functions by implication.

3. Michael Polanyi, *Personal Knowledge* (New York: Harper and Row, 1958), p. 92.

4. I have heard children describe italic type as "the wavy letters" and "the curly letters."

5. Presumably this is due to the perception (by early cartographers) of the Mediterranean waters as blue. In this country, a currently more analogous choice of color might be slime green, roily brown, or pollution black.

6. About 25 college-educated adults were presented with a series of three pieces of white $8\frac{1}{2} \times 11$-inch paper, in the center of each of which there was printed the name "Chicago." On the first day, the subjects were given the sheet with the name printed in letters .2 inches high, and told: "In 30 seconds, draw a sketch map that incorporates the name as you see it in front of you on this sheet." The procedure was repeated (to the subjects' surprise) with the .1 inches lettering on the second day, and with the .6 inches lettering on the third day. Subjects were not allowed to see what they had done previously, nor did they see each other's work. The maps produced by them were remarkably similar in scale range, with each size of lettering.

7. Dennis Cheetham, Christopher Poulton, and Brian Grimbly, "Graphics: The Case for Research," *Design*, CVC (1965), 48.

8. (No author), "Map Design and Typography," *The Monotype Recorder*, XLIII (1964), 45.

9. In an unpublished report of research conducted by this author (Barbara S. Bartz, "What About Illinois? or, Children and A Reference Map," Field Enterprises Educational Corporation, Chicago, 1967, 71 pp.), it is noted that when grade school children were asked to compare two reference maps of Illinois in various ways, they almost always pointed out typographic clarity contrasts. One particularly felicitous choice of words was, "This map is blur-ish, and that map is clear."

10. Eduard Imhof, "Die Anordnung der Name in der Karte," *International Yearbook of Cartography*, II (1962), 128.

11. Arthur H. Robinson, *Elements of Cartography*, Second Edition, (New York: John Wiley and Sons, 1960), p. 249.

12. Max Eckert, *Die Kartenwissenschaft*, Vol. I, (Berlin and Leipzig: Walter de Gruyter and Co., 1921).

13. *Ibid.*, p. 342.

14. *Ibid.*, p. 346.

15. *Ibid.*, p. 343.

16. Arthur Hinks, *Maps and Survey*, Fourth Edition, (Cambridge: The University Press, 1942).

17. *Ibid.*, p. 26.

18. Erwin Raisz, *General Cartography* (New York: McGraw-Hill, 1948), p. 133.

19. *Ibid.*, p. 58.

20. *Ibid.*, p. 51.

21. Arthur H. Robinson, *The Look of Maps* (Madison: University of Wisconsin Press, 1952).

22. *Ibid.*, p. 26.

23. An unpublished report by this author (citation in Footnote 9) contains testing which shows this can certainly be true. Over 100 ten- to thirteen-year-old children were being questioned about three place name reference maps of Illinois, and they were asked, "What do you *first* notice about this map—what catches your eye first?" and names and lettering characteristics were nearly always mentioned in first place. Later the maps were turned over, and again names and lettering were items which were particularly outstanding in their memory.

24. Robinson, *The Look of Maps*, p. 26.

25. *Ibid.*, p. 29.

26. *Ibid.*, pp. 48–49.

27. *Ibid.*, p. 51.

28. Robinson, *Elements of Cartography*, p. 246.

29. Captain J. G. Withycombe, "Lettering on Maps," *The Geographical Journal*, LXXIII (1929), pp. 429–446.

30. *Ibid.*, p. 432.

31. *Ibid.*, pp. 434–435.

32. William H. Dawson, "The Lettering of Maps," *Cartography*, I (1955), p. 88.

33. John S. Keates, "The Use of Type in Cartography," *Surveying and Mapping*, XVIII (1958), p. 75.

34. Imhof, "Die Anordnung . . ., p. 94.

35. George Kazuo Saito, *An Investigation of Some Visual Problems of Cartographic Lettering*. Master's Thesis, University of Washington, 1962.

The Sweep of the Eye

The skilled reader of English has, of course, learned to read from left to right. The same is not true of readers of other languages, who may read from top to bottom (classical Chinese), from right to left (Hebrew and Arabic), or in almost any other direction possible (Diringer, 1948; Gelb, 1963), including boustrophedon arrangements in which alternate lines are read in alternate directions.[1]

Because visual space is asymmetric (Braine, 1968; Kolers, 1968a; Takala, 1951), a question arises whether, neurologically-speaking, some directions are easier for the nervous system to cope with than others. In the present experiment I was concerned with a less subtle aspect of performance, however: the demonstration that reading involves a sweep of the eyes, a learned information-processing skill.

The method required university undergraduates, skilled readers of English, to read aloud as rapidly and as accurately as they could pages of material that had been altered in various ways. The original text had all come from a single source, the polished and gracious prose in G. A. Miller's (1962) *Psychology, the Science of Mental Life*. Eight pages of typewritten text, about 310 words per page, were prepared for the experiment, two pages in each of the four arrangements shown in Figure 1. The top-most sample in the figure is, of course, normal English. The second sample is also English prose, when the lines are read from right to left. In the third sample the words from "Presented" to "manipulated" contain a sentence, but in scrambled word-order. The fourth sample preserves the lengths of words of the original and the frequency with which individual letters appeared in it, but the ordering of the letters has been scrambled.

1. There are two main types of boustrophedon, rotation and reflection. In rotation, the second and other even-numbered lines are written with their characters rotated through 180° in the plane of the writing surface. In reflection, the even-numbered lines are written with their characters in a mirror-reflection transformation of the odd-numbered lines. In both cases the eye moves continuously, either rightward and then leftward and then rightward again, or the reverse, rather than always beginning at a single margin. The regularity of succession of lines is not a requirement of the style, however. In some cases a few lines may read in one direction only, followed by one or more in the other, or some other alternation (Guarducci, 1967).

If we wish to be certain that our indicant of anxiety is valid, how should we proceed? A direct approach is to ask people to introspect on their anxiety, to report verbally how much anxiety they

ton seod sriaffa fo etats gniyfsitas eht taht edam eb nac esac gnorts A eht tahw enimreted lliw rehtar tub ,nrael lliw lamina eht tahw enimreted eriuqca lliw slamina taht deugra sah tsigolohcysp enO .od lliw lamina

Presented experimental the the order in the defense were to booklets do in for the with witnesses and the had six prosecution the for twelve which six manipulated. Recent that were most followed favoring

Mgiikehhbr chupn ni Issseo sian rrm aip drt aehtoao he bwtr asco aseoab r or coh ete erai fna slson iginls doe Emtu adnee eoee. Eneoh sap rooolef tc etahbg aaseki dh ds ssord

Figure 1. Four samples of text that were used to study the effect of directional reading habits.

For brevity I shall refer to these four samples as, respectively, N, rM, Scrambled, and Pseudowords. The subjects read each page from left to right, and from right to left. For example, half the subjects first read "If we wish to be certain . . ." and the other half first read "dilav si yteixna . . ."; they then switched tasks and read in the opposite direction. In one condition, Scrambled, the leftward reading was always of whole words, however, as "booklets to were defense the. . . ." The reason is that in Scrambled we were studying the influence of direction on the naming of grammatically isolated words.

Table I summarizes the amount of time the subjects needed to read pages of each of the four types in each of the two directions. They needed 1.28 minutes to read a page of N aloud in the rightward direction, and 9.96 minutes to read it aloud in the leftward direction.

TABLE I. *Reading Time for Two Directions (in Min.)*

Direction →	*Time*	*Direction* ←	*Time*
Normal	1.28	Normal	9.96
rM	5.72	rM	6.91
Scrambled	1.76	Scrambled	2.10
Pseudowords	5.54	Pseudowords	9.44

N, of course, makes no sense in the leftward direction and the absence of sense could be an important fact here. Therefore consider the results for rM, which read rightward is identical nonsense to N read leftward, but makes sense when read leftward. Even here, the subjects perform more rapidly in the rightward direction. Thus it is not the lack of meaning alone that causes subjects to take so long on N read leftward; the unfamiliarity of the *direction* of reading also plays a powerful role.

This conclusion is brought out even more clearly by comparing Scrambled and Pseudowords in the two directions. Scrambled, which preserves the recognizability of words in both directions of reading, suffers an impairment of almost 20% in time when it is read leftward. The impairment for Pseudowords is much greater: read rightward, Pseudowords takes about the same amount of time as rM read rightward, and read leftward Pseudowords takes about the same amount of time as N read leftward.

We see then in three tasks—reading sensible prose, scrambled prose, and pseudowords—that the reader's skill is expressed not only in the recognition of the alphabetic elements of words and in forming their approximate sounds, but also in the inertia or momentum that carries him more rapidly in one direction than in the other. This directional reading bias is independent of the sense of the message he is reading, as shown by performance on Scrambled where there is no message, and on Pseudowords where there is no sense; the bias represents the action of an information-processing skill. Neither letters nor words are processed one-at-a-time in normal reading (Kolers, in press); the results on Scrambled and Pseudowords show that the sweep or skilled sequencing is expressed independently of the material read. This skill is, in a certain sense, content-independent for it manifests a high degree of transfer across various reading tasks.

The sweep of the eye illustrates a linked perceptuo-motor component in reading. But many other skills, and other psychological processes, characterize reading. Of particular interest to designers of typefaces is the problem of orientation of characters. I shall describe two experiments in which orientation was manipulated.

If the sweep of the eye were the decisive variable in reading, skilled readers of English would always read more rapidly in the rightward direction. In point of fact this does occur, but its significance is hard to estimate when we realize that precisely that behavior is the one on which skill was acquired. Are there some other aspects to orientation that should be considered; is the alphabet we now use the optimal one?

Pages of text were again taken from Miller's book, but now they were prepared in the eight transformations shown in Figure 2. On each of eight test days, 32 male undergraduates from Harvard University and the Massachusetts Institute of Technology read one page in each of the eight transformations illustrated. They read aloud as rapidly and as accurately as they could; they read different pages on each of the test days; and they read the transformations in different orders, to minimize the influence practice on any one transformation exerted on performance on another.

The upper four transformations (N, R, I, M) rotate lines of print around the principal axes of three-dimensional space. N is normally oriented text; R is a rotation of 180° in the plane of the page; I is a rotation of 180° on the horizontal axis of each line; and M is a similar rotation on the vertical axis, or mirror reflection. (The asterisk shows where each pair of lines begins.) The lower set of four transformations reproduces the upper and, in addition, reverses every letter, making rN, rR, rI, and rM. We recorded two aspects of performance, time required to read a page in each of the transformations, and errors made in the reading. I shall discuss some aspects of time here.

The amount of time the 32 subjects required is shown in Figures 3A and 3B, the former for the rotations and the latter for rotations whose letters had been reversed. The salient fact of the figures is that transformations which may be regarded as geometrically equivalent rotations in space are not equivalent for the reader: I and M take far

N

*Expectations can also mislead us; the unexpected is always hard to perceive clearly. Sometimes we fail to recognize an object because we

R

kind of mistake a New England Puritan might be expected to make. It is *Emerson once said that every man is as lazy as he dares to be. It was the

I

pe conscious of all his mental processes. When often reasons can be *Three are just a few of the reasons why people fail to use a jud are aren't jonnes more a jsdf privileged not anoseas adf to wel a jud are aren

M

university pay to wak his wasistant, a Nomad who of dreat intelligence *Several Aeaxs ado a brofessor mho teacues bachoplodk at a jaide

rN

On aip ui Aag fasif aip uo Hie feet were adove aie feef eaem qeinoiosiq Alpdnoroph saw ep quay Axrnt-abbot ui Aag fasif aip uo.

rR

ep uepm weht for pcrase of qay ep ;qaeh aip eaopa erem feef aie *A very young child seems as if an odfsd mrsrly a wis mrsrly a

rI

visual imbe jdsf ands laeve jds 'lalb of view psqrsicourly, yb detanimod saw thquoht naeporue nehw emit a ta ,yrutnec htneeteni eht fo sedaced gnisolc eht gnirud ecneics latnemtirepxe na emaceb ygolohcyap*

rM

elap a no elcric der thgirb a swohs enO .serutcip tnereffid owt enigamI* .dnuorgkcab yarg a no elcric neerg thgirb a rehto eht ,dnuorgkcab wolley

Figure 2. Eight samples of geometrically transformed text. The asterisk shows where to begin reading each pair.

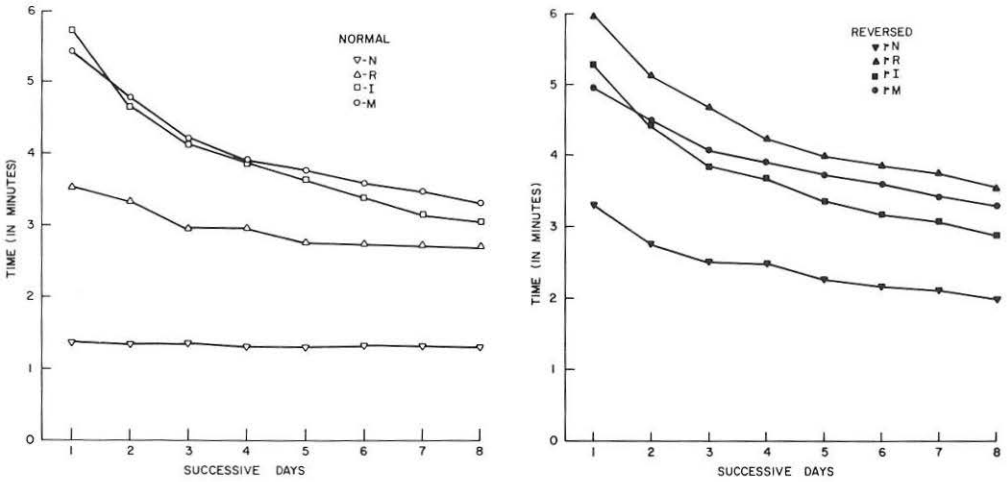
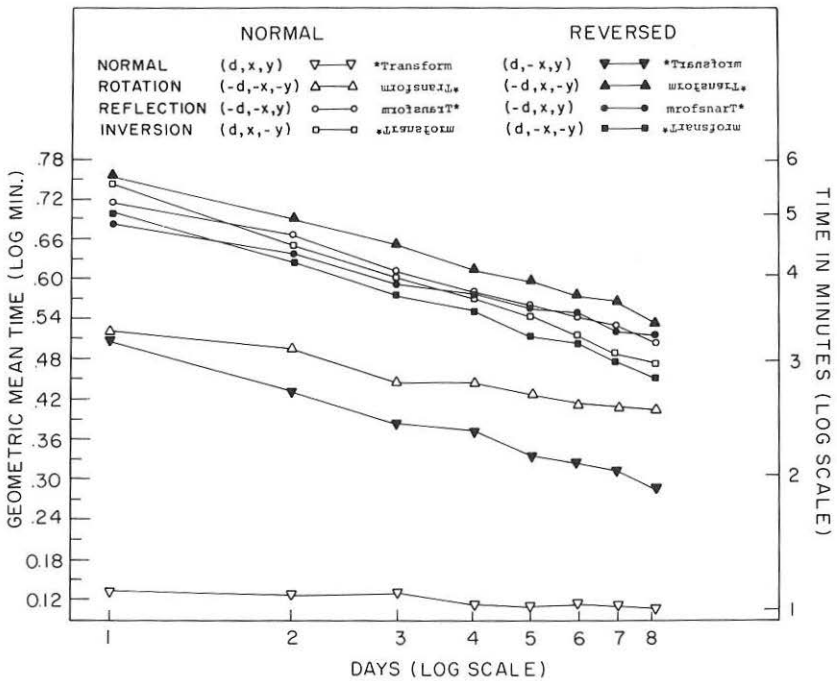


Figure 3. The amount of time taken to read pages in the transformations illustrated in Figure 2. A. the upper four transformations; B. the lower four.

Figure 4. The data of Figure 3 replotted on log-log co-ordinates to show the order of their difficulty.



more time than R. A second aspect of the data is that reversing letters affects the transformations differently. For example, reversing normal letters creates a transformation that is read quite rapidly (rN); rotation in the plane of the page (R) is also read rapidly; but reversing rotated letters creates the transformation that takes the longest time (rR). On the other hand reversing inverted text (rI) creates a transformation that is read more rapidly than text that is only inverted (I).

These and other facts can be seen more easily in Figure 4, where the data of Figure 3 are replotted on log-log co-ordinates. (The left ordinate shows not the arithmetic average of the measured time, as in Figure 3, but the arithmetic average of the logarithms of the measured time. The measured time equivalents are shown on the right ordinate, on a logarithmic scale.) The inset legend illustrates the transformations; it also expresses them in terms of the (x,y) co-ordinates of a Cartesian graph and the direction of reading (d).

Earlier I showed there is a skilled sweep to the eye that enables the reader to apprehend words more rapidly in the rightward direction. In Figure 4 we see again that normally-oriented text read in the rightward direction is the easiest to read; but some other relations qualify the interpretation of the idea of skilled sweeping movements. The chief qualification is suggested by the observation that transformation R, which is read leftward, is among the easiest to read, far easier than two others that are read rightward (I and rI). I do not yet have a complete explanation for this fact but have offered some conjectures elsewhere (Kolers, 1968a; Kolers and Perkins, in press).[2] We may explore it in another context.

Transformations analogous to those shown in Figure 2 were made of Hebrew text, and native readers of Hebrew unfamiliar with right-

2. An explanation based only on past experience is not sufficient. We may all have read other people's newspapers in the bus and subway, and even perhaps read other people's mail across their desks; we have also read store-window signs from inside the store (transformation M). We are very unlikely to have read inverted text (transformation I), yet it takes less time than M. Furthermore, few people are likely to have encountered transformation rN before the experiment, yet it is actually the easiest to read except for N.

going languages were tested.[3] Our interest was two-fold in making this test. First, to find whether the order of difficulty of the transformations, shown in Figure 4, was related to the direction of reading or to some other variable; and second, to make a specific comparison between performance on transformations I and R. Consider the latter problem first.

A rotation in the plane of the page of English text creates letters that are upside down and that face and are read leftward. An inversion of English creates letters that are upside down and are read rightward. A rotation of Semitic texts, which are normally read leftward, creates letters that are upside down and are read rightward; an inversion of Semitic text creates letters that are upside down and are read leftward. Thus the geometric arrangement of rotated English is identical to the arrangement of inverted Hebrew or Arabic, and the arrangement of inverted English is identical to rotated Hebrew or Arabic. Symbolically, $R_e = I_h$ and $I_e = R_h$. (I use "h" because the experiment was carried out in Israel on readers of Hebrew.)

The question of interest is whether native readers of Hebrew have more difficulty with rotated than with inverted Hebrew, or whether, like the American subjects, they find rotation easier to cope with than inversion. The former outcome would be predicted by a strict interpretation of hypotheses that assume that directional preferences are innate in the human visual system (for example, Smith and Smith, 1962); the latter is consistent with the notion that people possess preferred ways of coping with objects that have been transformed in space, but the preferences are expressed relativistically. Our finding with native readers of Hebrew was that they, too, found rotation easier to deal with than inversion, even though the base to which the transformation was applied was different in direction, proceeding from right to left in Hebrew rather than from left to right as in English. The order of difficulty of the transformations was substantially similar in the two languages. That is, the operations performed on the text created problems of similar magnitude among

3. This and the preceding experiment are described in greater detail in Kolers, 1968 (b).

readers of English and readers of Hebrew. It is not the geometry of the characters or the direction of scanning them that creates the major problem; it is the transformation to which the characters have been subjected.

Therefore, as powerful as the sweep of the eye is, performance must be understood in terms of a more complex variable, the ability of the human visual system to recognize familiar objects that have been transformed geometrically. I will discuss this problem again in the next section, but before doing so will pause for a historical footnote.

In contemporary Israel one sometimes encounters people reading newspapers that they hold upside down or even at 90° to the normal. The people are usually Yemenites, Jews from the southern tip of the Arabian Peninsula who grew up in dire poverty but with strong religious inclinations. The religious inclination induced them to study holy books, but the poverty made the books scarce. I am told that the usual mode of study was for boys to take fixed places around a table on which a book was laid out. Thus some boys learned to read pages upside down, others learned to read at other angles. A similar condition, I have read someplace, characterized learning to read in Europe during the Renaissance when books were scarce, and as late as the end of the nineteenth century in some rural parts of America. The Yemenites actually comprise a natural sample for experiments on the legibility of various transformations of text. Can equivalent degrees of skill be attained on any orientation of characters? The question might be answered by studying whether Yemenites who normally read text upside down or at other angles can do so as rapidly as their peers who read rightside up. (One might anticipate some interference in reading for a Yemenite who normally reads upside down as he wends his way through a street of shops whose signs are rightside up.)

A related phenomenon can be observed in contemporary Yugoslavia where children learn two different alphabets to represent approximately the same language. In eastern Yugoslavia (Serbia) the Cyrillic alphabet predominates, and in western Yugoslavia (Croatia) the Roman alphabet predominates. As a matter of fostering national unity, all Yugoslavian children learn to read and write their native language, Serbo-Croatian, in both alphabets. Regrettably,

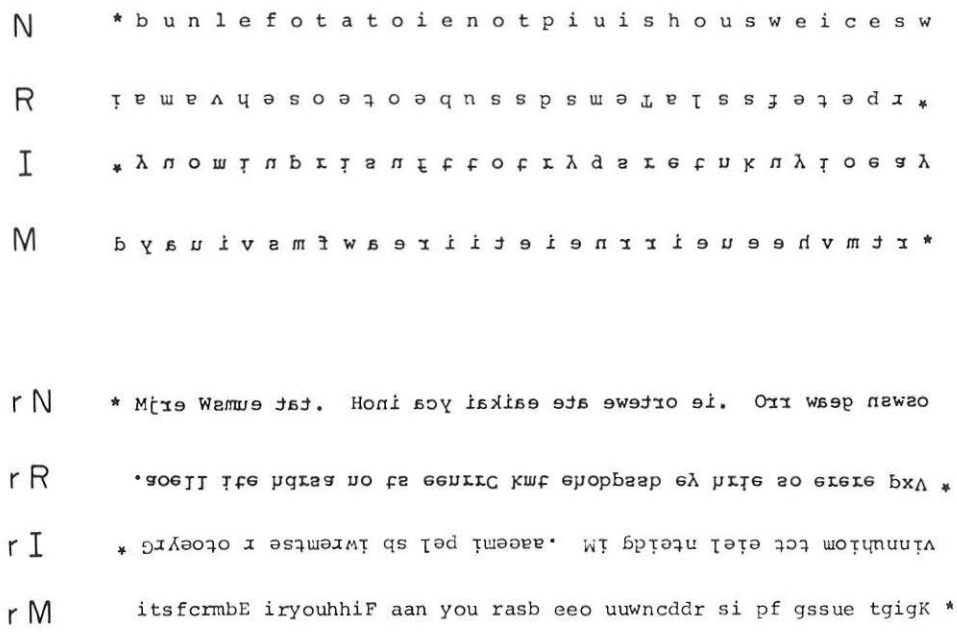


Figure 5. Isolated letters and pseudowords transformed as in Figure 2. Only four samples of each kind are shown.

I am not familiar with the details of instruction or with any studies of interference in learning.

Selecting Clues

I have shown now that the eye's passage along lines of print develops a sweep or inertia, and that this sweep must be understood within the context of a larger frame of reference or sense of orientation. In an experiment in which we required subjects only to name letters that had been transformed, these two concepts come together to yield some suggestions about the design of typefaces.

We studied the way subjects named letters as a simpler instance of the processing of text. Connected discourse and even isolated words have both grammatical and spatial characteristics; isolated letters eliminate the grammatical component. In doing so, of course, they destroy the main function that letters serve—conveying substantive information; nevertheless, something about the processing of words

TABLE II. *Time Taken to Name Transformed Letters (in Min.)*

Transformation	*Letters*	*Pseudowords (800 letters)*
N	4.65	4.51
rM	5.66	6.16
I	7.96	8.77
rR	8.55	9.56
rN	7.06	7.86
M	7.20	8.04
rI	7.16	8.33
R	6.72	7.64

can be learned from a study of the way people recognize isolated characters.

The subjects were 10 undergraduates whose native language was English and whose reading skill was restricted to right-going languages. They named aloud pages of letters that had been transformed geometrically in the manner of Figure 2. On eight pages the letters appeared as isolated characters, preceded and followed by a blank space. These pages contained 26 lines of letters, exactly 32 letters to the line. On another eight pages the letters appeared as pseudowords, clustered according to the distribution of word-lengths in the original page of connected discourse. There were about 1170 letters to each page of pseudowords. The randomizing of letter sequences, performed by a computer for both kinds of pages, preserved the relative frequency of the letters in the initial page of connected discourse. Four examples of Letters and four examples of Pseudowords are illustrated in Figure 5. Notice that for letters considered individually, the eight transformations actually create only four different geometric arrangements. The letters of N and rM are individually identical, as are those of rI and R, rN and M, and I and rR. The difference between N and rM, for example, is not in their geometry but is in the direction in which they were named.

Table II shows the amount of time the subjects needed to name 800 letters of Letters (not counting the first line) and the first 800 letters after the first line on the pages of Pseudowords. The data are

arranged as four pairs of similar transformations; they show the sweeping action of the eye in another way. Subjects take considerably more time to name the letters of rM than the letters of N despite the fact that the letters are geometrically identical in the two cases. The same is true for I and rR, the latter similar in appearance to I but named leftward. In one comparison, rN and M, no significant difference occurs, however; and in the fourth, rI and R, the advantage lies with the leftward direction.[4]

If only the directional sweep of the eye were important in this task, we would expect that the subjects would always name letters more rapidly in the rightward direction. But they do not do so. I shall now show nevertheless that sweep of the eye is important, but that it must be understood within the context of a sense of orientation.

In some of the samples of Figures 2 and 5 letters face leftward, opposite to their familiar direction of facing. One might think that this would interfere with their recognition. If it did, then letters facing in the unfamiliar leftward direction would always require more time to be recognized and named than their right-facing mates. In respect of facing, the transformations can be paired in the following way: N and rN, I and rI, rM and M, and rR and R. The data of Table II show that right-facing letters are named more rapidly than their left-facing mates in only two cases, however. Therefore, neither direction of scanning the lines nor direction in which the letters face can by themselves account for our results. But if we consider these two variables together, we can describe a characteristic of the letters that we may call directional consistency: whether the letters face in the direction in which they are named.

Directionally consistent letters face left when they are named leftward and face right when they are named rightward. Transformations N, R, I, M are directionally consistent, whereas rN, rR, rI, and rM are not. Looking again at the pairings of Table II we find that directional consistency accounts for the advantage of six of the eight transformations. A perfect accounting of data by our hypothesis requires that M be named more rapidly than rN, but this was not

4. This experiment is described in greater detail in Kolers and Perkins, in press, (a, b).

Clues to a Letter's Recognition: Implications for the Design of Characters

Paul A. Kolers

Several experiments are reviewed in which orientation of letters and direction of reading were manipulated. The results imply that skilled readers recognize letters by selecting clues to their identity and with these clues construct a subjective representation of the letters. The clue-seeking seems to be directed toward the right-hand side of letters. This finding suggests that typefaces might be redesigned to avoid bold strokes weighted on their left or heavy strokes that are all of equal weight. Some indication of where a character begins and a sharpening of the useful detail on the characters' right could facilitate the sampling that yields recognition. A second implication is that character-transmitting devices need not examine or transmit all of a character. Reconstruction, if needed, could be performed by the receiving instrument from the clues provided by a representation of the character's linear extent and its right-hand markings.

Several efforts to establish criteria for type design on an empirical basis have been made. I shall summarize the results of experiments on skilled readers of English that suggest some new principles for the design of type.

Under ordinary circumstances it is very difficult to learn much about the operations skilled readers go through when they read. The reason is that, by virtue of their skill, they process the material too rapidly for ordinary observation to make out the details. Many of the operations that are visible in a beginning reader are performed so smoothly by the skilled reader that Huey's (1908, 1968) analogy must be considered seriously as a first approximation to the process. His argument is that the reader engages in a complex perceptual-motor processing of information that is similar in many ways to the performance of a skilled athlete. The analogy emphasizes the automaticity and smoothness of performance, the inferences, predictions, and assessment of partial cues that characterize both the skilled reader and the skilled tennis player, say. These hallmarks of

skill, automaticity and prediction, establish reading as a complex process that goes far beyond the mere apprehension of letters on a page or the appreciation of meaning from a word-by-word uptake of the collected letters. It is worth noting Huey's remarks on this process.

The complexity and the automaticity make the study of reading difficult under ordinary circumstances. Thus, if we wish to study the process, we must change the circumstances. The scientist's method, when he is faced with complexity, calls for distorting reality. He creates artificial conditions that make a stage on which selected variables can act out their roles. The scientist builds his theory by studying the relations between those aspects of the complexity that he or his colleagues have chosen to manipulate. The scientific method, because it *selects* variables for manipulation and study, does not and cannot reproduce the complexity of reality. What it does do is study the influences that are deemed to be the most important for any situation. The success of the theory depends in large measure on the good taste expressed in the original selection of variables.

I begin with these well-hallowed truisms of the scientific method because the experiments I shall describe utilized many "unnatural" arrays of text. Saying these things now, I hope to forestall the criticism sometimes made of this work that, because the text was not normal, the results have little to say about normal reading. In rebuttal I would say that just because the situations are abnormal the principles revealed by behavior in them can be used to understand the way printed text is normally read, for the behavior reveals preferred or habitual modes of responding to printed text.

The experiments will show, first, that reading is carried on by an information-processing activity that builds up a considerable inertia or sweep, and that is strikingly dependent upon sequences of skilled movement. Next I will discuss some effects of unfamiliar orientation upon the recognition of text, and thirdly, upon the recognition of individual letters. At the end I will discuss the implications these results have for design of type.

observed. The results obtained with this pair do not contradict our hypothesis, however; therefore for the moment let us allow them to lie dormant while we explore its implications.

One idea advanced by Kolers and Perkins is that people do not need to see all of a letter in order to recognize it; rather, the recognition is accomplished by the person's constructing a representation in his own mind of what he is looking at, based on the use of a few clues to its identity. As I shall show below in more detail, the most helpful clues to a normal letter's identity appear on its right. Some notion of where the letter begins and some indication of its righthand extension provide a great deal of the information needed for recognition. How does it happen then that in at least one case the leftward scanning direction takes less time than the rightward? The answer we suggested is that the scanning is done within the context of a frame of reference or orientation set. Our subjects, we allege, are able to perform a mental transformation that enables them to do on the left of a letter that is named leftward the same things they would do on the right of a letter named rightward. They develop a set or attitude which not only allows them to perceive physically transformed objects, but enables them to transform the actions they must perform in a manner that is consistent with their set.

We believe that letters are not perceived through a passive uptake of their physical characteristics; rather, they are interpreted within the framework of a person's sense of orientation in space and some notion of what he is doing. (In the case of letters such as b, d, p, q this is clearly obvious, since one cannot identify any of these letters correctly with more than chance frequency unless he knows what the orientation is of the page he is looking at.) Our assertion, therefore, is that not only is a sense of orientation of the self and the page necessary for correct identification of letters, but also that the identification is performed by the visual system through the exercise of skilled sampling or scanning strategies. One novel feature of these ideas is that we suggest also that such skilled scanning strategies or motoric movements can themselves be transformed appropriately to accommodate a transformation of the test materials.[5]

5. As is well-known, the "secret script" of Leonardo Da Vinci, who was left-handed, was only a leftward writing and leftward facing of ordinary letters. In some

These matters of spatial orientation are somewhat removed from the main point of this paper, however; I have discussed them only to provide a rational basis for the data I have presented. More germane to this paper are the assertions that the important parts of a letter in the Roman alphabet are on its right, that people look for clues to a letter's identity rather than look at a whole letter, and the implications of these facts for type design.

The Design of Letters

I am told that the designer of letters learns to make his downstrokes heavy and his upstrokes and curves light. The faces that result are not read easily when they appear on the television screen or on the screen of the television-telephone (PICTUREPHONE®) now under development. Some special compensatory adjustments are sometimes made for television transmission (Bass, 1967; Shurtleff, 1967).

Weighted downstrokes have esthetic appeal; heavy curves or upstrokes make letters look top-heavy or clumsy. But because letters have the shapes they do, the major downstroke for Roman letters tends to be at the left edge. B, D, F, K, and so on, among capital letters and small, have heavy strokes at their left; their distinguishing marks, however, are on their right. This is seen easily in Figure 6, which is taken from the Bureau of Public Roads' (1966) *Standard Alphabets for Highway Signs*. (I choose this source as an example; almost any other standard source would do.) The heavy stroke at the left acts as a trap or moat for the eye, for it requires a good deal of visual processing to be apprehended, yet it conveys very little information. The lack of information is easily confirmed by sectioning the letters as I have done in Figures 7A and 7B.

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preliminary experiments I have carried out on handwriting, I have found that right-handed people who are requested to write with their left hands can usually do so at least as well (and usually better) if they write in mirror image script like Leonardo's than if they write in a rightward direction. I have even found that when people try to write simultaneously with both hands, they usually find it easier to move their hands in opposite directions (one hand normal, the other in mirror-image script) than to move both hands in the same direction.

Figure 6. One alphabet recommended by the Bureau of Public Roads.

In Figure 7A the right halves of the letters in the Standard Alphabet have been obliterated and in Figure 7B the left halves have been obliterated. Both kinds of mutilation impair the identification of the letters, of course; but it seems quite clear that retaining only right halves allows more letters to be identified unambiguously than retaining only left halves.

Similar mutilations performed upon upper and lower halves of letters are shown in Figures 8A and 8B. Among capital letters, retaining the lower half seems to be more advantageous, but among lower-case letters retaining the top half provides more of the information needed for their correct identification.[6]

I have used the Bureau of Public Roads font for these mutilations because that source conveniently lays the letters out on a matrix.

6. E. B. Huey (1908, 1968) noted some years ago that obscuring the lower half of a line of print interfered less with its legibility than obscuring the upper half. This finding now seems to depend upon the fact that a line of print contains many more lower-case than upper-case letters.

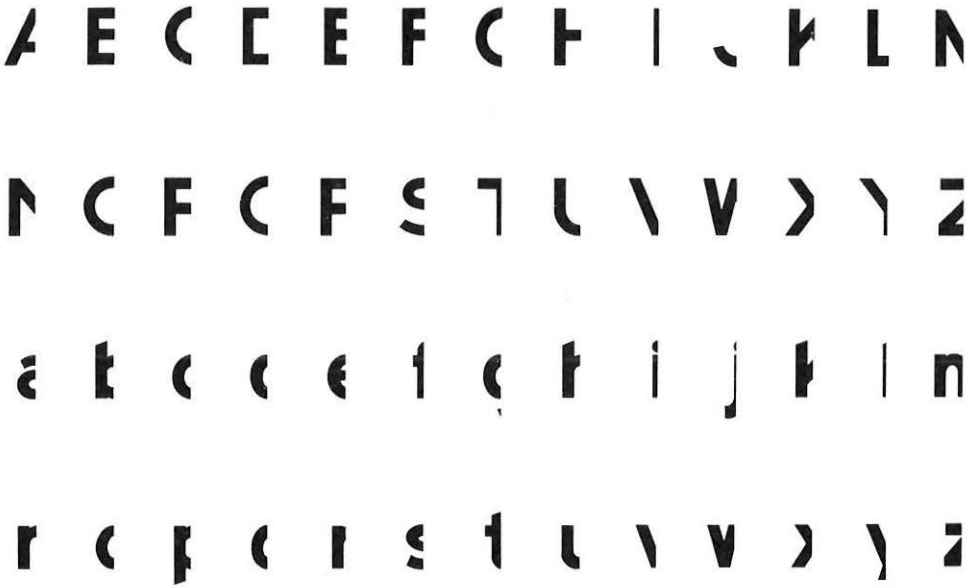


Figure 7. Vertical halving of the alphabet of Figure 6. A. right halves obliterated; B. left halves obliterated.

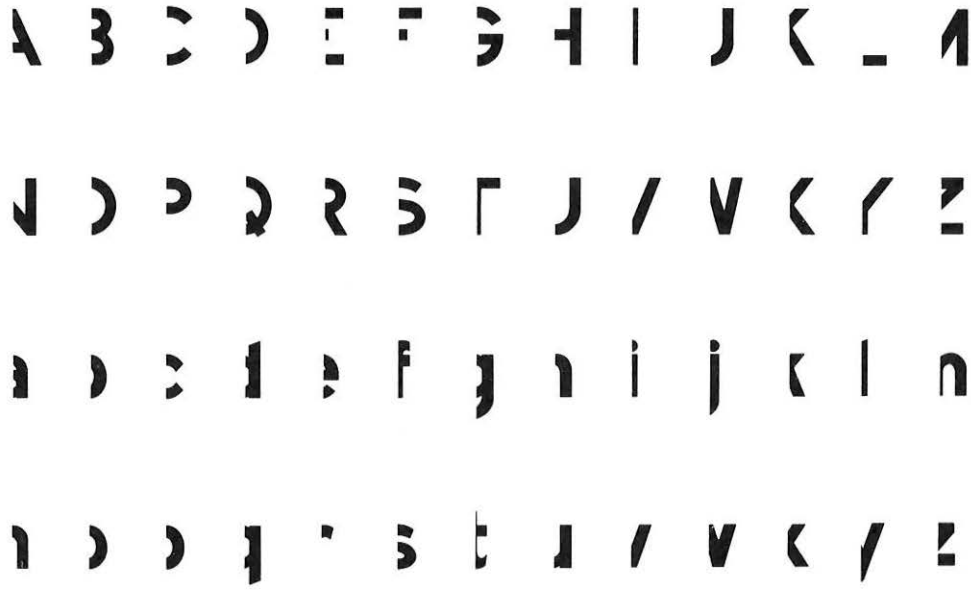


Figure 8. Horizontal halving of the alphabet of Figure 6. A. upper halves obliterated; B. lower halves obliterated.

Sectioning the letters is therefore an easy matter, for in order to halve a letter we need only count the number of cells to its linear extent and divide by two. Sectioning letters from commonly used faces is not quite so simple; letters on a typewriter, for example, are not usually centered in this geometrically exact way. I have found with several faces that the place indicator on the typewriter coincides only rarely with the geometric center of the letter. The designer of faces for the typewriter seems to offset his letters somewhat. Figure 9 illustrates the IBM Courier typeface used for the experiments I have described. The thin vertical lines above and below the letters represent the lines on a page of graph paper with which the centering indicator of the typewriter was aligned. In Figures 10A and 10B the results of halving that typeface are visible. Again both mutilations make some letters illegible, but the advantage lies clearly with retaining the right half of letters.

The conclusion seems clear that typefaces that emphasize bold downstrokes for the Roman alphabet, however elegant the letters esthetically, impede their smooth visual processing. As I have shown, the skilled reader needs to look more to the right than to the left; hence the typeface designer concerned to facilitate reading should emphasize the distinguishing marks of letters rather than the informationally impoverished downstroke. Distinguishing marks appear on a letter's right.

Not all alphabets are polarized spatially in the way the Roman alphabet is. The Sinhalese and Thai alphabets come to mind as directionally ambiguous examples. (Chinese, on the other hand, used to be written in vertical arrays that were scanned downward and then leftward; and the lower half of Chinese logograms tends to contain more information than the upper.) It should be possible to take advantage of the spatial location of clues to design a typeface that is pleasant in appearance and yet lubricates the path of the eye along the line of print.

It is not an easy matter to formulate principles on the basis of so few experiments that should guide the design of typefaces intended to facilitate reading; indeed, it is not known even on a theoretical basis how much improvement in speed of reading could be anticipated from such changes. Tinker (1963) compared speed of reading

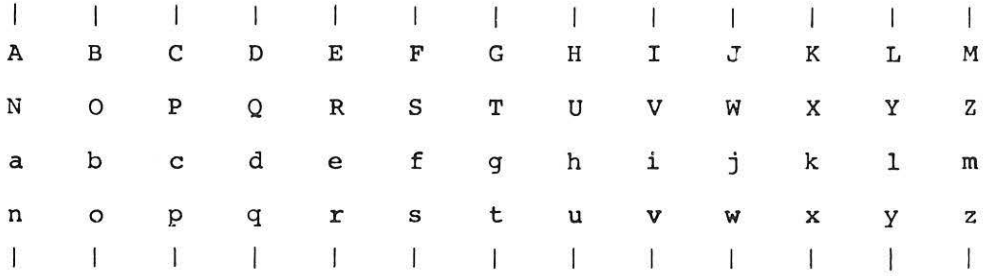


Figure 9. The typeface used in the experiments.

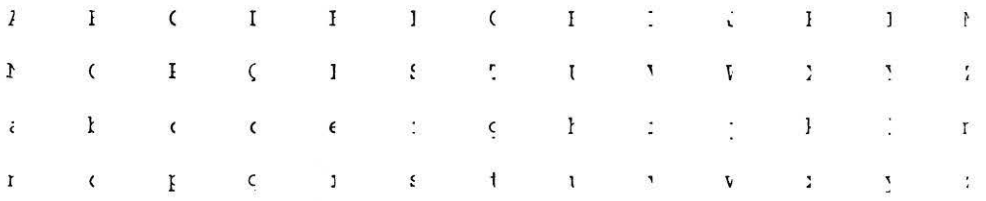
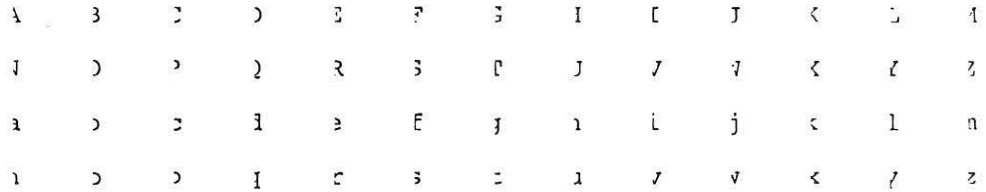


Figure 10. Vertical halving of the alphabet of Figure 9. A. right halves obliterated; B. left halves obliterated.



identical passages on ten common faces, among them Scotch Roman, Garamond, Bodoni, Caslon, and Cloister Black. Using Scotch Roman as a standard, he found that speed on seven of the other faces was affected by less than 2.5%; speed on American Typewriter was 4.7% less; and speed only on the elaborate and unfamiliar Cloister Black was seriously less, 13.6%. Lacking theory, the issue must be settled by empirical tests.

In Figure 11 a face is shown that incorporates some of the recommendations implied by the results of the experiments I have described. Designed by Jerome Abelman of Bell Telephone Laboratories, the face emphasizes the right side of letters and has few heavy lines on the left. I offer it not as prescription but as illustration. In constructing it we have tried to stay within the conventions that define the letters of the Roman alphabet, but there is no reason in principle that these ancient marks cannot be changed. Doing so might lighten the reader's burden and make his performance more efficient.

I have spoken only about the human recognizer of characters, but the results also have an implication for machine recognition of characters. Because characters tend to be distinctively marked on their right, it may be unnecessary for character-transmitting machines to examine or transmit all of a character. The same principles that seem to characterize the human's examination could be made to characterize the machine's, so that the machine examined only the linear extent and the right-hand side of characters, and transmitted only the result of that examination. If presenting the entire character to the recipient were thought to be desirable, the character could be reconstructed by the receiving device, either through a memory unit within itself, or through the intervention of an intermediary processing station, such as a central computer office. Some compression of the bandwidth required for transmission might be effected in this way.[7]

7. The experiments were carried out at the Research Laboratory of Electronics, Massachusetts Institute of Technology. Some of the ideas expressed were worked out in Project Zero, Harvard Graduate School of Education. This paper was prepared at the invitation of the Editor, *Journal of Typographic Research.*

Figure 11. Typeface suggested by the results of reading experiments.

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Visual-motor Skills: Response Characteristics and Pre-reading Behavior

Katherine P. DiMeo

Assumed facets of kindergarten subjects' visual-motor skill were studied by an analysis of the interrelationships in response characteristics to a set of geometric forms. Implications for initial response to letterforms (reading readiness) is discussed. Two measures of intersensory equivalence were used with the stimulus perceived through the sense of active touch (haptics). Stimulus characteristics—contour, closure, size, rotation, and embeddedness—were varied in five visual-discrimination subtests. Kindergarten subjects' V-M skill is significantly related to achievement in intersensory equivalences and in visual discrimination of geometric forms.

For some time, young children's ability to copy geometric forms has been used as an index to their perceptual development. The developmental norms, in reference to mental age, which have been accepted generally are as follows: (a) age 3, the circle and vertical cross, (b) age 5, the square and triangle, (c) age 6, the diagonal cross, and (d) age 7 or 8, the vertical diamond, horizontal diamond, and divided rectangle. After 8 years of age, children's extreme distortions in copying tend to have pathological significance. Before this time, the implications of distortions have not been elaborated. In addition, the non-comparability of scoring criteria and, therefore, of acceptable reproductions appear to limit the functional use of these norms for assessing visual-motor skill (see Table I).

Visual-motor skill, as defined in the present research, refers to the copying of outline forms by young children. It includes—in terms of learning behavior—a visually perceived stimulus, intersensory mediation, and a motor response. Therefore, the quality of the response may be affected by immaturity in perceiving visually, immaturity in motor response, or integrative difficulties in the central nervous system.

Consequently, a valid interpretation of children's copying ability

TABLE I. *Visual-Motor Development: Normative Data*

Investigator or Source	*Age of Subjects* 1	2	3	4	5	6	7
Bender (1938)	Scribbling		Differentiated into loops		Rapid differentiation, dextral and horizontal directions first. Patterns organized		
Gesell, and Others (1940)	Scribbles spontaneously	Vertical line	Horizontal stroke Copies circle, vertical cross	—	Copies square, triangle divided rectangle	Copies diamond	—
Terman and Merrill (1937)			Copies cross, circle	—	Copies square, triangle	—	Copies diamond
Vernon (1963)							Copies interior of divided rectangle correctly
Piaget and Inhelder (1963)	*Stage 0* Scribbles with no variation		*Stage 1* Scribbles vary according to model Closed and open shapes distinguished Square and triangles *not* distinguished from circles	*Stage 2* Square sep. from triangle Circle sep. from ellipse		*Stage 3* Rhombus drawn correctly	All problems overcome geometric shapes easier to draw than natural figures

seems to have implications as one criterion for perceptual reading readiness. The perceptual facet of reading appears to be a major factor in effective reading instruction and a primary problem in most clinical cases. Although the complexities of orthography are beyond the scope of this investigation, certain generalizations may apply to letterforms in the sense that they are interpreted as two-dimensional outline drawings. In other words, veridical pattern perception (e.g., b vs. d) becomes a critical factor as a child approaches school age.

The *criterial* stimulus attributes of letters and letter sequences as discriminated geometric forms include perceived differences in contour, closure, rotation, size, and embeddedness. An arbitrary division of these attributes renders the situation somewhat artificial. However, illustrations may be given in which each seems to be a dominant factor.

Discriminations in contour may be illustrated, for example, by i vs. c, v vs. u, home vs. come. When a child can take the -at from cat and apply it to sat, he is evidencing one type of closure. He discriminates differences in closure in c vs. o. Size is incorporated in the discrimination of BANG from bang, although there are also differences in contour. Size is also a factor in c vs. C, u vs. U, n vs. h. Rotation is the critical component in b, p, d, q, and in u vs. n. Embeddedness of go in going is but one example of this kind of discrimination.

The first purpose of the present investigation deals with possible cognitive-set effects on the reproductions in the visual-motor test. In other words, does the child's concept of a geometric form contribute to his ability to copy it? The effects of selective attention on a perceptual task have been modified by the different ways in which the subjects encoded the stimulus [18, 20].* Furthermore, the effects of verbal labels on cognitive set have modified reproductions and responses of subjects [7, 9]. In the case of ambiguous stimuli, perceptual set appears to be mediated by a class concept, e.g., letters presented prior to a broken-B stimulus [6]. Under similar conditions, perceptual-set deficiency has been attributed to young children 3 to 5 years of age [23, 33].

* Figures in brackets refer to references which begin on page 180.

TABLE II. *Haptic-Visual Equivalences and Stages in Haptic (Tactile) Explorations*

Investigator	*Age of Subjects* 1	2	3	4	5	6	7	8
Piaget and Inhelder (1963) (Haptic perception)	*Stage 0* Experimentation not possible		*Stage 1* Familiar objects easily recognized, but not euclidian figures		*Stage 2* Euclidian figures progressively differentiated		*Stage 3* Synthesis of complex forms achieved	
Birch and Lefford (1963) (Intersensory discrimination)					Equate haptic-visual information		Period of rapid change in functional organization—Visual-haptic integration achieved	
Zaporozhets (1965) (Tactile explorations)			Movements more like catching than touching	Movements similar with new elements Catching with 4 fingers and palm				
				Used palms and surfaces of fingers—Tactile exploration with 1 hand	Simultaneous touching of figure		Systematic tracing of whole outline of figure with fingertips	
Fisher (1965) (Haptic perception)		Passive touch No tactile exploration		Detailed tactile examination Identified majority of 30 common objects (e.g., banana, penny)				
					Linear shapes identified as readily as topological shapes (Taught nonsense names)			

Reported normative data and theoretical positions regarding the development of visual-motor skills are relevant to the second purpose of the present study—the range of children's achievement in copying certain geometric forms. Copying behavior has been assumed to reflect a learned type of form perception [17, 29]. Moreover, the correlation of copying with form perception, .60, has been reported significantly higher than that of copying with any motor ability, .00 to .18 [37].

A study of response implications in a visual-motor task may be facilitated by considering the implications of intersensory achievement—the third purpose of the present study. The assumptions are: (a) if experiences in other modalities have contributed to perceptual learning, and (b) if inferences about the level of perceptual achievement can be made from the drawings of children, then (c) a concurrent investigation of intermodal equivalences with the same set of geometric forms may contribute to certain insights. For example, is the achievement of a five-year-old higher for haptic-visual equivalences (forms explored by means of active touch and matched with a visual stimulus) or for haptic-kinesthetic equivalences (forms explored by means of active touch and then drawn without "seeing" the stimulus) ? Sensory inputs through other modalities that are "perceived" appear to be mediated by a visual image of the stimulus.

The research on intermodal discrimination is extremely limited [22, 27]. Moreover, the hierarchical hypothesis of perceptual development has not been supported by the research evidence [31]. However, there are developmental changes in intersensory equivalence. Visual-haptic equivalences were achieved readily by five-year-olds, but visual-kinesthetic and haptic-kinesthetic equivalences were poorly integrated. A minimum of errors occurred under all conditions by 11 years of age [3] (see Table II).

Inferences about visual-motor skill also may be modified by a study of the relationships among five factors in visual-discrimination achievement and the *quality* of a reproduction in a copying task with the same set of geometric forms. For example, if a child drew a cross considerably smaller than the stimulus in the visual-motor task, yet could discriminate accurately the size of the same form in a visual-

discrimination task, then inferences about the size of his drawing would not seem valid at his stage of development. Since letters in terms of their physical properties are geometric forms, the five previously mentioned *criterial* attributes—contour, closure, rotation, size, and embeddedness—of letter sequences were categorized in regard to distortions in children's copying ability and in a series of visual-discrimination tasks. These relationships were subsequently analyzed.

Contour bounds a figure, and shape can be considered a derivative of contour [10]. Conflicting data have been reported as to young children's ($3\frac{1}{2}$ to 7 years) utilization of contour cues. However, the upper contour of a figure appears to gain importance with subjects' increasing age [5, 24].

In perception, closure may refer to the preference for closed organization of stimuli or to the tendency of the organism to complete partial stimulus presentations [4, 38]. Ability to effect closure in reading may refer to an integrative process of completing perceptually a word stimulus in which a part was previously unknown [2].

Studies of size constancy as a function of subjects' age have yielded inconsistent data, but there is evidence that constancy increases with subjects' age [8, 29]. Kindergarten subjects were almost as accurate as adults in size judgments of similar-shaped geometric forms, but displayed greater variability [14]. Size constancy has been reported as reaching adult level at 9 to 10 years of age [29].

Despite variations in experimental design and in findings, the evidence is overwhelming that young children have difficulty with the spatial orientation of stimuli and perceive vertical reversals more easily than horizontal reversals [16, 35].

In addition, children from 4 to 7 years have difficulty in perceiving embedded figures, i.e., not clearly set apart [15, 40]. Even at 8 years of age, they make more errors than adults [39]. However, conflicting data have been reported for overlapping shapes. Children experience difficulty with this task before 5 to 6 years of age [30], yet four-year-olds have shown a high level of performance for overlapping figures [15].

Another consideration is the predictive indices which may be

obtained from perceptual measures. In beginning reading, for example, predictive tests should permit valid inferences regarding entering behavior in the perceptual facet of the reading process. Although the studies in this category remain largely exploratory, the bulk of the evidence points up a significant relationship between measures of visual discrimination or visual-motor skill and a standardized criterion of reading achievement [1, 19, 32]. However, as Koppitz [25] has pointed out, the scoring systems used by various investigators do not render their findings comparable.

The Problem

The investigation was undertaken to study (a) assumed facets of kindergarten subjects' visual-motor skills and (b) the relationship between achievement in these skills and a measure of visual-perceptual reading readiness. Data were obtained to test six hypotheses in null form:

*H*1: There is no significant relationship between kindergarten subjects' concepts of geometric forms and their ability to reproduce these forms by copying.

*H*2: There are no significant differences in kindergarten subjects' ability to copy the eight stimulus geometric forms.

*H*3: There are no significant relationships among visual, haptic, and kinesthetic equivalences.

*H*4: There are no significant relationships among visual-discrimination abilities in terms of the stimulus characteristics of the geometric forms.

*H*5: There are no significant relationships between achievement in the visual-motor test and certain measures of perception.

*H*6: There are no significant relationships between achievement in the word-discrimination test and certain measures of perception.

TABLE III. *Intercorrelations Among All Test Variables* ($N=58$)

Test	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Word discrimin.	—	.20	.29	.13	.16	.21	.28	.43	.43	.38	.39	.53
2. Visual motor	.20	—	.02	.35	.27	.39	.09	.29	.16	.19	.33	.33
3. Con. of draw.	.29	.02	—	.18	.18	.27	.38	.40	.06	.42	.18	.38
4. Haptic-visual	.13	.35	.18	—	.38	.81	.11	.29	−.19	.18	.23	.21
5. Haptic-kinesth.	.16	.27	.18	.38	—	.80	.04	.18	−.12	.22	.10	.13
6. Hapt.-vis.-kin.	.21	.39	.27	.81	.80	—	.13	.33	−.15	.30	.24	.27
7. Contour	.28	.09	.38	.11	.04	.13	—	.65	.08	.48	.27	.64
8. Closure	.43	.29	.40	.29	.18	.33	.65	—	.22	.64	.43	.80
9. Size	.43	.16	.06	−.19	−.12	−.15	.08	.22	—	.26	.24	.44
10. Rotation	.38	.19	.42	.18	.22	.30	.48	.64	.26	—	.48	.79
11. Embeddedness	.39	.33	.18	.23	.10	.24	.28	.43	.24	.48	—	.80
12. Visual discrim.	.53	.33	.38	.21	.13	.27	.64	.80	.44	.79	.80	—

Note: Correlations of .25 significant at .05 level and .33 significant at .01 level.

Procedures

A series of three tests—a visual-motor, a visual-haptic-kinesthetic, and a visual-discrimination test—was developed with the same set of geometric forms. The second two tests varied sensory modalities and stimulus characteristics. The visual-motor test was adapted from the CVAF (Lions Club of Winter Haven) with one figure added, making a total of eight forms—a circle, vertical cross, diagonal cross, square, triangle, vertical diamond, horizontal diamond, and divided rectangle. A scoring procedure was devised and evaluated regarding specific response deviations (e.g., rotation) in reproducing these forms.

A preliminary study with 31 kindergarten subjects was conducted to validate these tests and to standardize test procedures and directions. An interscorer coefficient of agreement (.71 for individual forms and .96 for total score) was computed for the visual-motor test, and the scoring procedure was submitted to a panel of advisers. Difficulty and discrimination indices were computed for the multiple-choice, visual-discrimination test; ineffective test items were revised or omitted.

In the subsequent main investigation, the three tests, a test of finger agnosia, and two standardized measures—the *Lorge-Thorndike Intelligence Test*, Level I, Form A, and the Word-Form Test of the *Betts Ready-to-Read Tests*, V-2—were administered individually by the investigator (with considerations for test interaction and practice effects) to 58 kindergarten subjects, who had been selected by random sampling from the total kindergarten population of three schools.

An intrascorer coefficient of agreement (.93) was obtained for the visual-motor test, and Kuder-Richardson Formula #21 was used to compute the reliability (.83) of the objective measures. In addition, photographic translucencies were made according to objective criteria for scoring borderline deviations in the visual-motor test. Interrelationships of subtests and tests were obtained by product-moment coefficients of correlation, which were converted to zr's to test significance (see Table I). In addition, the protocols for each test were analyzed for related data.

Results

Of the six null hypotheses, the first was accepted and the others were rejected. The findings may be summarized as follows:

1. The relationship between kindergarten subjects' concepts of geometric forms and their ability to copy them was not significant.

2. The subjects' scores for copying geometric forms ranged from no response distortions (5) to inability to reproduce the form (0). Their highest achievement was with the vertical cross and the lowest, with the divided rectangle.

3. The relationships among visual, haptic, and kinesthetic equivalences were all significant beyond the .01 level.

4. Twelve of fifteen relationships among visual-discrimination abilities were significant; two were at the .05 level and the rest, beyond the .01 level.

5. Six of eleven relationships between the visual-motor test and other perceptual measures were significant; one was at the .05 level and the remainder, beyond the .01 level.

6. Seven of eleven relationships between the word-discrimination test and other perceptual measures were significant; two were at the .05 level and the others, beyond the .01 level.

Discussion

The visual-motor behavior of young subjects is important in the educational sense to the extent that it reveals (a) an identifiable level of this type of perceptual achievement, (b) valid inferences regarding probable perceptual needs (e.g., a subject's inability to perceive rotation of a form), (c) a significant relationship to the perceptual facet of reading behavior, and (d) possible implications for improving perceptual abilities.

Almost all of the subjects who did not achieve at a high level in word discrimination—the measure of visual-perceptual reading readiness—experienced difficulty in reproducing the vertical diamond, horizontal diamond, and divided rectangle in the visual-motor task. They tended to make either poor or unscorable (score 0) reproductions. On the other hand, good to superior achievers in word discrimination rarely made unscorable reproductions of these three forms and were somewhat less likely to make poor ones. It appears,

therefore, that certain forms have discriminating potential as rapid screening devices for pupils who may experience perceptual difficulty in reading.

In addition, the fifth year of a child's life appears to be one of substantial individual differences in visual-motor skill and suggests vastly different types of entering behaviors in achievement. A logical inference seems to be that perceptual training with geometric forms, at a child's instructional level, probably would facilitate visual-motor skill and possibly improve perceptual abilities. This type of training would seem to be of particular value to the child who is not yet able to cope with the geometric attributes of letter-symbol sequences.

In relation to possible cognitive-set effects assessed subsequent to reproduction, a kindergarten subject's concept of a form as belonging to a class (e.g., square) does not appear related to his skill in reproducing the form. However, factors in concept attainment—defining the attributes of a class (e.g., four equal sides, right angles)—may be related to this skill. Furthermore, since the forms which were most "difficult" for the subjects to reproduce tended to evoke the greatest diversity of concepts (including "I don't know"), the factor of past experience is suggested as a variable in visual-motor skill.

In addition, measures of intersensory equivalence appeared to yield some insights regarding visual-motor skill. Except for the circle with which the great majority of subjects achieved both haptic-visual and haptic-kinesthetic equivalences, there was a differential order of geometric-form achievement between the two types of intersensory equivalence and between each type (i.e., haptic-visual and haptic kinesthetic) and the visual-motor task. This finding suggests that the order of stimulus "difficulty" may be a function of modalities as well as the properties of the stimulus (e.g., complexity).

Furthermore, since haptic-visual equivalences tended to be achieved more readily than haptic-kinesthetic equivalences, the implication is that mediation of the visual image tends to be achieved more readily than the motor pattern. For example, a substantial majority of subjects achieved the visual image for the vertical and horizontal diamonds, yet only about one-fourth achieved a kinesthetic equivalence for either form. Although motor ability

per se may not be an important factor in visual-motor behavior, as reported in other investigations, achievement of the motor *pattern* is strongly implied by the present findings.

In addition to intersensory equivalences, achievement in visual discrimination of geometric forms was significantly related to visual-motor skill. This type of achievement, although it does not appear to be a unitary ability, is suggested as an important factor in visual-motor behavior. For the present subjects, it appears that response distortions in the visual-motor test cannot be interpreted as the subjects' inability to perceive differences in contour size, and rotation. However, the factor of closure appears to have some implications in reproductions and to merit investigation.

Furthermore, kindergarten subjects' visual-discrimination abilities suggest a differentiated development related to stimulus attributes of geometric forms. Size differences appear to be perceived most easily, then differences in shape or contour (e.g., v vs. u). At about the same level is the ability to perceive differences in rotation or spatial orientation (e.g., b vs. d, p vs. q, u vs. n). Somewhat more difficult, for the present subjects, was perceiving differences in closure (e.g., c vs. o) and in embeddedness. An example is discriminating beet from beat, in which e and a are embedded in similar environments. These findings appear to have implications for a task taxonomy in visual-discrimination tasks for young subjects.

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A Standard Code for Special Typographic Character Identification

Stanley Rice

An industry-wide standard code to identify typographic characters and their uses for electronic character generation is proposed. The code would facilitate both traditional and automatic analyses of character sets and provide a mutually intelligible communication channel for author, editor, designer, and compositor. Reactions to the code are solicited.

It is considered highly desirable that there exist an industry-wide standard code to identify typographic characters and their uses—especially those that are not on standard minimum keyboards and for which no standard machine-readable code now exists.

This code would facilitate both traditional and automatic analyses (by any system) of character sets required by any manuscript, and would provide for the first time a mutually intelligible and hardware-independent communication channel for author, editor, designer, and compositor.

New methods of character generation make such a code highly desirable in the very near future. It should greatly facilitate the flow of information, especially in scientific material, and for complex material generally.

A useful code would represent each possible character by a simple but faceted structure capable of representing, at least, class and character identification, and typographical use features such as mode, weight, condensation or expansion, relative size, and relative vertical position in a line.

A preliminary description of a general code constructed along these lines is provided here. Your reactions are solicited and may be sent to The American Institute of Graphic Arts, 1059 Third Avenue, New York, N.Y. 10021.

A Preliminary Description

There is currently no common language or code for typographic specification of extensive character sets—let alone one that can meet current needs associated with newer typesetting and type-generating methods. Such inadequate specification systems as now exist are tied to traditional hardware systems and are usually associated with the particular needs and growth patterns of those systems rather than with the needs of author, editor, designer, and the individual typesetter.

Any graphic image that will be useful as a typographic character should be specifiable in simple and unambiguous terms, both as to its identity and as to generally defined potential typographic forms and characteristics. This specification should be possible in written notation and on all common typewriter or machine-readable keyboards—for human inspection, machine-readable coding in any system, and for optical character recognition by any system.

A simple code using only decimal digits and alphabetic caps can make these aims practical. All characters then become intelligible and machine-readable in any system and for any part of the communication chain. Any keyboard (or handwriting) will do to write the code, because there need be no ambiguities in any system between the characters used.

Subject to further study and criticism, we feel that there are certain essential character identification facets basic to typographic character discrimination. But there are others, often currently used, that are not essential to a general code.

A code is called for that will be based upon the practical needs of the entire communication chain, to be expressed in descriptive terms appropriate to those general needs. It must obviously, for example, be subject to both manual and machine interpretation. Surely it is obvious that many private code systems, such as are now springing up, will be much against the interests of the entire communications industry.

Also, it should be obvious that the assignment of ad hoc character substitution schedules, as in current practice, in no way obviates the growing necessity to define the actual identification and use facets of the special characters themselves—in specific and quantitative ways.

A general code will define types of characters, not individual character designs. Individual designs will be identified by their membership in a carefully defined set described by the code. When a general code is agreed upon, letter generating agencies of all kinds can then provide their own correlated listings, showing actual designs for characters available for sale within the various classifications described.

Some of the non-essential facets that are omitted from the general classification code proposed are: natural language character names (e.g., "pi"), typeface names (specific designs such as Baskerville), point size designations, set or unit values, font information (the collections accessible at one time on specific hardware), mixing or other mechanical limitations, codes for hardware access, and bearing or side spacing. These omitted facets are important only for specific hardware and specific character design, not for a general character identification code.

The actual structure of the descriptive code proposed is as follows.

General Code for Typographic Character Identification

Character identification

0 Class identification (see separate schedule), alphabetic
1–3 Identification within class, numeric

Typographic use

4 Style and use identification (see separate schedule), alphabetic
5 Mode (see separate schedule), numeric
6 Weight (0–9 scale, see notes), numeric
7 Condensation-expansion (0–9 scale, see notes), numeric
8 Size or vertical coverage (0–9 scale, see notes), numeric
9 Vertical position (0–9 scale, see notes,) numeric

The characters on the most common typewriter keyboard (e.g., IBM #101 Correspondence Keyboard) will not be specified by the code, in common practice. Their identity will be represented by any common code in use. But since such codes provide no typographic use information, the code provides that they also may be modified by the general code to provide such information. Also, their identity

can be "identified" in the common code, if desirable, by their three digit decimal code form (e.g., EBCDIC or BCDIC).

Characters that are not on the common typewriter keyboard are represented by the first four digits of the code only, if current setting is assumed and only the character identification is needed. If typographic use information is also needed, the full identification code is used, as proposed above.

The purpose of the general code is to identify all typographic characters that now exist and that may exist in the future—according to the possible combinations of their most important functional facets. All characters will fall within the defined ranges, or such is the aim (see notes). And within the defined ranges the values of the important facets may vary by small amounts. Of course, the values of the non-essential facets (not covered by the code) may vary in infinitely many ways.

The actual descriptive capacity of the code in full use is about 67½ billion combinations of identification and the typographic use facets. And within these limits there are infinitely many actual designs possible. There are 25,974 character identifications and 2,600,000 facet combinations.

The assumption in all this is that since typographic output flexibility is becoming increasingly prevalent, the author and the publisher should specify the less common typographic characters in general terms. These specifications can then be interpreted in terms of specific designs available or to be made available. Authors and publishers should not be governed now by past hardware limitations, or by the simple lack of a language to make their needs clear.

0 *Class Identification* (Classes are mutually exclusive)

X Characters represented in standard codes. These may be characters in the codes but not on the standard typewriter keyboard, or those on the keyboard when it is desirable for some reason to identify them as part of the general code.
A Accents in Romance languages (floating or non-floating)
Z Accents in non-Romance languages (floating or non-floating)
M Mathematical and logical—operations
W Mathematical and logical—non-operations
S Scientific (not mathematical or logical)
P Phonetic and teaching alphabets
R Reference and punctuation
C Cyrillic and Greek
H Hebrew and Arabic
N German
F Musical
D Decorative or pictorial (stylized and general use only)
G General geometrical (excluding 4C, 4Q, 4R, 4T)
Q Character augments (floating "non-space" character supplements—circles, underlines, cancels, etc.)
K Combination characters—logotypes, diphthongs, mnemonics
L Ecclesiastical, fraternal, commercial, monetary
B Bars, brackets, braces, rules, leaders
O Outline form
V Reverse form
I Multi-line interpretation for position #8
U Unclassifiable by classifications above

Letters E, J, Y and the many unassigned sequences within other letters are available for future needs. Obviously the above is simply an assignment for purposes of illustration and should be the subject of study.

Each class identification letter is followed by a three-digit number identifying 999 possible characters in that class.

4 *Style and Use Identification*

U Unclassified for style, or only one style permitted
A Roman—taper serif (general category, "universal" or transitional)
M Roman—taper serif, distinctly modern
O Roman—taper serif, distinctly old style
I Roman—sans serif
H Roman—slab serif
S Script or cursive (pointed pen or brush derived)
E Calligraphic (edged pen derived)
P Printout style or typewriter style (equal letter widths)
B Black letter ("Old English," etc.)
C Circle (solid, e.g. bullet)
Q Square (solid)
R Star (five pointed, solid)
T Triangle (equilateral, solid)

5 *Mode*

0 Mode irrelevant to character in question
1 Roman caps
2 Roman lower case (if arabic numeral, non-lining)
3 Small caps
4 Italic caps, slant #1
5 Italic caps, slant #2
6 Italic caps, slant #3
7 Italic lower case, slant #1 (if arabic figure, non-lining)
8 Italic lower case, slant #2 (if arabic figure, non-lining)
9 Italic lower case, slant #3 (if arabic figure, non-lining)

These codes for mode are here used as part of the general identification code. There would obviously be an advantage in using them to denote mode in any current setting—to remain in effect until an end delimiter.

A test could determine whether the first character after the parens is alphabetic or numeric. If alphabetic the general code is indicated, if numeric the mode code above is indicated. If desirable, the mode code can be followed by the #6 (weight), the #7 (condensation-expansion), the #8 (size only), and the #9 position

(vertical position)—but only in this order and with no omissions as far as the positions are extended. See the pages that follow. End is signalled by delimiter.

Notes on the Facets of the General Code

0 *Class Identification*
All classes are considered to be mutually exclusive in this category. One of the few limits to the code as it is here described is that owing to this class mutual exclusion only one member of this "zero" set may be described in respect to one character. For example, this means that only typewriter keyboard characters and four general geometric shapes (4C, 4Q, 4R, 4T) may be specified as outline form, reverse, or multi-line characters. Outline characters cannot be directly specified to be reverse, and reversed or outlined characters cannot be designated as multi-line. The reverse field size can be defined by the eventual point size and set width.

If a character is here defined as multi-line, the number of vertical lines it is to occupy will be defined by "I", which then modifies #8 position to mean vertical coverage rather than size.

Floating accents and character augments are "non-spacing" characters that require another character, the one following the code, for completion.

1–3 *Identification within Each Class*
999 characters may be defined within each class. Unassigned letters and sequences are to be used for future necessities. Oriental characters are omitted because of sheer bulk but a reference system to other tables could be used. This schedule needs considerable study and constitutes the structure to which each character is assigned in the general code.

If simple identification in current setting is the only necessity, only the class identification and these three digits need be used.

4 *Style and Use Identification*
Only clear-cut cases of taper-serif characters should be designated "old style" or "modern." Most serifed design adaptations should be classed "general," which means "universal" with respect to serif-type styles. Likewise this classification is used to discriminate

among the "universal" characters that can be used with all the broad style groups named.

5 *Mode*

Most characters except common alphanumerics would be classified "0" because most of them have no "mode" (e.g., phonetic characters have no caps or italics). The ranges of predefined slant for the italics should be a continuous range, roughly "sloped roman," traditional italic, and extreme-slope italic.

Note that bold-face versions of any mode noted in this facet will be generated by specifications in #6, below. Likewise condensed or expanded versions are generated by specifications in #7, below; and relative sizes by #8, below.

As noted, the lower-case mode, if it is applied to an arabic numeral means "non-lining."

6 *Weight*

0-9 scale provides ten ranges of boldness. Scale range #4 should probably be "normal" (an arbitrary definition based on usage, one critical dimension being named). Minimums and maximums for the range would be defined in terms of the ten-point size.

7 *Condensation-Expansion*

0-9 scale provides ten degrees of condensation-expansion. Scale range #4 should probably be normal, an arbitrary definition based on usage. Maximum expansion could indicate double the width of the normal form and maximum condensation one half the width of the normal form.

Characters that should not be condensed or expanded would always be specified as #4.

8 *Size or Vertical Coverage*

0-9 scale provides ten ranges of size in tenths of one line of the setting size, exclusive of leading. This is the normal meaning, but if class I is designated under class identification, the meaning here is changed to vertical coverage expressed in numbers of lines of current setting size, top of cap to bottom of descender. Up to ten lines, but note that numbering starts at zero.

Both tenths of lines and lines up to ten are relative size. The

eventual or actual size of the generated character is a function of the point size specified—not a part of the general identification code.

9 *Vertical Position*
0–9 scale provides ten ranges for location of the mid-point of the character. Each range is one-tenth of one line. Relative position in the line is what is expressed. Actual position is a function of the specified size and design.

When a manuscript is rendered machine-readable, the general code, or a referenced substitute of one or two keyboard characters, is keyboarded in place of the necessary non-keyboard characters. Most manuscripts, obviously, have a rather limited subset of special characters that must be specially coded. In practice these characters would be looked up once in the standard code book and listed as they are encountered, by the person marking the manuscript. (The author may already have used the code, of course.) The codes may then be assigned any convenient and arbitrary table look-up reference, and could be marked and/or keyboarded somewhat as follows (if the table look-up references were fewer than 26 characters, making possible alphabetic substitutions):

For the logical expression $\phi \rightarrow \psi$ we can type, say: (c,p,y)

A typical full code might be X076U04428 . This might stand for a non-standard-keyboard character having a standard code decimal designation 076 (EBCDIC character "less than" <), with unclassified style (here, one style existing), irrelevant mode, normal weight, normal condensation-expansion, small size (range #2), in superor position (range #8).

Another typical code might be as follows, if only typographical use information is needed: M88621 perhaps modifying a standard typewriter character coded in a standard code of any type. The typographic use indicated is as follows: modern roman type style, lower-case italic of #2 range slope (if a numeral, non-lining), boldface (#8 range), slightly expanded letterform (#6 range), small size (#2 range), and in an inferior position (#1 range). Possibly an inferior to an inferior.

If simple identification for current setting is all that is needed, only the classification letter and the three digits for identification

within class are needed; e.g., the code P058 for the phonetic character ð.

Table look-ups for common sets of special characters used by certain compositors can be arranged. And in general, by means of this code all characters can be accurately and rather easily expressed and interpreted by all parts of the communication chain, from the author to the output device. All tapes can be rendered mutually intelligible and revisable. It makes no difference whether the machine-readable keyboarding is by paper or magnetic tape, or for optical character recognition by any system. The same string of universally available characters will produce character identification and/or typographic use information, for any character assigned a place in the general code.

The communications industry should no longer be governed by traditional hardware conventions, or by the simple lack of a language for making specifications clear. Only if the needs are clear can compositors interpret them in terms of hardware and software and provide adequate preplanning. Only then can the communications channel operate with a reasonable minimum of noise in respect to character identification.

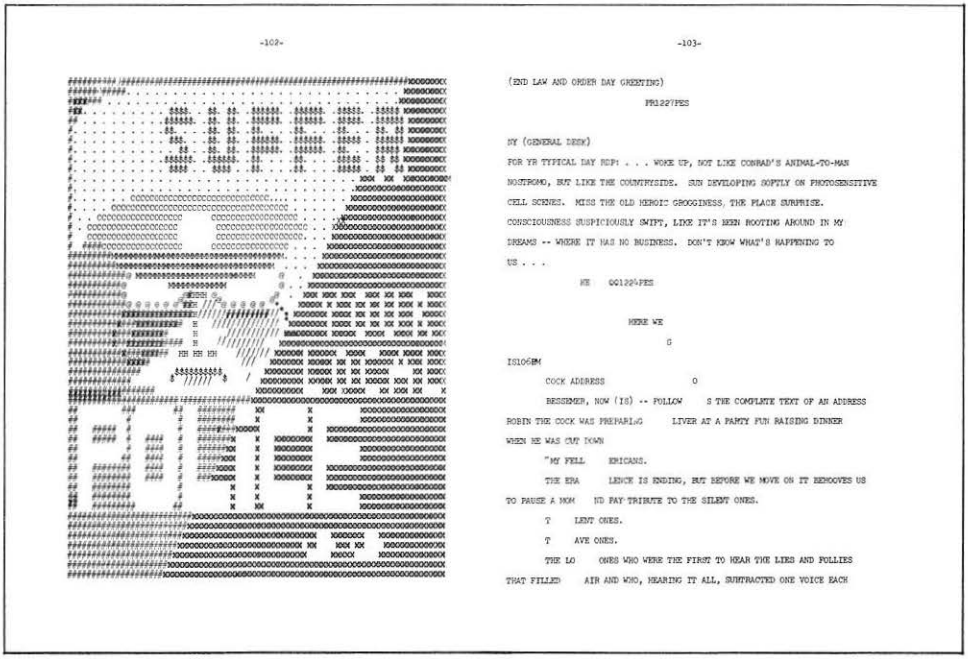
Excerpt: Typography That Makes the Reader Work

Joel A. Roth

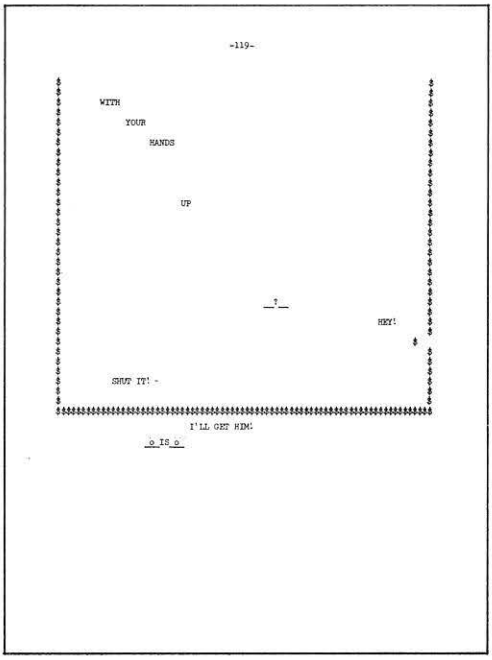
Book typography today basically follows the same configurations on the page that it has since books have been printed with moveable type. Except for relatively minor alterations, the reader of today's book is confronted with page after unrelieved page of blocks of type. But that may be changing. As McLuhan notes, the works of artists are often far in advance of what later becomes common usage. If this is so, then the work of several novelists and designers today may presage a new use for typography on the book page in the future. This new use for typography is based on erratic type arrangement which pulls the reader in as an active participant, and makes reading a creative act rather than passive absorption of information.

Of course, there is precedent for this. The use of odd line lengths and line placement in poetry—as an aid to metrical scanning—is now an established practice. And concrete poetry—employing blocks of type to convey meaning through visual impact, rather than through word meaning—is many years old. But today we are seeing wider applications of unconventional type placement; it may represent a new pattern in the imaginative use of typography in publishing.

Where will the trend go from here? There are sure to be misuses of the technique as it becomes defined—misuses based on the appeal of the "now" thing to do, regardless of its intrinsic value. But a movement must not be judged by its misuses, but by whatever enduring value it may have for its creative practitioners and for its ultimate users.



The novel *The Exagggerations* (gratuitous g is no error) *of Peter Prince* by Steve Katz (Holt, Rinehart and Winston, 1968) employs a number of typographic devices to help convey the novelist's intent. Some pages are virtually unreadable. Subordinate conversations or descriptive passages are carried out in different typefaces in the margins or overprint the main text in various decorative arrangements. Scenes which the author tells the reader he has decided to omit remain in the book but are crossed out—giving the reader the option of reading them. Three separate but related stories are developed on the same page, each in a different column, each picking up and ending in a random fashion.



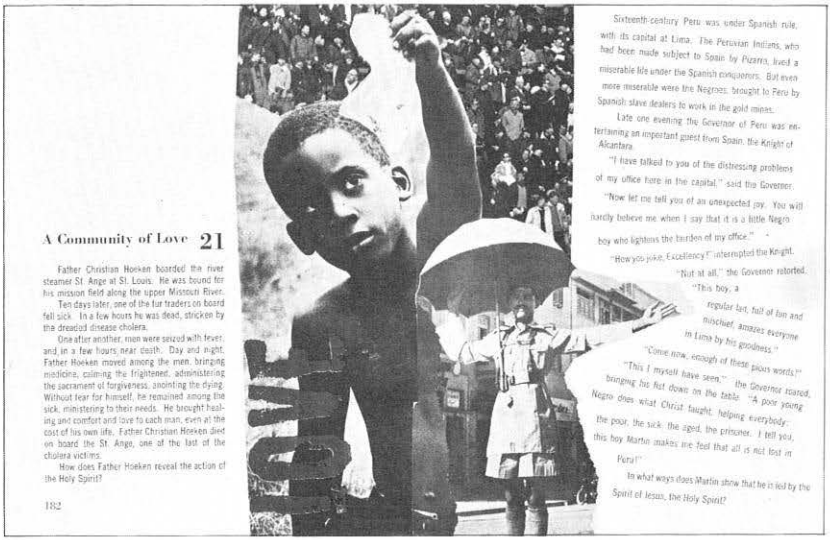
Informed Sources (*Day East Received*) is a novel by Willard Bain (Doubleday, 1969) written in double-spaced capital letters on $8\frac{1}{2} \times 11$-inch sheets to simulate a teletype printout. The story is told as a series of messages supposedly sent over the Associated Press wire service as the service is being taken over by hip revolutionaries. There are misspellings, crossed out letters, many code numbers, and pictures formed using the teletype-writer keys. Some incidents, such as the surrounding of the Green Dreams by the capitalist establishment, are represented graphically with alphabet characters, rather than with words. The reader finds that he must decode the messages and becomes involved as a receiver reading messages sent by "Informed Sources."


there
country, and he couldn't see accurately with electric
ght. He quickly sorted the eggs into racks. "Just
minute. I have a few more here." He finished up
and turned to Peter Prince. "Now what?" He squinted.
"Ach. It's you. My boy wants to see you. He's always
about you." The man grabbed hold of Peter
Prince's wrist and held it firmly as a hooked fish.
"He's had his appendicitis." He tugged Peter Prince
airs to the apartment where Stoop was recuperating.
[There lay the Creep under a huge featherbed, the
first Peter Prince had ever seen, with a stocking cap
on top of his twisted head. The sight made Peter
Prince laugh, and that good humor brought smiles to the
parents' faces, who were standing shoulder to shoulder
beside the bed, he still in his blue coveralls, she in
ded gray and yellow flowered smock. The boy seemed
augh and cry when he saw Peter Prince, and he looked
on him with so much love that it embarrassed Peter
Prince.
[The boy was wallowing in bedside gifts: books,
dolls, puzzles, kaleidoscopes, games. "They operated
on me and took my appendix out." He spoke with a thick
ity. From the midst of a pile of fluffy dolls on
mense night-table next to him he pulled out a corked,
sealed bottle, with a thing floating around in it like
small yellow sausage. "This is it. This is my own
[220]

with Jorgen and the woman and her children to follow the two who had headed for the alley that led to Piazza Dante and he saw Nancy Nottingham's flowered yellow shift suddenly extinguished by the lamplit brick of the tower on the corner when she moved out of sight. Nausea rose in him like a mercury column.
["He's not so very bad. . . Nilsen," Jorgen said. "He only makes a lot of noise. He likes to make Nike unhappy."
[Peter Prince didn't want to follow any longer. Nancy Nottingham was trying to make him unhappy and he wouldn't have that. He wouldn't have her annoying him and stunting his intentions. What were his intentions? He sealed with his eyes the lovely Verona tower, the narrow alternating rows of brick and tufa, past the one-armed clock to the white, octagonal belfry. That was what he wanted. Something like that. To absorb in himself the delicate structure of humanity's heritage and to get from there. That's why Peter Prince had come to Europe, and not to follow Nancy Nottingham around with her random Danes. He swallowed, and turned, and looked at the Danish girl.
["I'm sick of following them," he said. "We'll sit down at a caffe and I'll buy you a drink. We can wait for them to find us." He spoke strongly.
[The Danish woman smiled at him, sort of pitied, and they walked to the Caffe Filippini, Jorgen following, and sat down in the low chairs of plastic rope facing the market-place fountain. The sound of water dropping settled on them like sleep.
["What did Jorgen say your name was?" he asked the Danish woman.
["Nike," she said.
["Nike?"
["Like the Winged Victory of Samothrace," she said. "My father was inspired by my birth. He was Nilsen a teacher once. He's a ceramist."
["I'd say that was really an inspired name," said Peter Prince.
["I don't know if I disappointed my father or not," she said. "We live in Paris now, anyway, like my namesake."
["In Paris you live," he repeated, charmed by the thought.
["We have a house there," she said.
[This is how I like it, thought Peter Prince, settling back to sip his Campari Soda, to sit in the sound of an Italian fountain sipping bitter drinks and amicably conversing with expatriate Danes who have houses in Paris.
["What do you do?" Jorgen asked him.
[Peter Prince decided that he liked even Jorgen, that mutilated face held such kindness in its eyes. "I don't know," he said, sympathetically. "I hope to write."
["Every American I meet hopes to write," laughed Jorgen. "What have you written?"
[145]

The first short story in a collection by John Barth, *Lost in the Funhouse* (Doubleday, 1968), is called "Frame-Tale," and consists of a single page, printed along one edge on both sides of the sheet forming a continuous mobius strip, and imprinted with the words: "Once upon a time there was a story that began. . . ." The flat sheet also contains the directions: "Cut on dotted line. Twist end once and fasten AB to ab, CD to cd." The reader creates an "endless" story.

Growing as Christians (Sister M. Johnice and Sister M. Elizabeth; Allyn and Bacon, 1967) is a textbook using non-standard typographic page arrangement. According to the book's designer, Morris Kirchoff, many text lines were set at an angle rather than horizontally—to attract students' attention. Kirchoff reports that in a pre-publication field test, students were found to prefer slanted type to conventional horizontal type.



A Community of Love 21

Father Christian Hoeken boarded the river steamer St. Ange at St. Louis. He was bound for his mission field along the upper Missouri River.

Ten days later, one of the fur traders on board fell sick. In a few hours he was dead, stricken by the dreaded disease cholera.

One after another, men were seized with fever, and, in a few hours, near death. Day and night, Father Hoeken moved among the men, bringing medicine, calming the frightened, administering the sacrament of forgiveness, anointing the dying. Without fear for himself, he remained among the sick, ministering to their needs. He brought healing and comfort and love to each man, even at the cost of his own life. Father Christian Hoeken died on board the St. Ange, one of the last of the cholera victims.

How does Father Hoeken reveal the action of the Holy Spirit?

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Sixteenth-century Peru was under Spanish rule, with its capital at Lima. The Peruvian Indians, who had been made subject to Spain by Pizarro, lived a miserable life under the Spanish conquerors. But even more miserable were the Negroes, brought to Peru by Spanish slave dealers to work in the gold mines.

Late one evening the Governor of Peru was entertaining an important guest from Spain, the Knight of Alcantara.

"I have talked to you of the distressing problems of my office here in the capital," said the Governor. "Now let me tell you of an unexpected joy. You will hardly believe me when I say that it is a little Negro boy who lightens the burden of my office."

"How you joke, Excellency!" interrupted the Knight.

"Not at all," the Governor retorted.

"This boy, a regular lad, full of fun and mischief, amazes everyone in Lima by his goodness."

"Come now, enough of these pious words!"

"This I myself have seen," the Governor roared, bringing his fist down on the table. "A poor young Negro does what Christ taught, helping everybody: the poor, the sick, the aged, the prisoner. I tell you, this boy Martin makes me feel that all is not lost in Peru!"

In what ways does Martin show that he is led by the Spirit of Jesus, the Holy Spirit?

Book Reviews

H. D. L. Vervliet, *Sixteenth-century Printing Types of the Low Countries.* (Foreword by Harry Carter.) Amsterdam: Hertzberger & Co., 1968. 1 vol. 38.5 × 26.5 cm. 366 pp. 275 Guilders ($76.50).

Until recently the author was assistant-curator of the Museum Plantin Moretus in Antwerp (Belgium) since 1949. He specialized in the classification and history of the typographical material there surviving. It is a unique collection. Firstly, on account of the fact that Christophe Plantin commissioned type from every significant punchcutter in a period that was supreme for punchcutting. Secondly, Plantin himself, but also his associates and successors, have been conservative to the extent that they preserved down to the end of the nineteenth century and the opening of this Museum, not only their printing material but also abundant records of their business transactions and correspondence.

It took Mike Parker, K. Melis, and H. Vervliet over a year to list an inventory[1] of the somewhat 4,500 punches, 16,000 matrices, 4,500 strikes, and 60 moulds, which make this collection unrivalled so far as the sixteenth century is concerned. These preliminaries were necessary if only to be able to use the punches to make "smokes" and the matrices to cast type for a thorough study of the fonts as such.

The author took full advantage of his position—which will benefit all his readers and students. Yet, it should be clear that he did not confine

himself inside his Museum, but also consulted libraries and archives, in his home country and abroad, to complete and illustrate his findings. In this way he was able to identify nearly half of the types in the catalogue—which is quite a feat, since hitherto only a few types of this period had been identified or dated; the artists were, for the most part, unknown.

This book has a twofold aim, as stated by the author in his preface: 1. to survey the printing types in the Low Countries during the sixteenth century; 2. to provide historians, philologists, and bibliographers with a means to the more exact descriptions of old printed material, particularly unsigned and undated books—which was precisely the object of such incunabulists as Proctor and Haebler. This book, however, departs from the tradition of incunabulists in seeking to associate types not with printers but with lettercutters. This methodological innovation is in accordance with modifications in typographical practice and trade organization that came about in the course of the late fifteenth century: "the work of a printer in the period before 1490 can be treated successfully on the assumption that he was the only user of his type. . . . When we come to the sixteenth century it can on no account be assumed that any printer was the exclusive owner of a typeface. . . ." In other words, "the printing trade had centuplicated; typefounding and the sale of type had become internationally organized. . . ." This period, again, had an information explosion of its own—although not an "implosion," to be sure. This should be sufficient reason to warrant a variety of approaches to the study of printing types, apart from the merely aesthetic and perfectionist ones. For it aptly illustrates the fact that printing types (i.e., more fundamentally, writing) as vehicle of civilization and tool of the world of ideas, is bound up with nearly every material, spiritual, and social aspects of any given culture. In fact, during the last century, printing types came to be studied by historians, librarians, bibliographers, printer-historians, archaeologists, and psychologists.

Legibility and congeniality are now objects of study as well as style, identity, and chronology. They are, however, beside the point for Dr. Vervliet and he is, quite naturally, content with giving some more examples of the contribution of the archaeological study of type to history and philology.

A section is devoted to the discussion of Proctor and Haebler's method of measurement (20 lines expressed in millimeters), its workability with fifteenth-century material, and its relative applicability to sixteenth-century material. Here again a new context begs a new axiom. Instead of "the peculiar ownership of a typeface," a new hypothesis is put forward:

"the peculiar ownership of a *combination* of types." When a piece of printing of the sixteenth century is wholly in one face of type, "there is little likelihood of being able by typological proceedings to establish who was the printer . . .; should there be as many as four different types, there is as a rule only one printer to be associated with them. . . ." As this point the author was led to draw a diagram to show the evolution of typemanufacturing and the specialization of the printing trade from the fifteenth century until the present day, thus emphasizing the gradual shift in significance from the printers (XVth), to the cutters (XVIth), to the casters (XVII–XIXth), and to the designers (that is, to format) to-day.

He then goes on to show that any systematic investigation of the sixteenth-century types implies a satisfactory nomenclature and also insists on the necessity of studying the alphabets as wholes, as against the use of any given form of one particular letter as a means for identification of a printer, cutter, or first user. Nomenclature is a matter of agreement and convenience. While the current classification in this context is in terms of letter families—such as Textura, Rotunda, Bastarda, and uncial script for the Gothic; Gotico-antiqua, Jenson, and old-face for the romans; and Aldine, Cancellaresca, and old face for italics—sixteenth-century usage was to name letters by the uses to which they would be put by the printer concerned: *grosse lettre*, *lettre de messes*, *de breviaire*, *glose*, etc.; in short, in terms of congeniality.[2] Or should congeniality be a different concept at present from what it was, consciously or not, in the sixteenth century? "Above all it was Plantin at Antwerp who promoted the names, and his Folio Specimen of about 1585 was the first in the history of such things to bear indications of the bodies of the types." To conclude this aspect of his subject, the author settles on indicating the body both by the traditional English and Dutch names and by Proctor's and Haebler's 20-line measurement.

The second chapter contains the most spectacular findings about sixteenth-century punchcutters in the Low Countries, especially concerning Hendrik van den Keere of Ghent (*gallice*: Henry Du Tour Lejeune). The collection of his work in the Museum Plantin Moretus—some 40 sets of his punches and matrices, the bills from him, correspondence, account books and posthumous inventories—amount to the earliest detailed picture that we have of a working foundry. That in itself should earn him a conspicuous place in typographical history, but Vervliet has more to say about Van den Keere's merits: "More even than Lettersnijder's, van den Keere's Gothic design governed the development of black letter in the Netherlands in times to come, from Christoffel Van

Dyck to the last century. . . . His romans . . . are among the best that were made in that glorious age of letter-cutting. . . . His importance cannot easily be overrated. He is the link between the French school which dominated the sixteenth century and the Dutch which led Europe for a century after it." The reproduction of his types in the catalogue are proof that these statements are much less than overstatements.

The name of Hendrik van den Keere (1540 or 1542–1580) may be connected if somewhat loosely with two other punchcutters whom Vervliet has brought in their proper place next to Garamont, Granjon, and Le Bé among the foremost practitioners of their art and craft on an international and historical level: Joost Lambrecht (florebat 1536–1553), whose typefoundry Hendrik van den Keere's grandfather bought in 1553 when Lambrecht quit the country; and Ameet Tavernier (1522–1570), who learned to cut punches from Joost Lambrecht at Ghent. A fourth name has been given a new lustre: François Guyot (florebat 1539+1570), who came from Paris to fill a vacancy in the typefounding trade left following the death of De Keyser in 1536. "Guyot's types with those of Tavernier and the important faces of Parisian origin quite changed the appearance of the printed work of the Low Countries in the decade 1560–1570 so far as roman and italic are concerned. The rather old-fashioned typography of a culturally out-of-the-way province gave way to a Renaissance book of the highest standard, but with some national characteristics clearly marking it off from its French, German, or Italian counterparts." Vervliet was able to establish the authorship of seventeen types for A. Tavernier (who may have taught punchcutting to H. van den Keere), eight for Joost Lambrecht, eight for F. Guyot, and eight for Maarten De Keyser whose printing office grew to become one of the largest of the period 1500–1540. In these identifications the determining factor, more obvious than any other when the punches are preserved, was the various personal manners in which the cutters shaped the shanks of their punches. These names are the more outstanding. Other punchcutters, such as Henric and Cornelis Lettersnijder and lesser figures, are also highlighted and commented upon.

Two chapters are further concerned with "Gothic types in the Low Countries" and "New versus old: Roman or Gothic." Here again, there are two main difficulties which are still very much with us as psychologists, historians, and designers in our present century: terminology and congeniality. There is no general agreement among palaeographers, still less between palaeographers and printing-historians, as to the suitable nomenclature for the subdivisions of gothic types. Having stated that he would keep the names made familiar by Hessel, Crous,

Kirchner, and A. F. Johnson, Vervliet wonders if there were not originally a difference of aim and a relation to format to account for the difference between, say, the *Textura rotunda* and *quadrata*. Which is already, in a way, a matter of congeniality.

He further makes it clear that at the beginning of the sixteenth century the handwritten and typographical Textura, for example, still showed regional differences, unequivocally expressed in contemporary descriptions such as gros canon *flamen*, parangon *duyts*, augustijn *Belgicum*; leading to four distinct styles: Northern French, Flemish, Dutch, and German. This geographical factor must, of course, be weighed against other factors: contents or purpose of the text, the influence of the religious orders (especially in the Low Countries, the Brothers of the Common Life), the universities, the chanceries; to which should be added, even then, technical and economical factors.[3] As a matter of fact, Vervliet points out that Hendrik van den Keere the Younger introduced French forms in a mainly Netherlandish Textura, not for aesthetic reasons but to make the type easier to print, in that the "new" forms were simpler and would not be choked with ink. Last but not least comes the factor of what at a given point may very well have been almost a matter of "snobbery" of fashion. To quote E. P. Goldschmidt,[4] "To write Tacitus in gothic letters would have been a betrayal. The use of 'roman' minuscule became a manifesto that proclaimed the spirit pervading the contents of the book"—very much like the use of sans serif without capitals became in the Twenties a manifesto of the Bauhaus spirit. We know, now, that the "roman" won the day. But it was not an easy victory. And it was not won everywhere at the same time. On the other hand, a diagram shows that the italic—which enjoyed at a given moment (1525) all in all the same degree of popularity as the roman—lost ground, in the end, never to come back as a text letter. Which at least suggests that some objective measure must exist for legibility; while history warns us that a clear cut description, let alone a definition, of congeniality may prove harder to come by.

A special chapter deals with the italic. How and when the "littera Aldina," or italic, made its way to the Low Countries is still open to research. More than any other kind of letter it was the emblem and the blazon of new ideas, even to our imperfect knowledge eighteen italics had appeared in Italy by 1520—nearly one a year. One generation, between 1500 and 1570, could see its rise in three main varieties, and fall in any and every variety—at least in Italy—for the adoption of italic in the various countries of Europe was in the order of their reception of the Renaissance.

The year 1540 is significant for Vervliet because of the arrival in the Netherlands of the first Parisian italics and for the issue of the earliest writing master's book (Gerard Mercator's) in the Netherlands (as against Feliciano's and Moyllus', 1480, in Italy). The first of a generation of letter cutters to come into prominence after 1540 was François Guyot, a French immigrant. His italics, with sloped capitals as Mercator directed, were among the first to be designed for purposes other than the composition of books of small format. After 1570 the production of italic typefaces in the Netherlands virtually ceased.

In this context it may be noteworthy to mention that one or two generations was still, in the first half of this century, the "lifespan" of a typographic trend even in text letters. This becomes evident when one compares, for example, a specimen book of the Typefoundry Amsterdam of, say, 1912 with any other specimen of the same firm in the Fifties.

The printing of music was marked by special technical difficulties. The first satisfactory solution was by double impression: the staff lines in red; the notes, separately, in black. It was the technique used by Ottaviano de Petrucci, at Venice and Fossombrone, the best music printer of the sixteenth century. 1542 marks the beginning of the flourishing period of music printing in the Netherlands, as a belated echo of the glorious polyphony of the Flemish composers early in the century. Susato at Antwerp, Phalesius at Louvain, and Plantin at Antwerp availed themselves when they could of the technique of the single impression. Later, music becoming more complicated, one resorted to copper engraving. Plantin, in this respect perhaps the least in importance, generally had his music types cut by Hendrik van den Keere, who greatly excelled all his predecessors in the Netherlands in this as in other fields.

The last chapter is also the most extensive for obvious reasons; it consists of the reproductions of 154 typefaces: 52 texturas, 1 rotunda, 7 bastardas, 8 civilités, 7 uncials, 35 romans, 17 italics, 3 exotics, and 27 music. They are illustrated by reproductions of pages of sixteenth-century books and by impressions of new type cast in sixteenth-century matrices (if the matrices still exist) or, if they do not, by composite photographs showing the characters of the font. For each type the contemporary description is given: the size, the name of the cutter (when known), and the earliest appearance. Known specimen sheets are mentioned, as well as the place where matrices or punches are kept. Most of them are also commented upon wherever this comment is warranted by factual information.

It is abundantly clear that this study will serve philologists, historians, and bibliographers. It seems obvious to this reviewer that psychologists also should avail themselves of the historical background it provides to the psychology of writing and reading, of authors and readers. And not only to the psychology and the history but also to the permanent interplay of psychological factors with technical, economical, spiritual, and social evolutions.

Finally, it must be said that this book is magnificently produced. This is not a small merit, for the intricated subject matter entailed a special gift for clarity and elegance. In this respect it does credit to its publisher and is worthy of its author.

Fernand Baudin

1. Privately circulated in April, 1960; published later in the same year in *De Gulden Passer*, Antwerp, 38e jaargang, 1960.

2. This word is never used by Vervliet. It is used here to start thinking and in some way to "actualize" an historical subject but also an ever-present problem.

3. As late as 1748, Izaak and John Enschedé commissioned J. M. Fleischman, one of the foremost cutters of the period, to cut the first Duyts two-line Great Primer ever, and boasted to be the one foundry to have all their Duyts type cut by one and the same hand. They went as far as to claim that theirs was finer even than the Double Pica (Van den Keere's!) used by Plantin. Duyts types were felt to be most appropriate, congenial, for Bibles, New Testaments, psalters, and religious books generally. See: Ch. Enschedé, *Fonderies de Caractères et leur matériel dans les Pays-Bas* (Haarlem: DeErven F. Bohn, 1908) pp. 208–209.

4. *The Printed Book of the Renaissance* (Cambridge: University Press, 1950), pl. viii, p. 2; which is missing in the bibliography.

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.

Jan Tschichold, *Asymmetric Typography*. Translated by Ruari McLean. London: Faber and Faber (also published co-operatively—Toronto: Cooper & Beatty; New York: Reinhold), 1967. Designed by Jan Tschichold. 94 pp. 45/- ($5.50).

Jan Tschichold's influence has spread into our printing by inky osmosis. But now at last we can read *Typographische Gestaltung* in English, 32 years after its Basle publication.

Tidbits have come our way over the years. I remember reading, post-war, his article "Type Mixtures" and the excitement of it on top of an art school diet of Caslon and poor man's private press gruel. We also saw other seductive examples—oh, the lure of all that European licentiousness!

Now I find that the "new typography" wasn't the way to freedom it seemed; no room for open-ended arguments in this book. In the author's note we have "precision and brevity in formulation are the principal virtues of a writer," another, more liberal man, would have added "persuasion" or "sympathy."

These pages are Mosaic Tablets from the Mountain, and in lieu of explanation we must put up with frequent injunctions: "never," "must always," "under no circumstances," "two bleeds should rarely be used on a single page; more than two—never." By and large the strictures though harsh, are good strictures; but perhaps those of us that looked at the pictures, but could not understand the German text had the happiest time of it.

In *Asymmetric Typography* there are chapters on—what types to use, the needs of hand and machine composition, the word, the line, emphasis, leading, length and grouping of lines, the type size for the job, and so on. This main part concludes "only typography whose arrangement is clear and whose production is technically faultless, can be called art. Every skill implies an art, only in this sense is the word 'art' used." This is the stuff of typography in its right priorities. Tschichold repeatedly refers to the precision of letterpress, the prerequisite of "technical integrity," the need for a sense of precision in the placing of elements, "perfect legibility," and "the two dimensional nature of the new typography"—few typographers, I think, would find these unnecessary truisms but rather qualities to be observed and achieved only through trained sensibilities, qualities to be both emotionally and intellectually experienced. Some of these qualities are difficult to pin down with words and are better seen in Tschichold's own examples.

Here then is the gap between what we saw in his own early work and what we now read. We always hope for the book that will teach us to play

the piano like Rachmaninov! We would like lots of step-by-step rational explanations: but Tschichold is an artist, and an understanding of an artist's motivation is as much as we can expect in print. The chapters "Richness of Form" and "Abstract Art," however, get near to the bones of his early work.

"Typography and architecture are not closely related—the new typography is not the child of modern architecture; both are descended from non-representational painting." ". . . Bring the severity of modern architecture into typography without noticing its lyric qualities." "Typography as an art is close to the graphic arts and painting of today!" He is himself concerned with producing a work of art out of every typographic artifact—"This feeling for materials and proportion can transform what is merely functional into a work of art." One more ingredient was felt to be necessary in 1935—"The significance of contrast is the basis of a modern design."

Tschichold goes on to show how his immediate sympathies are linked to painting: (this about the abstract content of representational painting) "half escapes most people . . . the combination of color and form created by the painter's hand"; and later on, "Traditional typography is much more closely related to the facade-architecture of the Renaissance and its heritage of styles, than to painting."

"The new vision is most purely embodied in abstract painting, which is both the foundation and the summit of modern design."

He recommends the study of abstract painting but warns "We must not just make literal copies but work in the same spirit. We must remain within the limits of our technique and our purpose of our jobs or we will descend into mere formalism."

It is fun to tick off the points which, to some degree, have been won since this 1935 definition of objectives—we have got rid of tables set in fish net rule forms and the creeping duo-tone inks; but not much progress with cover papers, "dowdy colours with hideous embossings."

The most interesting and important of these points is the subject of "The Book Today" chapter. "I am convinced that the modern movement in typography will not leave books untouched . . .; attempts have been made, but unsuccessfully. Modern books tend to show either a most superficial and inadequate knowledge of the classical rules, or a specialized and pedantic obedience to them. The second way is no better than the first and produces a kind of artistic barrenness seldom seen in other spheres today."

This is the problem cycle of all new movements (e.g., Basle *neue grafick*)—the quick descent into new conformity and formalism. I am not

sure that *Typographische Gestaltung* was as of much help with book printing as it was with the more ephemeral stuff. Modernity is referred to with distinct half-heartedness in this chapter, "It would be senseless to place an asymmetric title page in front of a conventional book. It is equally senseless to dress up in modern layout a book whose contents are conventional; traditional typography would be correct. Form and contents should harmonize."

It may have been that there was a gradual predominance of publishers' commissions which had something to do with Tschichold's celebrated (or notorious) change of style from asymmetric to symmetric design. What is clear from this volume and from his work at Penguin Books, is that at all times Tschichold knew both the value of asymmetry and the lessons that tradition had to offer; and at no time has he repudiated his earlier advocacy of the new typography. However, Picasso said of Miro, "one can't spend all one's life riding on a uni-cycle." And in the 1940's, for whatever reason, Tschichold decided to step down from his asymmetric penny-farthing and try the completely symmetric safety model. But before this, in the very early 1930's and later very largely with *Typographische Gestaltung*, he had given substance and sense to much of the experimental work of the Bauhaus—and a good number of his strictures have been assimilated into our everyday paper and print environment.

When previously asked to recommend a book to people wanting to learn a little more than the nuts and quads of typography, I have always suggested Oliver Simon's *Introduction to Typography*, knowing this was not the complete answer. *Asymmetric Typography* now exactly balances Simon's book, but with 94 octavo pages at 3d per page, I hope Fabers can see their way to a cheap paperback edition.

It is a pity to end this review of such an important book on a sour note, but Tschichold often belabored his predecessors for "grey" productions; here—with a wide measure of Bembo, large margins, and very smooth paper—he has designed a monument of greyness in which the typographical minutae are placed asymmetrically. Without the dynamic of tonal or textural contrasts, it looks "neither fish nor fowl." It is wrapped up in what must be one of the silliest joke jackets on the bookstalls.

Colin Banks

Colin Banks is a partner in the design firm of Banks and Miles (7a Grafton Street, London W1). He received a calligraphic and typographical training in the England of the 1951 Festival of Britain, sans *Typographische Gestaltung*. He has recently put the late S. H. Steinberg's *Five Hundred Years of Printing* into asymmetric dress.

David Diringer, *The Alphabet*. London: Hutchinson, 1968. 2 vols. 956 pp. 252/- ($30.00).

This work is a valiant attempt to present the state of knowledge today on the history of both alphabetic and non-alphabetic writing systems. The subject is vast and Dr. Diringer's book is well subtitled "A Key to the History of Mankind." Each chapter is provided with its own bibliography: chapter one, "Cuneiform writing," lists well over a hundred books and articles; and in the bibliography to "Dead Sea Scrolls" (an article occupying only a page and a half in the present work), the author points out that "numerous authors, in more than 2,000 books and articles, have taken part in the 'Battle of the Scrolls.' This active interest shows little sign of abating." The total number of works consulted, let alone those actually mentioned, must have been in the tens of thousands. It was an almost impossible task for one man, rendered even more difficult by the fact that every single avenue explored leads ultimately to an area of total uncertainty. Diringer narrows the actual invention of the alphabet (and he believes it was an *invention*) to the period 1730–1580 B.C. in time and to somewhere in Syria or Palestine as a place: but even this is debatable, and the "Proto-Semitic" alphabet (from which all later alphabets are supposed to derive) is an imaginary alphabet, since no example of it is known to exist.

It would be impertinent of the present reviewer to attempt to assess Dr. Diringer's scholarship, which can only be called awe-inspiring. But the publisher's statement on the jacket flap that the book "has also proved its worth as a stimulating and provocative source for those engaged in communication studies and graphic design" deserves some comment. (*The Alphabet* was first published in 1948, and this is the third edition, completely revised with the collaboration of Reinhold Regensburger, in two volumes: volume 1 comprising 496 pp. of text; volume 2,460 pages of illustrations on "art" (coated) paper.)

As a guide to published works on the subject, and as a resumé of current knowledge, it is invaluable, not least owing to its wide scope: every known main writing system is described and illustrated. For this reason alone it deserves to be accessible to typographers, designers, and "communicators". But, alas, Diringer's own powers of communication are not good; the fact that English is not his native language is only too clear. (It is to be assumed that the book was written in English, since no mention is made of a translator.) Worst of all is the design of the book itself. The typographic design of the text is faultless, but the decision to separate the illustrations from the text was fatal. This is a book where it is

necessary to consult the illustrations at almost every line, let alone each page; and the illustrations have been provided—but in another quarto volume weighing several pounds. It is difficult to use even with a nice clear empty desk; but why should we be denied the chance to read Diringer in the train, or even in a chair at the fireside? The value of the work is grossly decreased by thus hindering its proper use.

Even if one picks up the volume of illustrations to try and read them consecutively, it does not work. The illustrations, often several to a page, cannot be understood without reference to the text, and page references are not given—only a chapter reference, and many of the chapters are long and complicated.

The subject is fascinating, the material is fascinating, but the design problem in communicating the results of Diringer's researches has been totally misunderstood.

Ruari McLean

Ruari McLean has his own freelance design business (29 Villiers Street, London WC 2) and is Hon. Typographic Adviser to Her Majesty's Stationery Office, and design and printing consultant to various large international firms. He is the author, editor, and translator of numerous graphic arts books.

Books for Review
Publishers should send books and other materials for review in *The Journal of Typographic Research* to either of two addresses:
Europe—M. Fernand Baudin, c/o Journal of Typographic Research, 64 rue du Village, Bonlez par Grez-Doiceau, Belgium.
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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 44106*

To the Author, Peter Mayer:

I find your review of the concrete anthologies [*The Journal of Typographic Research*, II (October 1968), 383–89] interesting because it is literate and serious. But I can't understand why you are so severe with Stephen Bann's anthology. A longing for Justice, prompts me to say that Mr. Bann's is the only anthology of the three, which is free (so far as I can see) of deplorable errors. In the Chicago anthology, the Pignatari "LIFE" poem is *woefully* misprinted—indeed, whoever printed it *that* way quite failed to understand the poem. Again, though I count Emmett Williams as a very good friend of mine, it is a fact that one of my poems in that anthology has a word missing (and is thus rendered absurd), while another is printed upside down—and have others fared better? It is true that Stephen Bann's anthology has a near-uniformity of typeface, but this seems to me a *good* thing, for a lot of faces in the American anthology are deplorable, and I myself could almost have died of shame when I saw their setting of my "horizon of holland" poem (of which I saw no proof). It seems to me that Mr. Bann interprets "concrete" in its most *useful* sense, as referring to that movement which was closely related to concrete *art* in general, and to the example of Max Bill in particular. This movement seems to have ended, while the term concrete remains in use, with the unfortunate result that Mr. Bann's anthology is seen as excluding poets which it never *set out to* include. Thus, it is a little as if a book on Mondrian was to be faulted for excluding Dali—an illustration which is vulgar (I admit) but scarcely *wild* when one considers the area that *concrete* is now used to invoke. A friend of mine recently used, in fun, the phrase "post-concrete," but I think this *is* a recognition of what has happened—and I think you would be fairer to the Stephen Bann anthology if you saw it as dealing (precisely) with concrete poetry, where the big American one deals with something which might be indicated by the phrase "visual poetry." I do not wish to suggest that the *possibilities* should be narrowed but that the delineation of the *different* possibilities is a useful job, and probably a vital one. I know

that Mr. Bann's anthology has been adversely commented on; but it has also been greatly appreciated, and *ought* to be, I suggest, because it was *very* well done, in its own quite reasonable terms.

What will emerge from the concrete movement is another matter. Like you, I hope that concrete will not be cast into "the rubbish heap of history." For one thing, it has scarcely yet been understood, and it will not be understood till it has been written about seriously, and it cannot be written about seriously till the word concrete is seen as referring, now, to several quite different things. I am not quite sure what you mean about concrete becoming "more poetic," but if you mean more aware of literature, as a source of value, I could not agree more. . . .

Ian Hamilton Finlay, Wild Hawthorn Press
Stonypath, Dunsyre, Lanark, Scotland

To Ian Hamilton Finlay:
Thank you for your letter and for sending me some of your fine poem/prints. The errors which you point out in the two American works reviewed are important. . . .

Concerning Stephen Bann's anthology. The limited repertoire of typefaces is to me a typographic procrustean bed for cutting poetry to a tasteful typographic size. Very convenient for the typographer, very pretty, but poor old Pegasus gets his wings cut off. As for the great variety of typefaces (as well as calligraphy and photos) in the other two works, I can't bring myself to deplore typefaces other poets have chosen. The grounds for deploring such things are a matter of taste. Do you agree? Anyway I do not consider myself as having any right or the slightest inclination to talk of taste good or bad. Down with good taste. Terrible to have to say this fifty years after the futurists. Re: Stephen Bann's anthology I do agree with you that it is visually homogenous and it successfully deals with its closely defined intention.

You ask me what I mean by "more poetic." I will not define ie negate ie set off on a dichotomous vicious circle. Poet from Greek creator, poet-Dichter—densifier, condenser, *pace* Pound. More poetic is therefore more creative more condensed, more than what? More condensed than prose. So a page of poetry which is less creative and less condensed than a good line of poetry or even sometimes of prose, could be more poetic. I think too that experimental poetry has an enormous amount to offer what is called literature by literary consumers, some experimental poets could, I agree, be more aware of literature as a source of value, too. The pigeon-

holes are poisoning the pigeons here as they did in the definition of concrete. . . .

Peter Mayer
34a Lanhill Road, London W9

Dear Mr. Mayer:
. . . I do think that you are wrong (though not alone in being wrong) about "concrete." It is not a question of pigeonholes, but do we gain any breadth by including (say) surrealism under a cubist heading? I think not; we just cause confusion. Concrete poetry was (I use the past sense deliberately) a specific movement, as cubism was. By all means don't let's tie Poetry to movements, but categories do remain as a part of order (and understanding). In short, let us allow concrete to retain its original meaning (which was desired by the poets who created it); and let us deny the word concrete to those who wish to borrow it but to *do* something else. There are many other suitable words.

Just so, I wouldn't wish to deny *the poets* in the Something Else anthology the right to their typefaces, but simply to deny my very good friends at Something Else the right to substitute *their* typefaces for those of the poets. I think you would find that the appearance of Mr. Bann's anthology fairly accurately reflected the appearance of concrete poetry (in the proper sense of that word).

Please do not think me a quibbler. I don't usually bother to disagree nowadays, but your article (review) is very intelligent and therefore worth taking seriously. I feel that Mr. Bann—no, I feel that *Justice* demands that Mr. Bann's anthology be praised, for its intelligence and care.

I cannot agree with you in deploring good taste. I see nothing else which prevents the Dropping of the Bomb. . . .

Ian Hamilton Finlay

Dear Mr. Hamilton Finlay:
. . . I quite agree that it is up to you and the other poets who created the term "concrete" to use it in your sense. The word has also been used by literary consumers and wholesalers (including critics) in a loose sense. This fate of the word concrete is one which is altogether only too common in the life of labels in art whereby members of a movement create a label which art consumers, wholesalers, and retailers stick onto other works bearing some alleged resemblance or showing some "influence." The progress of terms such as Constructivism (or for that matter Hoover, Nescafe, or

Xerox) shows the same label being stuck onto things regarded as disparate by their makers, e.g., Van Doesburg and Lissitzky's works both sharing the procrustean bed of "Constructivism" according to some critics and art historians.

As a person who tries to CO Muni cate through art I make an attempt not to use labels whose glue is getting loose because of watering-down critics etc. and consequent secondhand consumption by the public. Other artists, poets, and creative people in general may do what they will.

I think this is case for the Middle Way. Yes, use pigeonholes for clarity, understanding—but do not use pigeonholes to prevent the pigeons mating. . . .

Again, I agree with you that poets have their unalienable right to their typefaces which the publisher or editor has no right to abrogate unto himself. . . .

Peter Mayer

Complimentary copies of *Designcourse*, a new publication for designers and design educators, are being sent to subscribers of *The Journal of Typographic Research*. Edited by Al Gowan, chairman of visual design in the Department of Creative Arts at Purdue University, the quarterly will provide a continuing dialogue such as that found at the leading design meetings; e.g., the annual International Design Conference at Aspen. Subject matter will involve every area pertinent to the design process, including such topics as perception, human engineering, education, and business as well as materials, developments, and critical analysis of design. Gowan believes the magazine can be on "the leading edge of design practice and design education related to needs of the next 10–20 years, to predict and prepare for situations in the design field." The name *Designcourse* was chosen with this in mind, charting the course of the presently ill-defined design area.

Résumé des Articles

Traduction: Fernand Baudin

La lisibilité des différents caractères utilisés en cartographie.
Par Barbara Bartz

L'examen des diverses fonctions attribuées aux textes en cartographie mène aux conclusions suivantes: leur style et leur disposition s'inscrivent sur un plan qui va du symbolique à l'analogique a. selon l'emplacement; b. selon le style; c. selon la dimension (analogie quantitative). Une enquête dans la littérature cartographique consacrée à la lisibilité, en tant que notion et en tant qu'objet, tend à établir qu'elle est essentiellement dérivée de l'expérience typographique sans contexte spécifiquement cartographique. Comme on peut prouver que certaines utilisations des lettres en cartographie n'ont pas d'équivalent en typographie la validité de cette étude est au moins sujette à caution.

Les signes distinctifs pour l'identification des lettres. Conclusions applicables au dessin des caractères. *Par Paul A. Kolers*

Plusieurs expériences sont passées en revue. Elles portaient sur l'orientation des lettres et sur le sens de lecture. D'après les résultats, il semble que les lecteurs habiles n'utilisent que certaines caractéristiques pour identifier les lettres dont ils se font ensuite une représentation subjective. Ces caractéristiques se trouvent du côté droit des lettres. Il y aurait donc des retouches à apporter à certains caractères en vue d'atténuer des pleins exagérés à gauche ou une trop grande uniformité des traits en général. Pour faciliter l'effort d'identification il conviendrait aussi d'accentuer l'attaque de la lettre ainsi que tout ce qui lui est particulier du côté droit. Une autre conclusion encore: les appareils de pure transmission ne doivent pas nécessairement enregistrer et transmettre la totalité d'un caractère. L'appareil récepteur pourrait fort bien en reconstituer l'image totale à partir de quelques indications concernant son encombrement et ses caractéristiques du côté droit.

Les aptitudes motrices visuelles. Les réactions caractéristiques et les aptitudes à la lecture. *Par Katherine P. Dimeo*

Quelques a priori concernant les aptitudes motrices visuelles à l'âge du jardin d'enfants ont été examinés. La méthode consistait à étudier les rapports possibles entre les réactions les plus caractéristiques à quelques formes géométriques; ensuite, les aptitudes probables qu'on en peut déduire pour la lecture alphabétique. Les équivalences intersensorielles étaient mesurées par deux méthodes différentes, les stimuli étant perçus par le toucher. Quant aux stimuli—c'est-à-dire quant aux

formes, à leurs contours, ouverts ou fermés, complets ou fragmentaires; leur volume, mobilité, immobilité; leurs dimensions—ils étaient diversifiés au cours de cinq expériences subsidiaires portant sur la perception visuelle. Conclusion: les aptitudes motrices visuelles à l'âge du jardin d'enfants sont en relation directe avec la sensibilité aux équivalences intersensorielles et l'habileté à distinguer les formes géométriques.

Un code universel pour la lecture électronique des caractères.
Par Stanley Rice

C'est ce qui est proposé à l'usage des industriels. Ce code faciliterait la description des compositions en caractères traditionnels aussi bien que ceux des procédés automatiques les plus récents. Il simplifierait et clarifierait les communications entre auteurs, éditeurs, maquettiste et opérateur. Tout commentaire sera bienvenu.

Kurzfassung der Beiträge

Übersetzung: Dirk Wendt

Schrift-Variation und das Problem der Lesbarkeit in der Kartographie *von Barbara Bartz*

Eine Analyse verschiedener Funktionen von Buchstaben auf Landkarten legt den Schluß nahe, daß typographische Erscheinungen und Anordnungen auf der Landkarte mit Hinsicht auf ein symbolisch-analogisches Kontinuum betrachtet werden können. Druckschrift wird gesehen als 1. Symbolik, 2. Analogie, und zwar a) lokale (Orts-) Analogie, b) qualitative Analogie, c) quantitative oder Wert-Analogie. Eine Übersicht über die kartographische Literatur, die mit dem Begriff und mit Untersuchungen der "Lesbarkeit" zu tun hat, zeigt, daß ihr Inhalt hauptsächlich auf typographischer Forschung basiert, die nicht in kartographischem Zusammenhang durchgeführt wurde. Da nachgewiesen werden kann, daß der Gebrauch von Druckschrift auf Landkarten in mancherlei Hinsicht von besonderer Eigenart ist, wird die Anwendbarkeit jener Forschungsergebnisse in Frage gestellt.

Anhaltspunkte beim Buchstaben-Erkennen: Implikationen für den Entwurf von Schriftzeichen *von Paul A. Kolers*
Es werden verschiedene Experimente referiert, in denen die Lage (Orientierung) von Buchstaben und die Leserichtung manipuliert wurden. Aus den Ergebnissen folgt, daß erfahrene Leser Buchstaben dadurch erkennen, daß sie Anhaltspunkte zu ihrer Identifizierung auswählen und mit diesen Anhaltspunkten ein subjektives

Bild des Buchstaben aufbauen. Die Suche nach Anhaltspunkten scheint auf die rechte Seite des Buchstaben ausgerichtet zu sein. Dieser Befund legt es nahe, daß die Schriftzeichen so neugestaltet werden sollten, daß starke Striche auf der linken Seite oder überall gleichstarke dicke Striche vermieden werden sollten. Irgendein Hinweis, wo ein Schriftzeichen anfängt, und eine Betonung der brauchbaren Details auf seiner rechten Seite könnten diesen Auswahlprozess erleichtern, der zur Erkennung führt. Eine zweite Folgerung ist, daß Einrichtungen zur Übermittlung von Schriftzeichen nicht den ganzen Buchstaben zu analysieren und zu übertragen brauchen. Die Rekonstruktion, wenn nötig, könnte vom Empfänger aufgrund der Anhaltspunkte geschehen, die durch die lineare Ausdehnung und durch die Charakteristika auf der rechten Seite des Schriftzeichens gegeben sind.

Visuell-motorische Fertigkeiten: Reaktions-Charakteristika und Verhalten im Alter vor dem Lesen-Lernen *von Katherine P. Dimeo*

In einer Analyse der Beziehungen zwischen den Eigentümlichkeiten von Reaktionen auf eine Reihe geometrischer Formen wurden einige vermutete Aspekte der visuell-motorischen Fertigkeit von Kindergarten-Kindern untersucht. Die Folgerungen für die ersten Reaktionen auf Buchstaben-Formen (Bereitschaft zum Lesen) werden diskutiert. Zwei Maße für die Äquivalenz verschiedener Sinnesgebiete wurden benutzt, wobei der Reiz durch aktives Betasten (haptisch) wahrgenommen wurde. Die Reiz-Charakteristika—Umriß, Geschlossenheit, Größe, Drehung und Eingefügtheit—wurden in fünf visuellen Unterscheidungs-Tests variiert. Die visuell-motorische Fertigkeit von Kindergarten-Kindern steht in signifikanter Beziehung zu ihrer Leistung bei der Äquivalenz verschiedener Sinnesgebiete und zu ihrer Unterscheidungsfähigkeit für geometrische Formen.

Ein Einheits-System zur typographischen Schriftzeichen-Kennzeichnung *von Stanley Rice*

Ein Standard-Bezeichnungssystem mit breitem Anwendungsbereich in der Industrie zur Kennzeichnung von typographischen Schriftzeichen wird vorgeschlagen, mit Anwendungsmöglichkeiten bei der elektronischen Erzeugung von Schriftzeichen. Das System würde sowohl die herkömmlichen wie auch automatisierte Analysen von Zeichenreihen erleichtern und außerdem ein allseits verständliches Kommunikationsmittel für Autor, Herausgeber, Graphiker und Setzer darstellen. Es wird um Reaktionen auf das System gebeten.

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