VISIBLE LANGUAGE

The Journal for Research on the Visual Media of Language Expression

Volume VII, Number 3, Summer 1973

Cover: Some of the several thousand farmers of small holdings demonstrating in Cairo April 26 to thank President Anwar el-Sadat for exempting 3,000,000 small holders from all land taxes. Photograph: United Press International.

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Dr. Merald E. Wrolstad, *Editor and Publisher*
c/o The Cleveland Museum of Art, Cleveland, Ohio, USA 44106.

Announcement: MIT Press to Publish *Visible Language*

With this issue, *Visible Language* becomes a publication of The Massachusetts Institute of Technology Press. Dr. Merald E. Wrolstad continues as editor and owner of the Journal.

All business and subscription matters will be handled by The MIT Press Journals Department. A few modifications in distribution procedures and charges are listed on the General Information pages which follow; no changes in the basic format and content are anticipated. *Visible Language* will continue to be manufactured by W & J Mackay Limited of Chatham, England, which has since early 1969 produced the Journal according to the high production standards publishers have learned to expect from them.

We anticipate a three-fold advantage to the Journal in the new publishing arrangement: First, the Press—as well as MIT itself—has had deep interests and experience in a wide range of areas basic to our editorial philosophy (e.g., linguistics, graphic presentation) which the Journal will be able to tap at appropriate times. Second, our business, subscription, and promotional affairs will be on an even sounder basis in the hands of experienced professionals within an established journal publishing program. Third—and perhaps most important for the Journal's overall development—being relieved of the responsibility for these business affairs will permit the editorial side to concentrate on editorial matters.

It makes a great deal of sense, we have decided, to establish a separation of these two aspects of our publishing operations. It should also be pointed out that *Visible Language* maintains its policy of having no formal editorial affiliation with any professional organization—which requires the continuing, active cooperation of key investigators and practitioners in all of the disciplines which impinge on the Journal's development of the visible language concept.

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Typographs

Frank Harary

Typographs are defined as graphs derived from letters. A method for classification of letters by their underlying graphical structure is illustrated. A classification of the upper-case roman letters is presented, and tables of typographs are compiled as well for the roman numerals and the lower-case script letters. The possibility of devising new alphabets is mentioned.

The shape of letters has always had a fascination for literate mankind. With the advent of the computer came the need for the development of rapid methods for pattern recognition. The patterns formed by individual letters are studied in the science of graphology and the art form known as calligraphy. It is interesting to note that both calligraphy and graphology contain the word "graph" as the root. It is not at all unnatural to associate a graph with each letter. We have learned, in fact, that others are independently pursuing similar studies. We shall call these associated graphs *typographs*. Only capital roman letters will be studied in this paper. Other alphabets including the Hebrew, Greek, and Cyrillic may be investigated in later communications.

Graphical Preliminaries

Before presenting the typographs of the roman letters, it is necessary to explain quite a bit of graph theoretic notation and terminology. The following definitions, included here for the sake of completeness, may be found in [1].

A *graph* G is defined to be a finite, nonempty set of points, along with a set of unordered pairs of points. The pairs of points in the graph are called the *lines* of G. To illustrate, all the graphs with four points are shown in Figure 1. Those to the right of the dashed line are the *connected graphs* with four points.

Visible Language, VII 3 (Summer 1973), 199–208.

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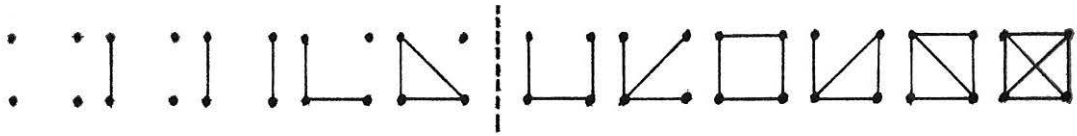


Figure 1. Graphs with Four Points.

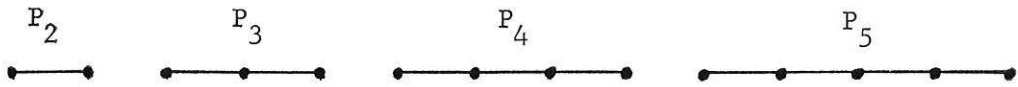


Figure 2. Paths.

Figure 3. Cycles.

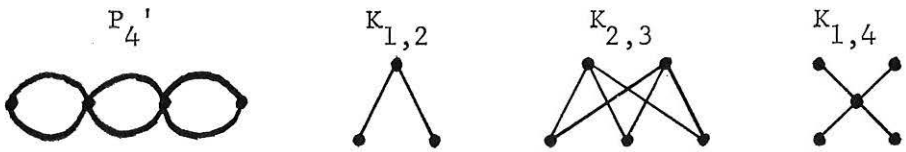


Figure 4. Types of Graphs.

We show the smallest graphs known as *paths* in Figure 2 and the smallest cycles in Figure 3.

An *acyclic graph*, also known as a *forest*, has no cycles; there are just six such graphs with four points. A *tree* is a connected acyclic graph; there are two trees with four points.

Strictly speaking, as in [1], the first two cycles shown in Figure 3 are not proper graphs; the first being known as a *loop* and the second as two lines *in parallel*. Just as P_n in Figure 2 denotes the path with n points, let P_n' be the graph derived from P_n by replacing each line by a pair of parallel lines.

The graph $K_{m,n}$ consists of two disjoint sets of points; one set with m points and the other with n. If two points appear in different sets, they are joined by a line, otherwise they are not. A *star* is a graph of the form $K_{1,n}$. Examples of the preceding types of graphs are shown in Figure 4.

Graphs of the Roman Capital Letters

In Table I we give the typograph of each letter. We have chosen letters similar to those used by Telingater [2].

The letters are classified in Table II as treelike, pathlike, unicyclic, starlike, or other. Note that the only letter in the "other" category is B, whose typograph is P_2'. In the same table, we have grouped together the letters which have the same typograph. Also, the letters are arranged in one of four groups depending on the frequency of occurrence of their typographs.

Table I. Typographs of Capital Roman Letters.

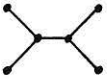
Letter	Typograph	Name	Letter	Typograph	Name	Letter	Typograph	Name
A			J		$K_{1,3}$	S		P_2
B		P_3'	K		$K_{1,4}$	T		$K_{1,3}$
C		P_2	L		P_3	U		P_2
D		P_2'	M		P_5	V		P_3
E			N		P_4	W		P_5
F			O			X		$K_{1,4}$
G		$K_{1,3}$	P			Y		$K_{1,3}$
H			Q			Z		P_4
I			R					

Table II. Classification of Typographs of Capital Roman Letters.

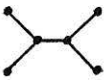
Frequency	Typograph	Letter	Classification
1		E	tree
		F	tree
		A	unicyclic
	P_2'	D	unicyclic
		O	unicyclic
		P	unicyclic
		Q	unicyclic
		R	unicyclic
	P_3'	B	other
2		H, I	tree
	P_3	L, V	path
	P_4	N, Z	path
	P_5	M, W	path
	$K_{1,4}$	X, K	star
3	P_2	C, S, U	path
4	$K_{1,3}$	G, J, Y, T	star

Table III. Typographs of Arabic Numerals.

0	1	2	3	4	5	6	7	8	9
									
									
0	1	2	3	4	5	6	7	8	9

Conclusions

It is necessary to point out that the typograph of a letter definitely depends on the particular way it is drawn in the plane! Clearly two topologically different presentations of a letter can produce different typographs with possibly different classifications. As an illustration, we take the arabic numerals 0 through 9; occasionally giving two drawings, and thus two typographs.

Cuspless printing, that is printing with rounded rather than pointed characters, provides another illustration of ambiguity in presentation. In Table I, if we had used .... rather than A, we would have had typograph (a) rather than (b) in Figure 5.

Here one should also note the relation between the capital script $\mathcal{Q}$ and the capital printed Q. The typographs of the two are identical and are shown in Table I. Tables for both lower- and upper-case script roman letters similar to Table I for capital typed roman letters can be constructed and used for comparative purposes.

Other figures which have been analyzed and classified are the roman numerals and the lower-case script alphabet. To clarify the notation of Table IV, we define the *union* of two graphs G_1 and G_2 to be the graph $G_1 \cup G_2$ containing every point and line in either G_1 or G_2. Figure 6 gives examples of unions of graphs.

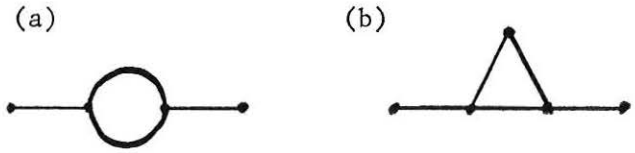


Figure 5. Two Typographs of A.

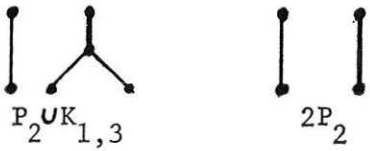


Figure 6. Unions of Graphs.

The first nine roman numerals are given below. The classification of more complicated numerals follows directly, and is left to the reader.

When analyzing the script lower-case roman letters, it is especially important to recognize the difference in typograph due to individual embellishments in penmanship. One set of typographs of the script lower-case Roman letters is presented in Table V.

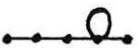
Amongst other things, our approach in this paper suggests the possibility of changing and improving our own alphabet, by exploiting typographs. Instead of using a letter, we could use its typograph, and in the cases where more than one letter belongs to the same typograph, we could choose a different plane embedding of the graph to correspond to each letter. For example, we could choose the embeddings (a) and (b) of Figure 7 of their (isomorphically) common typograph to represent H and I.

Clearly graphical classification offers limitless possibilities for modification and expansion of existing alphabets, and paves the way for the construction of entirely new alphabets.

Table IV. Classification of Roman Numerals.

Numeral		Classification	Numeral		Classification
I	P_2	path	VI	$P_3 \cup P_2$	forest
II	$2P_2$	forest	VII	$P_3 \cup 2P_2$	forest
III	$3P_2$	forest	VIII	$P_3 \cup 3P_2$	forest
IV	$P_2 \cup P_3$	forest	IX	$K_2 \cup K_{1,4}$	forest
V	P_3	tree	X	$K_{1,4}$	star

Table V. Typographs of Lower-Case *Script* Roman Alphabet in a Standard Presentation.

Letters	Typograph	Letters	Typograph
a		m, u	
b, h		n, r, v	
c		o	
d, e, l		p	
f		s	
g, g		t, x	
i		w	
j		y	
k		z	

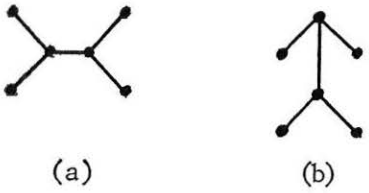


Figure 7. Two Embeddings of a Typograph.

REFERENCES

1. Harary, F. *Graph Theory*. Reading, Mass.: Addison-Wesley, 1969.
2. Telingater, S. B. The standardization of alphabetic graphemes. *Journal of typographic research* (now *Visible language*), II (1968), 235–240.

Added in proof. This article was received for publication on January 11, 1970, at which time the name of this journal was as in reference [2]. It was circulated in preprint form and inspired the insightful and interesting paper: J. A. Bondy, The "graph theory" of the Greek alphabet. *Graph theory and applications* (Y. Alavi, *et al.*, eds.), Berlin: Springer, 1972. Pp. 43–54.

This article was prepared with the assistance of Linda Bidelman.

Character Recognition Based on Phenomenological Attributes

B. Blesser, R. Shillman, C. Cox, T. Kuklinski, J. Ventura, M. Eden

A theoretical approach is suggested for describing upper-case letters not in terms of the physical attributes of their archetypes but in terms of more general descriptions of their underlying representations. A method is presented for finding these general descriptions through the study of ambiguous characters. Functional attributes are the describers of the underlying representations of letters. The relations between the physical attributes of the input character and the functional attributes that specify its identity are given in part by graphical context rules which incorporate the stylistic consistency within the character itself and its neighbors. The implications of our theory of characters to the areas of computerized character recognition and type design are noted.

I. *Introduction*

The literate human is adept at recognizing both hand and machine printed characters. Even though there are well over 1000 different type styles in general use in the United States (Karch, 1952), these variations do not affect our ability to correctly identify characters. Rarely used artistic fonts and hand printed characters, with their extreme idiosyncratic and variable forms, are easily recognized in the context of a word or when standing alone, even if one has never seen those particular variations before.

The ease with which humans identify characters misled many scientists into thinking that reading machines could be built based upon relatively straightforward descriptions of character archetypes. In contrast to human performance, the computer systems designed over the past 15 years are accurate only when they are restricted to recognizing characters which are limited to at most a small number of typefaces; changing the character's size, orientation, line thickness, serifs, etc., usually requires that the machine be retrained (for a survey of machine performance, the reader is referred to papers by Nagy [1968] and Harmon [1972]). An ideal machine would

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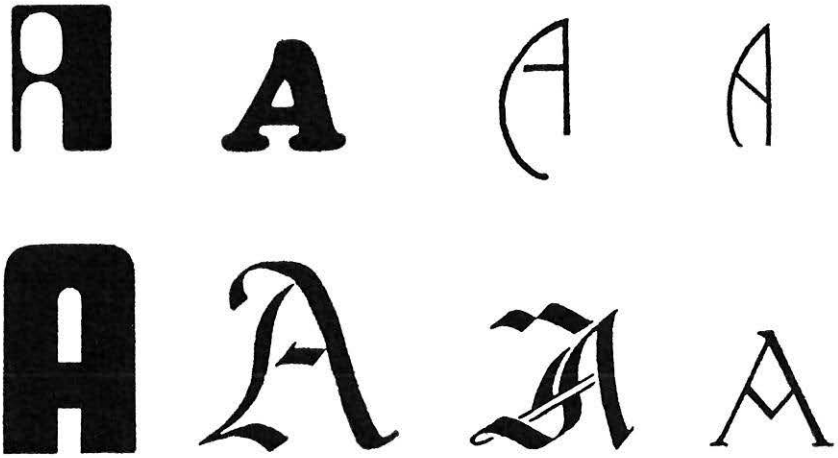


Figure 1. Various examples of the letter **A**.

duplicate human performance without the requirement of frequent retraining or updating.

Humans have the ability to generalize, to consistently group physically different objects into a common class. Although the physical similarities of the examples shown in Figure 1 are minimal, all literate people of our culture recognize them as the letter **A**.[1] Each of these allographs must possess certain invariants in order to account for this result; the discovery of these invariants has plagued psychologists and computer scientists alike. In the absence of knowledge of these invariants, we can neither explain how the human recognizes the examples in Figure 1 nor hope to design a computer recognition system which will duplicate human performance. Neisser (1967) stated the problem quite clearly: "Without some definition or criterion of similarity, no empirical prediction is possible; we are left to guess whether any particular stimulus will be

1. Henceforth, a letter printed in sans serif boldface will be used to represent the class of all characters that can be assigned that letter name; for example, **A** represents all characters that are called "ay."

recognized or not. Without an explicit model or mechanism, the notion of 'similarity' is only a restatement of the observed fact that some inputs are recognized while others are not." Similarity of letters can only be defined in terms of abstractions; the examples in Figure 1 are all A's despite the fact that they are not similar in terms of shape or size. Therefore, we make a sharp distinction between the physical image with all its allowable variability and an abstract underlying representation. We postulate a model for similarity based upon the presence of functional rather than physical invariants.

Functional similarity, however, depends on the nature of the question being asked. The allographs in Figure 1 are all similar in terms of the letter label, yet they are all dissimilar when considered as representative of their type style. Each allograph is a unique representation of its type style, e.g., Countdown (Letraset), Futura Display (Bauer), etc.

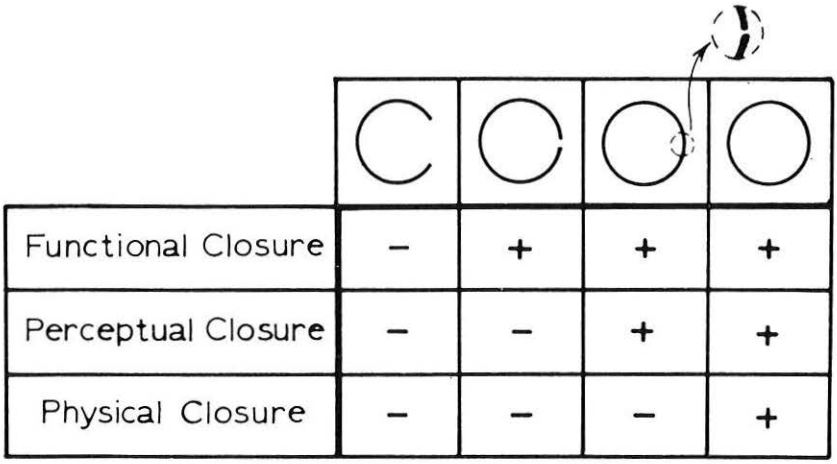
A model of character recognition can be called complete only when it provides a set of similarity relations for describing each letter such that the model predicts human performance. In our investigation, we seek an experimental strategy for finding these relations which will ultimately be stated as a set of "grammar-like" rules and which will be based upon a set of functional invariants or attributes.

II. *The Relationship between Physical, Perceptual, and Functional Attributes*

We postulate the existence of three classes of attributes for each character.[2] Physical attributes are the geometric parts which make up the character—such as lines, angles, and physical closures. Perceptual attributes are the parts that are perceived by an observer as being present in the character. Functional attributes are the underlying describers of letters.[3]

The difference between functional, perceptual, and physical attributes is illustrated in Figure 2, for the attribute closure. The state of the attribute is indicated by a plus sign (+) for closed and by a

2. We shall use the term "character" to denote the specific physical printed sample to which an alphabetic (or numeric) label will be assigned.
3. "Letter" is used to represent a class of characters all of which are assigned the same alphabetic label.



Functional Closure	–	+	+	+
Perceptual Closure	–	–	+	+
Physical Closure	–	–	–	+

Figure 2. Three levels of the attribute closure: functional, perceptual, physical.

minus sign (—) for not closed. The first character has no closure in any of the three senses: it is physically open, it is perceived as being open, and it functions as open—since the character is identified as a C. In contrast, although the second character is physically open and perceptually open (a gap is visible on the right side), it functions as if it were closed—since it is reported more often as an O than as a C. The third character is physically open but is perceived as being closed, because the gap is too small to be resolved when viewed at a normal reading distance. The fourth character is closed in all three senses.

Physical closure is determined by examining the character according to a topological test for the existence of a completely surrounded white region. Perceptual closure is determined by experimentally answering the question, "Is it closed?" Functional closure can only be determined by answering the question, "Is it an O or a C?"[4]

Functional attributes are concise descriptors of the underlying representation of letters. Removing or changing a functional attri-

4. Although one might think that functional closure is the answer to the question, "Can you easily imagine the right side being closed?", this is not always the case. The contextual effects, which will be discussed later, are an integral part of the functional question.

bute usually changes a character's identity.[5] Since the change of a functional attribute can shift a letter's identity, a partial change in a physical attribute related to a functional attribute can result in an ambiguous character, one that is labelled equally often as either of two or more letters. Conversely, the ambiguous character is a manifestation of at least one attribute in transition; by observing ambiguities we find functional attributes. For example, Figure 3 shows various A-H ambiguities. Let us consider the attribute closure; by varying the physical image, we alter the degree to which the top of the character exhibits functional closure. However, we are faced with resolving why character 6 is more often judged closed (functionally) than character 14. Here we have a direct contradiction between physical closure and functional closure: character 14 is physically closed but functionally open, whereas character 6 is physically open but functionally closed.[6] Another apparent contradiction is illustrated by the top regions of characters 26 through 30. Although the regions are identical, character 26 possesses A-like functional closure whereas character 30 lacks it. These examples clearly indicate that observations on a region alone are not always sufficient to determine whether or not that region is functionally closed. Other portions of the character or neighboring characters provide a context within which the state of the functional attribute is resolved. In characters 26 through 30, the lower region provides a context for the characterization of the top region.

III. *Functional Attributes*[7]

Our method for discovering functional attributes is based on characters which have an ambiguous identity. We began the process of discovering functional attributes by creating the matrix shown in Figure 4 which contains 180 different ambiguous characters

5. Functional attributes are analogous to phonetic distinctive features in linguistic theory. In both a linguistic theory and a character theory, the abstractions are chosen to describe human performance in the most compact and predictive way possible.

6. This apparent contradiction can be resolved by using graphical context as shown in Section IV.

7. We purposely avoid using the term "feature" because its meaning in the literature is often unclear; it could refer to either the physical or the functional level.

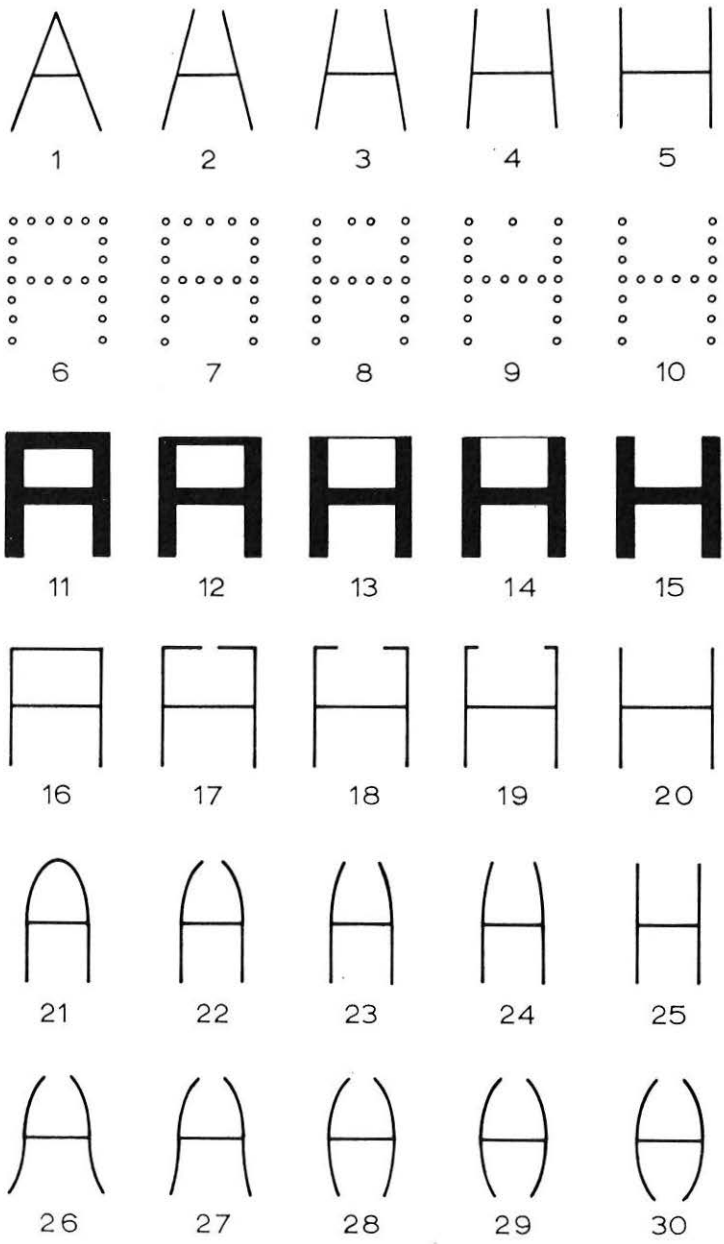


Figure 3. Various examples of the functional attribute closure in transition (left to right).

(Shillman and Blesser, 1973). According to our theory, such characters have one or more functional attributes whose state is not clearly defined.

To date, the functional attributes we have found are: closure, line extension, line addition, symmetry of intersection, symmetry (about the vertical or horizontal), smoothness, and verticality.[8] Examples of ambiguities involving these seven attributes are shown in Figure 5. The first character in Figure 5a is an O if the state of closure is a plus (+) and is a C if the state is minus (−). Similarly, the identity of each of the other characters in the figure depends upon the state of its functional attribute.

As we discovered new ambiguous characters, we found that they could often be described in terms of previously found functional attributes. Various combinations of the seven major functional attributes can describe over 90% of the ambiguous characters of Figure 4.

The underlying representation of each upper-case letter of the roman alphabet will ultimately be described in terms of the functional attributes that resolve the ambiguities involving that letter. Figure 6 contains a partial list of functional attributes of the letters A, B, H, K, P, and R; the list was prepared after considering 13 of the 56 ambiguities we have found involving these six letters.

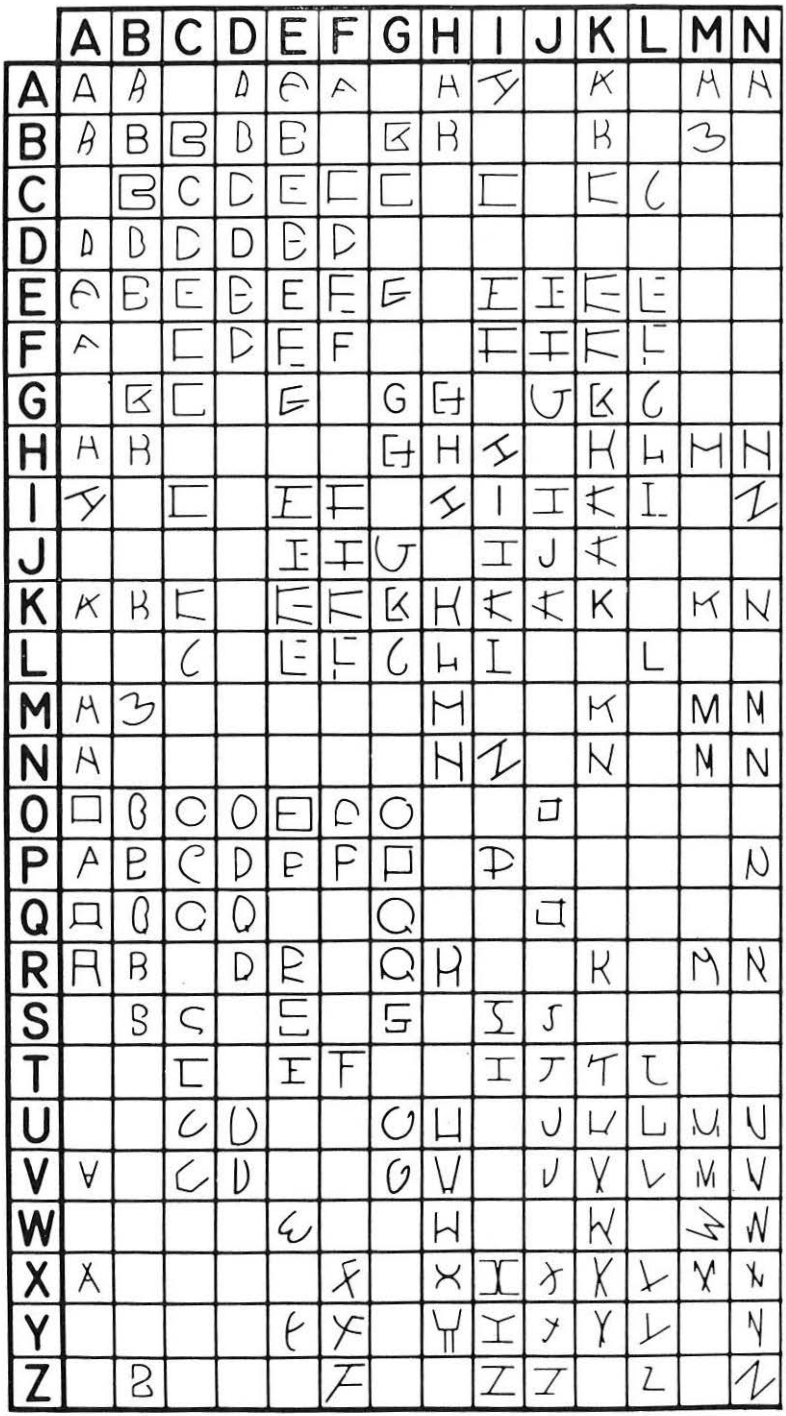
IV. *Graphical Context*

In order to identify which functional attributes are present in a given character, one must be able to map from the given physical attributes of the sample to the set of functional attributes. We shall refer to these mapping rules as graphical context rules. It is our contention that these rules are a basic part of character recognition because they provide a basis for the mapping between the physical and the functional.

Many types of context[9] have been suggested as an aid to character recognition, e.g., semantic, syntactic, letter n-gram statistics, and

8. We do not argue that our list of attributes is complete, but we note that any counter example may itself generate the necessary additional attributes which must be added to our grammar.

9. We are using a broad definition of context; information from the general used to analyze the specific.



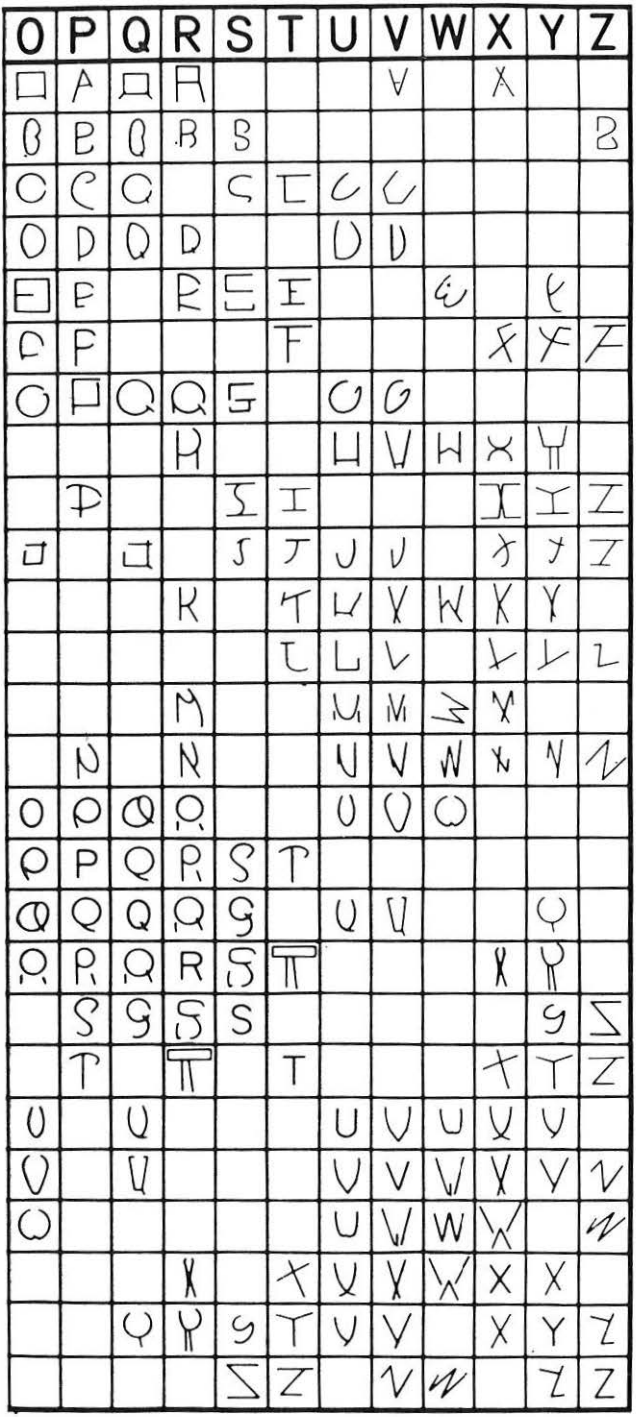


Figure 4.
A matrix of
ambiguous characters.

Functional Attribute	Character	Character Identity (state = +)	Character Identity (state = -)
Closure		O	C
Line Extension		Y	V
Line Addition		E	C
Symmetry of Intersection		A	R
Symmetry (vertical)		O	D
Smoothness		D	B
Verticality		N	Z

Figure 5. The seven major functional attributes and examples of characters whose identity depends upon them.

	A	B	H	K	R	P
Closure (upper)	+	+	-	-	+	+
Closure (lower)	-	+	-	-	-	o
Symmetry of Intersection	+	-	+	-	-	o

A zero (o) indicates that the functional attribute is not relevant for that letter

Figure 6. A possible coding of letter identity using functional attributes.

word probability of occurrence (Harmon, 1972). We shall restrict ourselves to a discussion of graphical context which is the particular type of context that depends upon the consistency of stylistic design within a character itself and with its neighbors.

In contrast to most character recognition techniques which implicitly take stylistic consistency into account, we will explicitly incorporate graphical context rules into our theory. The rules do not exist a priori; they must be derived from the given samples. They can be inferred by examining neighboring characters or through the examination of other parts of the character under consideration. We refer to these two types of inference as inter-character and intra-character graphical context respectively.

Incorporating inter-character context entails using information derived from the consistency of stylistic design among neighboring characters. For example, the character of Figure 7b is ambiguous, it could be an **N** or a **Z**. In the context of Figure 7a, the same character is easily identified as an **N**, whereas in the context of Figure 7c the character becomes a **Z**. Figure 7 shows how the mapping of the attribute verticality from the physical to the functional domain is achieved by using inter-character context; Figure 8 shows a similar

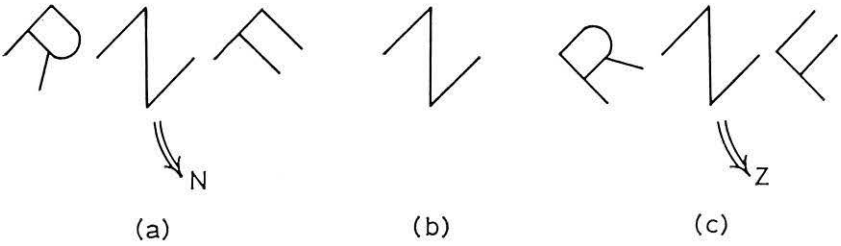


Figure 7. The effect of inter-character context upon the functional attribute verticality.

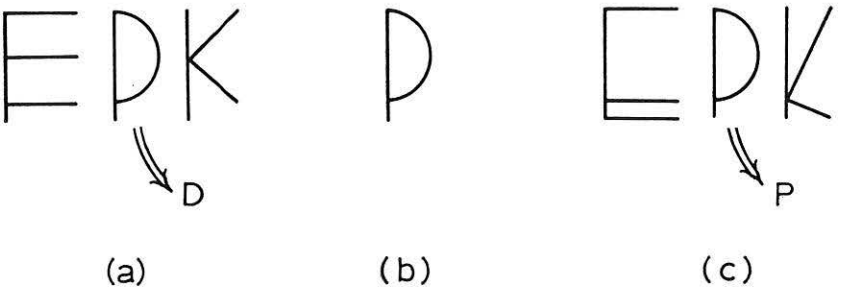


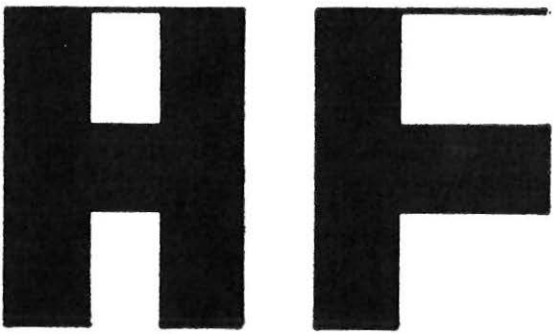
Figure 8. The effect of inter-character context upon the functional attribute line extension.

Figure 9. The effect of intra-character context upon the determination of functional closure.

effect for the attribute line extension. In both figures, inter-character consistency can be used to identify an otherwise ambiguous character.

Intra-character context can be viewed as a localized version of inter-character context; it entails using the consistency of stylistic design within the character itself. To illustrate this concept, consider the confusing examples discussed in Section II which are reproduced in Figure 9. Using intra-character context, the apparent contradiction between physical and functional closure can be resolved by considering the definition of line within the stylistic design of each of the characters. Figure 9a is an A since a sequence of open circles defines line within that particular character; Figure 9b is an H because the definition of line demands a thick physical line, hence the thin upper horizontal line is rejected as being a stylistic flourish or an artifact even though it is a line in the physical sense. In both cases, intra-character context determines the state of functional closure.[10]

10. According to our theory, graphical context is necessary for character recognition; we do not claim it is always sufficient. The following example illustrates how ambiguity can persist when inter- and intra-character context conflict. The identity of the first character remains in question since inter-character context implies that top horizontal lines can be thin whereas intra-character context implies that this line is an artifact.



V. *Summary*

We have proposed a theory of characters in which each upper-case letter of the roman alphabet will be represented by a unique set of underlying attributes. We have presented a technique for finding these functional attributes through the study of ambiguous characters. The characterization of the alphabet is not yet complete but evidence indicates that the number of functional attributes will be small. We do not argue that our set of functional attributes is the only possible set; we will choose that set of attributes which yields the most compact description of letters.

The relationship between the physical attributes of a character and the functional attributes which specify its identity are given by the graphical context rules. These rules do not exist a priori: they must be derived from the samples under consideration.

Experimental data relating physical attributes to functional attributes in specific contextual situations have been obtained (Sefkow, 1973). In addition, we are currently investigating the graphical context rules for several different type styles. Experimental results in support of our technique are forthcoming.

VI. *Conclusions*

Our theory of characters has implications both to the area of computerized character recognition and to the design of new type fonts.

Because our technique for describing letters is based upon the underlying functional attributes of letters as opposed to the physical features of archetypes, we feel that a computer implementation of our technique will have a higher recognition rate and be capable of handling a wider variety of input text than currently available character recognition systems.

According to our theory, the design of a new type style can be viewed as character recognition in reverse. The design of a new type font is the creation of a set of *inverse* graphical context rules that operate on the invariant set of functional attributes that define letter identity to yield new graphemes.

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Forth and Back and Forth

I went to interview Professor Otto R. Osseforp in November of 1970, shortly after his appointment to the Emor D. Nilap Chair in Palindrominology at Harvard. The sign on his door said "Professor Osseforp" and the monogram on his tieclasp read "O.R.O.," but he asked me to call him simply "Otto.". . .

"What about your new novel? Could you tell me the title?"

"Dennis Sinned."

"Intriguing. What is the plot?"

"Dennis and Edna sinned."

"I see. Is there more to it than that?"

"Dennis Krats and Edna Stark sinned."

"Now it all becomes clear," I agreed. "Tell me, with all this concern about the ecology, what kind of car are you driving nowadays?"

"A Toyota."

"Naturally. And how about your colleague, Professor Nustad?"

"Nustad? A Datsun."

"Yes. And do you drive to the campus via Belmont?"

"Not so. By Boston."

"I understand you are also an expert on foreign affairs. Whom do you see as the next leader to be deposed in Southeast Asia?"

"Lon Nol.". . .

"Do you see your position as support for Administration policy in Vietnam?"

"No, it is opposition."

"What was the turning point of the war?"

"Tet." . . .

"I heard you recently spoke at the University of Ethiopia. Don't they refer to the capital city as Addis?"

"Ababa."

"Wasn't there some new product you were urging them to export?"

"Lion oil." . . .

"Could you tell me who are some of the other leading experts on palindrominology, and where are they located?"

Without hesitating, he launched into an alphabetical recitation that began with

"Akaso—Osaka; Amoroso—Roma . . ."

and seemed to continue interminable. Somewhere in the vicinity of

"Olson—Oslo."

I made my apologies and left the room. I am not entirely sure he noticed.

Excerpted from an article by Solomon W. Golomb, professor electrical engineering and mathematics at the University of Southern California, in the *Harvard Bulletin*, March 1972.

Reading Between and Beyond the Lines

Malcolm P. Douglass

Rather than be bound by traditional assumptions about reading—e.g., that learning to read is a difficult task for a child and counter to his natural learning processes—we should view reading holistically. A child's earliest attempts at handling visible language symbols parallel his earliest efforts to speak and to listen, and these attempts emerge naturally as a part of normal human development. We can teach reading only indirectly. Our efforts should nurture the spontaneous nature of language learning and should provide the climate and opportunity for a child to write and to read in the broadest possible context—including the "reading" of symbols, gestures, works of art, etc.

The forty-year existence of this Conference is testimony that the original purpose for calling it into being has not been met. That purpose has been to view reading holistically: to see reading in its broadest possible context, to encourage thinking about its nature, and to derive applications for schools and elsewhere that encourage the better development of reading abilities. The simple truth of the matter is, of course, that the problem of reading is very much with us and the holistic idea is still waiting in the wings to be given a serious tryout. Despite all the technological advances—a factor which clouds today's picture as to what is real and what is myth in reading—responses to the problem of literacy in this country remain singularly unchanged.

Read if you will Edmund Burke Huey's *The Psychology and Pedagogy of Reading*, originally published in 1908 and recently republished.[1] Huey's book, loaded with ideas that today are still considered radical, serves as an especially good example to demonstrate to us that things

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may look quite different but, in fact, they are not. In school, advocates of holistic conceptions of learning and behavior remain a small minority. Just how small, it is difficult to tell because there are many more who agree with holistic ideas than practice them in teaching. In major part, I think this is because teachers have by and large lost control over what they do in the classroom, at least in reading. They have become, instead, purveyors of curricula designed in places far removed from their own classrooms and their own students.

When one examines these "new" programs in any detail, it is amazing how much they are like all that has come before. At their base is the notion that reading is a subject in the school curriculum. We teach that subject matter with the underlying presumption that mastering it is *the* premier avenue to a child's becoming a fluent and critical reader. There is no agreement as to what constitutes the subject matter of reading; every set of materials is different both in terms of total content and in the sequence in which it is presented. Nevertheless, the notion remains that one must study reading to read, and the best insurance against teaching failure is the purchase of, now, very expensive sets of materials.

We also believe that reading is something that is hard to learn; that it is somehow going against human nature when we set out to to teach a child to read. As well, we accept the idea that there will be failure. America produces more "problem readers" per thousand population than any other reasonably literate society. At the same time, we teach reading longer—both by the day and by the year—than any other nation. It is surprising more people aren't shouting "Stop this self-fulfilling prophecy, I want to get off!"

Tradition has strong allies as well as strengths of its own. There are good reasons why holistic conceptions of reading behavior have not been received more openly and given a major try-out in our schools. We have been distracted by wars, by internal violence, by shifting moral and ethical codes and behavior. Little energy has been left to try to bring about change in our schools. Even if the energy had been available, the will deliberately to change the schools has been lacking, and the schools themselves have always been extremely effective in blocking change.

The most important set of controlling factors, however, remains the continuing domination of a traditional point of view about the

nature of knowledge and ways of knowing, which in turn is reflected in our views about the nature of reading and how that is learned. Those roots can be traced back to the Calvinistic teachings of some of our forefathers: reading provided the means by which God revealed himself to the individual—reading the Bible, that is. Anything done in the name of God could not, of course, be frivolous, or fun, or easy. Ergo, the work-ethic of reading and the beginnings of the idea that reading ran at cross-purposes to human nature. In addition, that tradition has since been supported by a particular psychological position about learning processes.

A major reason why so little movement has occurred in reading remains largely unrecognized, and that, surprisingly, is that we know so very little about it. Literally billions of words have been written about reading, and thousands upon thousands of research studies reported, but they tell us very little about how one becomes a reader or what reading behavior is like. Virtually all of the studies are predicated upon assumptions about the nature of the reading process which remain open to criticism and even attack. However, there is now on the horizon a growing body of information that we may find extremely useful in helping us better understand what conditions appear to be most important in the learning-to-read process. It provides very specific descriptions of child language behavior, and while it does not tell us how a child learns to read or even how he learns his oral language, it does at last provide us with the capability for generating inferences. I will develop some meanings that I derive from this newer kind of information about reading.

The problem of reading is not in reading the lines of characters—as is our usual way of going about the business of teaching. Instead, it is the problem of reading between and beyond the lines, simply because reading behavior is apparently not taught directly. Rather, an environment exists—hopefully, arranged with care and understanding—where reading and other language learnings are encouraged to emerge. Not only is reading *not* a separate entity, it appears as if it emerges quite naturally as a part of normal human development and that it grows and expands along with other forms of language and knowing generally, if properly nurtured, primarily as a consequence of practice. Like learning to speak and to listen, the ability to read

and to write is, in action, far more complex than our simplistic systems have, so far, been able to describe with any satisfaction. Additionally, teaching so that those complexities are mastered seems not to be the analytic, logical thing we have thought it to be.

We know that listening and speaking come into being in the first few months of life and that they experience their greatest growth and expansion during the first four to five years—or before the child enters school. *We do not know how the child learns his language*; all we have are the beginnings of descriptions of what he appears to be doing at various stages of development. As the amount of that information expands, we are seeing more and more clearly how adults model the "grown up" language for the child; how he seems, voluntarily, to practice what he is learning, how his language emerges and grows. We see each child putting together combinations of words in ways he has never heard before, without ever having to be taught—in fact, we find we cannot teach the child to modify his oral language, apparently only he can do that. Our conclusion is that whatever is happening is very complex, that it appears to be internally directed, and that he utilizes clues from the environment in a fashion that cannot be clearly explained. Understanding the growth of listening also remains very obscure, partly because the whole hearing apparatus is hidden from direct observation and because, like reading print itself, it is a silent, interior kind of activity beyond our ability to describe exactly, simply because it is impossible to establish common standards for the purpose of making comparisons.

Many linguists argue that this proclivity for language is innate. There appears to be an inborn language capacity, and it is certainly true that all hearing children who grow up around other people learn to speak and to listen. However, the thing that is peculiar or unique about humans in relation to other animals is their ability to manipulate those words in strings of language symbols so as to create an infinite number of different meanings. But just how that manipulation occurs, how the child masters the language rules that govern what goes with what, remains a mystery. He appears to do it very much on his own—with some help from his friends—but how he utilizes that help we do not know.

Why it is we would think that such natural symbol-using should stop with oral language also qualifies as a mystery. It would appear

that the human organism is in fact incapable of stopping, or delaying significantly, comprehension of other symbol systems, including printed and written words. The only major restriction would seem to be opportunity. We see many pre-school children who very early on engage in something that might be called "pretend writing" as a precursor to what you and I might call "real writing." Just as the infant presages the oral production of "real words" by babbling, it is not surprising that we might see two- and three-year-olds producing squiggles which can be repeated, or "read" back, with amazing accuracy. Likewise, we see very young children "pretend reading." Not all children engage in such processes. Whether they do or not seems to depend upon such things as the availability of pencil and paper, opportunities to see others writing or reading, and (possibly most important of all) being around other people who recognize the effort as something worthwhile that is noticed and praised.

On what grounds do we separate reading and writing from other language activity and, in fact, from other ways of knowing? Man is a symbol-using and symbol-creating animal. And as the child is father to the man, it is not surprising that by the time the child reaches school age he is already speaking fluently and beginning to develop the ability to create meaning for print (which is reading) and to devise symbols to accompany his oral language (which is writing). There are those who will argue that the ability to identify the Cheerios box, or Channel 7, or any other common symbol around the house is not reading. But to exclude this ability as a beginning stage of reading is like demanding that we only think of speaking as when a child can put two or three or more words together. We commonly consider speaking to be at its beginning stages when a child can utter one word as an expression of a holistic meaning—it is called holophrastic speech. Why not accept this definition for beginning reading when the child responds to one symbol (like Cheerios, to mean: breakfast, good, hungry, now, etc.)?

If we can accept the holophrastic response of a child to a printed stimulus as a legitimate first stage in reading, then we can see that reading in its conventional sense begins for all children around the age of three or so. And we can perhaps get used to the idea that responding to visible symbols is quite a natural event in a child's life. It might help us also to explain how it is possible for some children at

three and four, with a minimum of instruction, to become quite competent readers and writers, given their intellectual maturity.

Lying behind what I have been saying, of course, is the question: Is it possible to teach reading? I think the answer is: Only indirectly. Just as the linguist would say that it is not possible directly to teach a child to speak or listen, then, if there is any truth in the idea that reading and writing are directly related to oral language, the development of those abilities would occur in a very similar circumstance. As I have pointed out earlier, we have very little data to prove that teaching the subject matter of reading in fact leads to proficiency in reading. We have assumed a great deal in this regard without ever seriously questioning whether cause leads to effect. For example, Clymer[2] and others have done a great deal of research into the "utility" of phonics generalizations (but not into the ability of the child to utilize generalizations in "unlocking" new words). He does point out, however, that many of the generalizations teachers' manuals include seem only to be useful *after* the child can already say the word! It would appear highly possible that even those few generalizations which have wide applicability will be applied only in those cases where the child already knows the word. In any case, given the great variation in word structure vs. pronunciation, it is very clear that the learning of phonic generalizations could be applied only with respect to the smallest fraction of one's vocabulary. Without commenting on the efficiency of such activity, it seems quite clear that the child is using other strategies to decode words, and we know next to nothing of what those strategies may be. At the same time, we elect to teach strategies based on an adult logic of what the problem of reading appears to be, in the face of further evidence from such people as Piaget and other cognitive psychologists who point to the fact that child logic is something quite different from that of the adult. That one form of behavior (reading) emerges as a consequence of certain other kinds of learning (acquiring knowledge of phonic generalizations, learning the alphabet, etc.) is a matter that must be seriously questioned. Imagine the outcome, if you will, were speaking to be taught as reading is usually taught. The result would very likely be speaking-impaired people,would it not?

Let me bring out two other examples that suggest children appear

to learn to read by rather indirect methods as far as we teachers are concerned. First, it is the experience of every remedial teacher I know that children who somehow do make a leap forward in reading—this usually occurs only after months and even years of very intensive instruction—make that leap apparently not as a consequence of any special bit of information or acquaintance with rules, particular skills, and the like. Somehow, such children manage to, at last, put it all together. There may have been a critical piece of information, but we rarely can say we know with any surety what it was. Thus, again, the question of efficiency; just what do remedial procedures produce per hour of instruction and what else is there in the situation that affects the result? We also find that some children blossom when special medicines are prescribed, such as thyroid medication. Progress in such cases can only be described as "spontaneous," since it is usually observed to have happened without any change in instruction.

A second batch of evidence about the spontaneous nature of reading growth is contained in the experience of other countries. I have recently had the opportunity to study reading programs in Russia and England, as well as Norway. And through my students and colleagues I've been able to learn about experiences with reading development in a number of Asian and African nations. The fact is that no other country with a comprehensive school system experiences the difficulties we do. Most seem to find beginning reading problems in about five percent of the school population. This figure is reduced to one or two percent within the first few years of schooling. This is the result in the face of a minimum of instruction. In Norway—and I believe this holds true for the other Scandinavian countries—directed teaching of reading lasts at most for two years, and usually one. In the USSR, children enter the equivalent of our elementary school already reading (they have an extensive educational program for younger children and efforts to instill this ability appear to be concentrated in the fifth to sixth year of that experience). In Vietnam and Korea most children learn to read at home, before they go to school. In Sierra Leone the problem seems to be finding something worthwhile to read rather than learning to read itself.

The meanings in these situations are many and varied. Let me mention only a few. First, there is no contination of "reading instruction" as we know it beyond the point of reasonable fluency, whether

learning takes place before formal schooling begins or at its very outset. After that, there is a heavy use of books, but these are books that relate to the subject areas of the curriculum. Reading ability grows, evidently, as a consequence of practice in reading about things, in reading for the joy of it, or reading the great literature in the country's heritage. Note, too, that as far as normal instruction itself is concerned, the methods of teaching are, by our standards, old-fashioned and the instructional materials minimal. We would find those standards unacceptable here. Just as we have found with the Cooperative Reading Studies, it appears that the methods and materials used make little difference; whole word procedures work as well as phonics, in other words.

There are some things that do make a difference, however, and which may have special meaning for us in understanding our "reading problem." One is that formal instruction in reading in these other countries usually does not begin until a year or two later than it does in the United States. I would have to revise that to two or three years where our kindergarten programs have become involved in formal instruction. The modal beginning age where formal instruction is very rigidly applied is the seventh year. Also, it is important to note that the cultures with the least amount of difficulty are the more homogeneous ones. There, values are more completely shared between child, teacher, parent, and community. Enculturation is a powerful factor, but so is the commonly held belief that all will learn to read, in due time, and probably sooner than later. "Failure" is not a concept Norwegian teachers know about as far as their classroom experience is concerned, nor does one find it often in terms of early developmental problems anywhere else. We seem to have a corner on that idea.

Here, then, is one more set of examples demonstrating that reading probably emerges very spontaneously. If children are old enough to think logically—this begins at about age 7 or 8—we can probably utilize some of the subject matter of reading to get them started if we wish, although that may not be necessary. In any event, once started, the process of reading evidently develops primarily as a function of practice.

The reading curriculum in schools thus is much broader than we commonly assume. In fact, what we call reading instruction may in actuality be only a very small—and not critically important—part of

the reading curriculum. To extend the daily or weekly time devoted to formal teaching of reading may therefore be accomplishing just the opposite of our intent by reducing the amount of more potent learning experiences. It may also be true that our unwillingness to let the culture of the community be represented in the school (except where that community represents the dominant middle-class) puts such a strain on differing value systems that it will be impossible for a child to learn to use his natural inclination to utilize symbol systems. Thwarting innate structures, if they do indeed exist, can possibly lead to some very serious problems.

If what I have been saying makes any sense at all, then it follows that the formal reading program ought to be the *least* expensive effort in the school curriculum. This is because it need not require fancy materials, and the formal program itself could be shortened greatly. A wiser place to put our resources would be into school libraries and the content curriculum. We would also need to buy a lot more blank sheets of paper and more pens and pencils. Less time would be spent on correcting workbooks and grading tests; more time in reading what children were writing and talking and reading about. Teaching would be harder work. And, we could still state our objectives. We would be searching for the youngster who "reads independently," "selects a book to keep at his desk to read when all other work is done," or who "uses research materials, such as the classroom encyclopedia, independently." We will see how valid such objectives are as more information about reading behavior and the nature of the reading process becomes available.

I have largely limited our definition of reading to the sense of creating meaning for words, usually as they are found in their printed or written form. That is actually not the broadest possible context for viewing reading behavior. The generic meaning of the term "reading" has to do with the process by which an individual creates meaning for anything in his environment for which he is able to develop an awareness. Because reading is a silent, interior act, the exact nature of the stimulus—e.g., printed words, symbols, gestures—is irrelevant to reading. As one tries to think how it is that a person can learn and then remember forever that a word stands for a certain set of ideas—all of this accomplished without ever having to think

about the processes involved in remembering—he becomes aware that getting the hang of a particular symbol system or complex of signals is not the important thing in reading at all. Experience, including of course the ideas that come into being as a consequence of experience, is the central aspect in reading. And while language as we conventionally view it is a most powerful tool for thinking, it is not difficult to imagine how other means for knowing—reading a television screen or a work of art—are also powerful in learning, if we can learn to read them critically. We can also perhaps see that symbol systems appear to be quite easily apprehended once experience is appropriate to the kind of reading that we wish to engage in.

I think there is great power in this very broad perception of reading behavior. The "literature" of reading conceived in this context is to be found in many different places. Linguists tell us of language development, social scientists of the milieu that affects values, attitudes, economics, and the like. From the arts and literature we find guides for setting standards of excellence, and from medicine and its allied arts and sciences we learn of the optimal functioning of the organism itself. Educationists will, I believe, find these to be primary sources for understanding reading behavior, for therein lies the information we can use to read between and beyond the lines.

1. Cambridge, Mass.: MIT Press, 1968. xlix + 469 pages, $3.95 (paper). New introduction by Paul A. Kolers.
2. Theodore Clymer, "The Utility of Phonic Generalizations in the Primary Grades," *The Reading Teacher* (January 1963), pp. 252–258.

Gothic Letterforms and *Codex Vindobonensis*

L. Allen Viehmeyer

Traditionally the Gothic bishop Wulfila (c. 311–c. 383) is credited with the development of Gothic alphabetic letters. The Gothic documents which have come down to us from the fifth and early sixth century exhibit letterforms and scribal practices which have led to various hypotheses about the source(s) of the Gothic letterforms. Although the existence of Gothic alphabets in *Codex Vindobonensis* has been long known, the lack of an adequate appraisal of the alphabets has led to their neglect. An appraisal is offered here which attaches great significance to these alphabets as evidence of an early phase in the development of Gothic letterforms, and hence of prime importance for a derivation of the Gothic alphabet.

Some 150 years after the birth of Christ, the first reference to the Goths was made by the Greek geographer Ptolemy. By that time many Goths had left their Scandinavian homeland, crossed the Baltic, and settled in the vicinity of the Vistula. Throughout the second century A.D. there was a steady flow of Goths toward the Black Sea. The first groups reached that area about 170, and for the next hundred years the Gothic population there was steadily increased by new arrivals. About 260 two major groups of Goths emerged: the Visigoths and the Ostrogoths. The Ostrogoths settled briefly in an area to the north of the Black Sea; the Visigoths established themselves at first in Lower Dacia to the west of the Black Sea and north of the Danube. Pursued by the Huns, the Visigoths were later compelled to cross the Danube and settle in Lower Moesia. Only after the battle of Adrianople in 378 were the ever transient Visigoths able to secure a somewhat permanent settlement in Thracia.

The Visigothic conversion to Christianity was a gradual acceptance and observance of Christian tenets. The first Visigothic contacts with Christianity apparently occurred during raids into Roman provinces in the latter part of the third century. Later forages in Asia Minor—particularly Phrygia, Galatia, and Cappadocia—netted the Visigoths

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a great many prisoners, a number of whom were Christians. Despite their captivity, these Christians were apparently able to convert a few of their captors. Missionaries from both the East and the West were yet another source of Christian influence during the fourth century. Working among the Goths, Audius of Mesopotamia is said to have brought about many conversions, and there are even reports of Gothic monks. Yet, in spite of these various forces, there were very few Christian Goths before 370. Apparently it was sometime between 383 and 395, while settled in Moesia, that a large number of Goths became Christian.

Never long in any one location, the Goths were constantly on the move within the general area of Moesia and Thracia. In 375 began what are usually called the Barbarian Migrations, and during the next century the Visigoths wandered from the Black Sea to southern France and the Iberian peninsula, while the Ostrogoths established a kingdom in northern Italy. It was during the Ostrogothic sovereignty in Italy that the extant Gothic manuscripts were written.

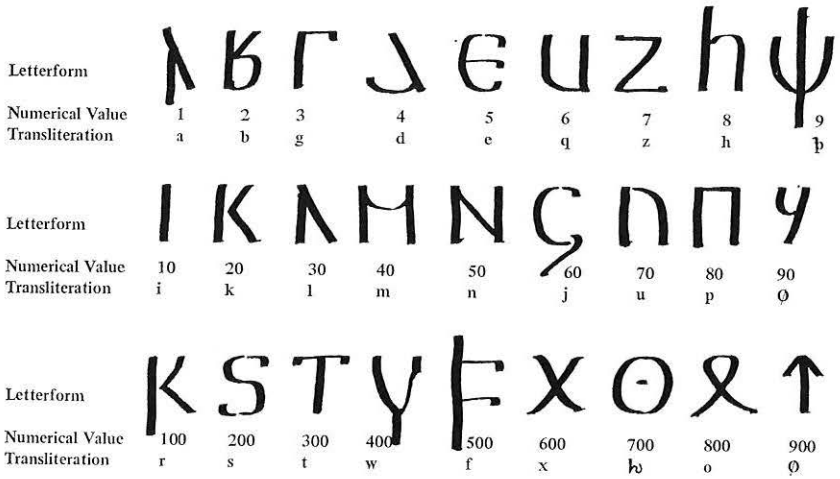
During the early period of Christian growth among the Goths, Wulfila, the grandson of a captive Cappadocian Christian, became a leader in the spiritual life of Visigothic communities in Lower Moesia. Wulfila (c. 311–c. 383) was a zealous apostle of the faith and persuaded many Goths to forsake their pagan ways. In 341 he was appointed bishop, and he served in this capacity for some forty years. Most of our knowledge about Wulfila's creed (Arianism) and activities as a church leader comes from a biography written by his protege, Auxentius of Dorostorum. Although Auxentius is silent on the matter, many later writers, among whom are the fifth-century church historians Philostorgios and Sokrates, credit Wulfila with the invention of Gothic manuscriptal letterforms.

Table I illustrates Gothic alphabetic letterforms, especially as they are found in *Codex Argenteus* (c. 600), the most famous of Gothic manuscripts. Some hypotheses proposed about the derivation of Gothic alphabetic letters would admit only a single source for all of the letters; others would trace some letters to the Greek, some to the Latin, and yet others to the runic alphabet. All of these hypotheses are based upon the letterforms as they are found in the extant Gothic Biblical codices (primarily *Codex Argenteus*), the earliest of which was written in Italy in the late fifth century nearly 200 years after Wul-

fila's death. The lapse of time between the origination of the letterforms and their documentation, coupled with an entirely different geographical location of the scriptoria which produced the extant codices, makes it thinkable that some of the letterforms in Table I are not those which Wulfila himself originally devised or adapted for writing the Gothic language. In a much later, non-Gothic manuscript —*Codex Vindobonensis* (c. 800)—there are Gothic alphabets which contain letterforms not found in any of the extant Gothic manuscripts. After a brief survey of the extant Gothic manuscripts and the letterforms used in their production, it will be shown how the unique Gothic letterforms in *Codex Vindobonensis* could well be earlier versions of letterforms found in the extant Gothic documents. As a link between Wulfila's original alphabetic letters and those of the fifth and sixth centuries, these letterforms would be very important for a derivation of the Gothic alphabet.

Several manuscript fragments containing the Gothic rendering of the Gospels and Pauline letters are the primary source of Gothic letterforms. These Biblical documents are the *Codex Argenteus*; the *Codices Ambrosiani A, B, C, D,* and *E*; *Codex Carolinus*; and *Codex Gissensis*. The problems of dating these manuscripts and determining the location of the Gothic scriptoria which produced them are very

Table I. The Gothic Alphabet.[1]



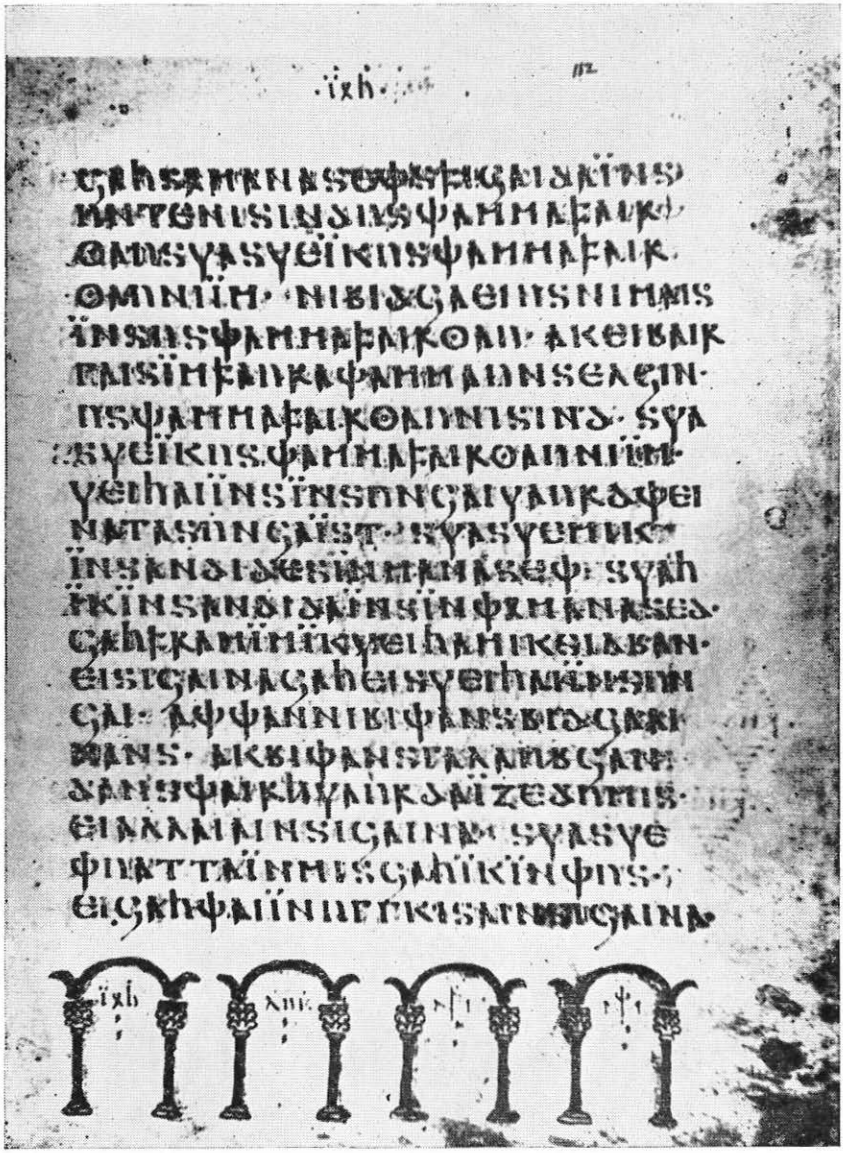


Figure 1. *Codex Argenteus*, the Gospel according to John, 17:14–21. Reproduced from the facsimile edition by von Friesen and Grape (1927).

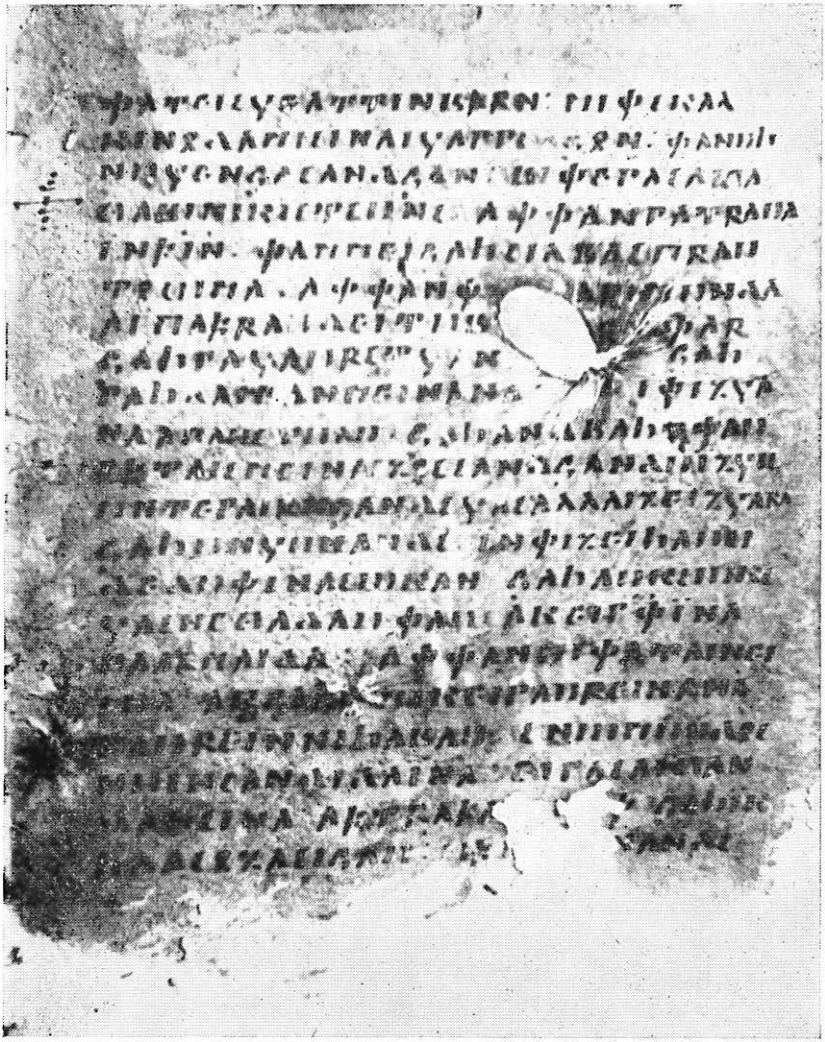


Figure 2. *Codex Ambrosianus B*, Paul's letter to the Philippians, 2:22–28. Reproduced from the facsimile edition by de Vries (1936).

complex. In general terms, the dating has ranged from 400 to 600 A.D. *Codex Carolinus* and *Codex Gissensis* are usually considered to have been written earlier than the others, whereas *Codex Argenteus* is generally regarded as the last to have been written. The scriptoria in which these codices were written are believed to have been located in northern Italy and possibly in the southeastern corner of France.

The Gothic Biblical documents are written with letterforms which may be called uncial, a term of Latin and Greek palaeography used to describe letterforms that are rounded or that have descenders or ascenders. In Gothic manuscript writing two types of uncial—"upright" and "sloping"—are distinguished. When the upright uncial is formed, the squared tip of the pen is held at a right angle to the writing line and the vertical pen stroke forms a right angle with the base line. In writing the sloping uncial, the pen is tilted at a 30° or 60° angle away from the shoulder and the vertical pen stroke forms a 60° angle with the base line. Upright uncials were used in the writing of *Codex Argenteus* (Fig. 1); *Codex Carolinus*; *Codices Ambrosiani A, C, E*; and *Codex Gissensis*. Sloping uncials were employed for producing *Codices Ambrosiani B* (Fig. 2) and *D*.

Of the various aspects of Gothic palaeography, the abbreviation of final -n and -m should be mentioned. In the texts written with upright uncials, the scribe abbreviated final -n and -m by drawing a line over the letter which immediately preceded the -n or -m. In the manuscripts written with sloping uncials only final -n was handled in this way; final -m was never abbreviated. The usual interpretation of this practice is that the abbreviation of both final -n and -m is based upon the Latin practice, whereas the abbreviation of only final -n is Greek in origin (there are no final -m's in native Greek words).

Although of only secondary importance, two contractual agreements containing several phrases in Gothic might be mentioned. These contracts preserve the only specimens of Gothic cursive handwriting (Fig. 3). Both manuscripts were found in northern Italy—one in Ravenna dated c. 551 and the other in Arezzo dated c. 540.

All the codices mentioned above contain the Gothic translation of the New Testament and were written during the late fifth and early sixth centuries. *Codex Vindobonensis* is not a Gothic Biblical account, but rather mainly a collection of personal letters by Alcuin and others addressed to Arn, an archbishop of Salzburg. This codex was compiled about 799 or roughly 100–150 years after the last extant Gothic codex

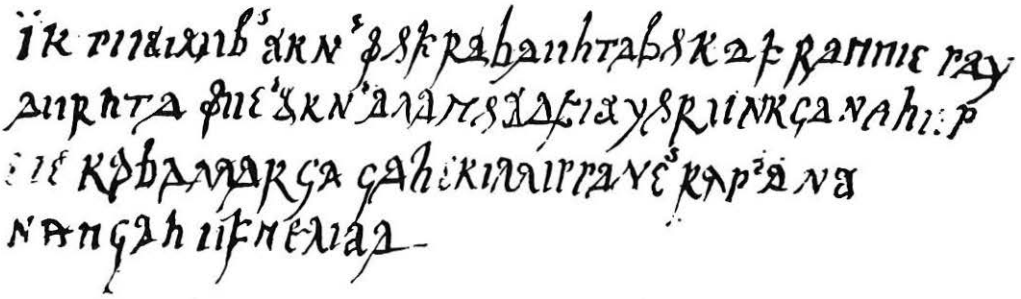


Figure 3. Reproduced handwriting of the Gothic clergyman Gudilub. Taken from the facsimile edition by Massmann (1838).

was written. Besides this correspondence, which is in Latin, there are several alphabets, which include one partial and two complete Gothic alphabets (Figs. 4 and 5). It cannot be said precisely who wrote these Gothic alphabets nor when nor where the writing took place. Palaeographic and historical evidence suggests an eighth-century scribe of a Salzburg scriptorium.

Customarily the partial Gothic alphabet on folium 20r (Fig. 4) is designated as "a," the alphabet near the left margin of folium 20v (Fig. 5) as "b" and the alphabet to its right as "c."[3]

On folium 20r (Fig. 4) the first two columns on the left contain the Anglo-Saxon runic letters in runic alphabetic order. To the right of each letter is its name, and above each letter is evidently a transliteration. The runic signs are in a reddish-orange ink, whereas the notations are in brown. The third column contains Gothic alphabet "a" (Fig. 4). Obviously incomplete, this alphabet is composed of only the first 16 letters in Gothic alphabetic order. In the upper right-hand corner is a stray Gothic j.

Folium 20v (Fig. 5) contains a variety of information. Dividing the page in half vertically so that the alphabets are on the left, the information recorded on the right falls into three groups. From top to bottom, the first four lines are phrases in Gothic with an Old High German equivalent written above each word. The next six lines are a commentary in Latin on the pronunciation of Gothic letters j, g, ai, and q. The last two lines are composed of numbers in Gothic with a roman numeral below. The interpretations of this information vary, but are of no consequence here. The left-hand portion of the page contains Gothic alphabets, and across the top of the page there is a

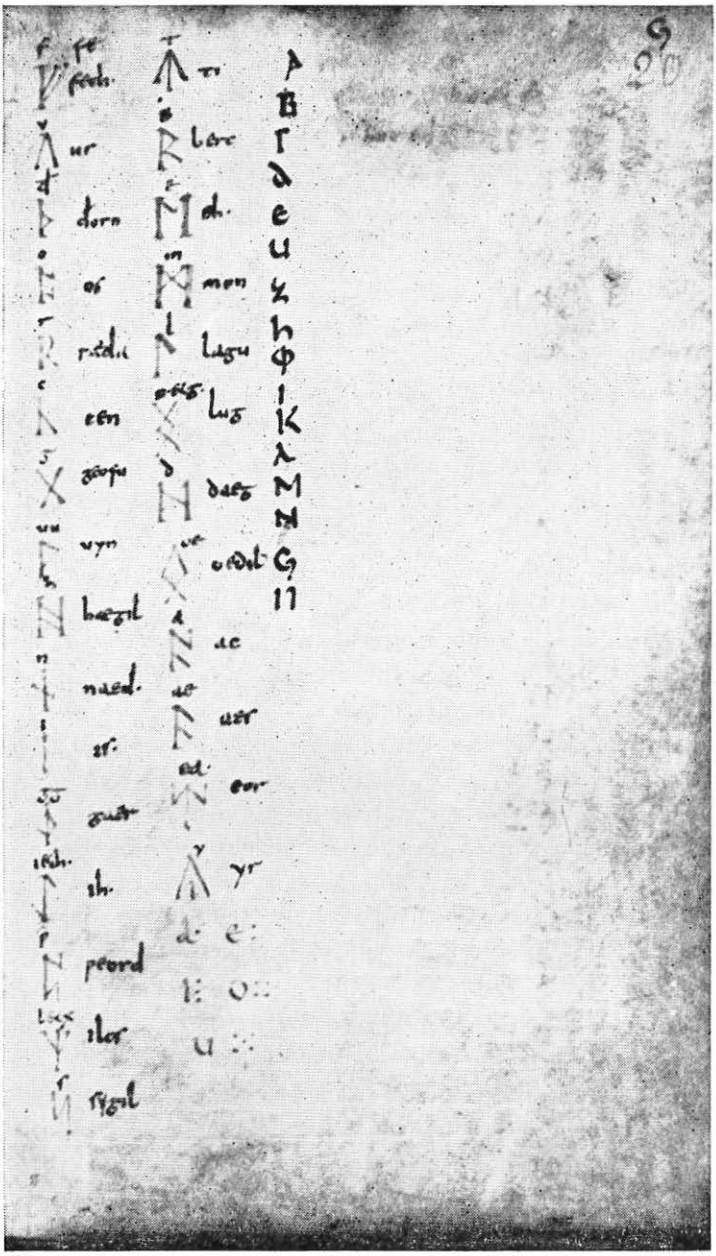


Figure 4. *Codex Vindobonensis*, folium 20r. Both photographs of the Gothic alphabets in *Codex Vindobonensis* were kindly furnished by Dr. Franz Unterkircher of the Austrian National Library.

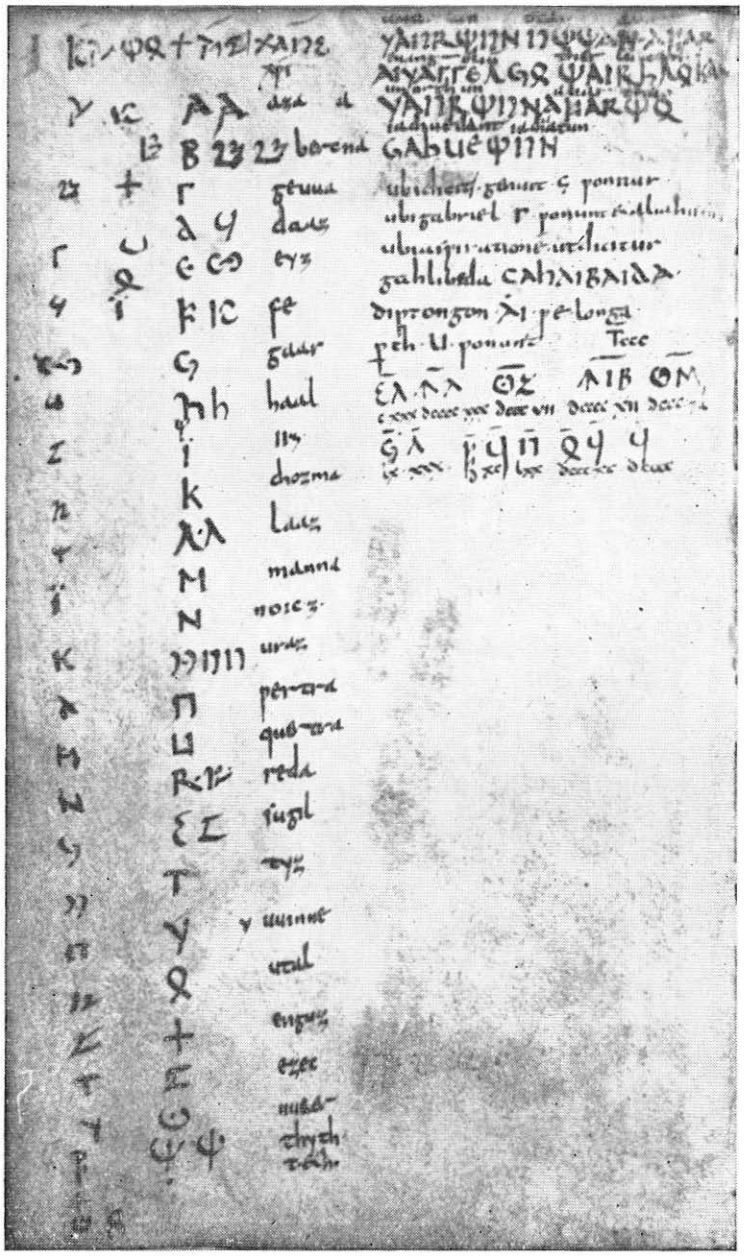


Figure 5. *Codex Vindobonensis*, folium 20v.

string of letters which appear to be abbreviations of *nomina sacra*. Alphabet "b" is composed of all the alphabetic letters in Gothic alphabetic order, although the signs for 90 and 900—which have no phonological, only numerical value—are not present. Alphabet "c" also contains all the letters with phonological values, but none of only numerical value. The letters of this alphabet are not arranged in Gothic alphabetic order (cf. Table I) nor are they completely in Latin alphabetic order. The last five letters seem to come at random. To the right of these letters are their names.

The three alphabets on these folia are unmistakably Gothic, yet there is something peculiar about the letters, especially those of alphabet "b." After scrutinizing the letters of alphabet "b," some of the ways in which they differ from their counterparts in the Biblical manuscripts can be pointed out. The a has a cross bar, as do all a's on these folia. The b is jagged, and there is a distinct tendency to close the upper loop. The d and e are totally unlike their counterparts in any other manuscript. The dot between the bars of the u appears only in the alphabets of *Codex Vindobonensis*. The r with the feature of a closed loop is similar to the r of the sloping uncial style, but not that of the upright uncial; the leg rising at a 45° angle is found, however, only in these alphabets. The x of the Biblical manuscripts is turned here and gives the appearance of a plus + sign. The form of hu with the circular portion open at the top is similar to the sloping uncial, but not the upright.

The letters of alphabet "c" are essentially the same as those of the sloping uncials, but some of the variants immediately to the right are very much like their counterparts in alphabet "b," especially b, d, e, r, and s. The reasons behind the variants of a, l, u, and th are not easy to fathom. The letter f has a variation without a counterpart in alphabet "b" (note the use of this variant in the abbreviations for *nomina sacra* at the top of the page [Fig. 5]). The closed loop of the d is repeated in alphabet "a."

The a, b, and d of alphabet "a" are similar to those of alphabet "c," but the th of alphabet "a" with its closed circular form is unique.

The scribe's purpose in recording these Gothic letterforms, names, phrases, remarks on pronunciation, numbers, and abbreviations for *nomina sacra* is open to debate. The compiler of this portion of *Codex Vindobonensis* evidently had an interest in old, antiquated writing

systems for he not only included the runic and Gothic alphabetic letters on folia 20r and 20v, but also the Greek letters, their names and numerical values on folia 19r and 19v.

In putting his information down on folium 20v, it appears as though the scribe wrote alphabet "c" first, since it consists of letterforms which are very similar—though not identical—to those in the Biblical manuscripts. The scribe seems to have also known that several letters had variant forms—evidently outmoded—and added them next to the current forms for completeness' sake. Then he added the names of the letters. Next the scribe wrote the material to the right of the alphabets. Note that he did not use any of the variant letters, but only the "current" ones.

The same scribe—or perhaps another scribe—wrote out alphabet "b" and the abbreviations for *nomina sacra*. Note that the variant f of alphabet "b" was used in these abbreviations, but not the variant s; that the a is similar to that of alphabet "b," but not that of alphabet "c." It is possible that the scribe wanted to provide the reader with a "true" Gothic alphabet; i.e., he gave the original Gothic alphabetic letterforms and ordered them according to the traditional Gothic alphabetic sequence.

Above, it was assumed that the variant letterforms antedated rather than postdated those of the Biblical manuscripts. The basis for such an assumption is manifold. The earliest of the extant Gothic manuscripts was written at least a century after Wulfila's death (c. 383), and therefore it cannot be assumed that the letterforms of the extant manuscripts are necessarily the original forms in every case. It must also be kept in mind, that the Gothic manuscriptal alphabet was originated in an area of the world dominated by Greek language and scriptoria. Scholars have therefore rightly sought and found Grecian influence on various aspects of Gothic palaeography. On the other hand, all extant manuscripts were written in areas far removed from the site of development where Latin culture and scriptoria were predominant. Many scholars have detected a Latin influence on the Gothic writing system, but the question whether this influence was primary (i.e., at the time of origination) or secondary (i.e., during the period of Gothic settlement in northern Italy) has not been resolved, but silently set aside. Investigations of Gothic scribal practices show that there is a great uniformity among the letterforms of all extant

manuscripts; only the s's and the abbreviations for final -n and -m hint at a departure from a previous scribal practice. It is also possible that the extant manuscripts are among the last Gothic codices ever produced. Not only was there a general decline of the Gothic nation after the death of the Ostrogothic king Theodoric in 526, but the suppression of non-orthodox faiths (the Goths were of the Arian faith) in 533 made the production of many more codices unlikely. Any changes in letterforms must therefore have taken place prior to the writing of the earliest extant manuscripts.

The Gothic alphabets in *Codex Vindobonensis* are important for understanding the development of Gothic manuscriptal letters because they show that significant changes occurred in certain letterforms between the time of origin and the time of the earliest extant manuscript. Major changes took place in the case of d, e, and s, and minor modifications were made in a, b, u, r, and x. At this time it is clear that the letterforms of *Codex Argenteus* are not original forms in every instance; consequently a new study of the Gothic alphabet is necessary which will take the alphabetic letterforms of *Codex Vindobonensis* into consideration.

1. For a detailed description of Gothic calligraphy and a history of Gothic type fonts see Fairbanks and Magoun (1940). Additional information on Gothic scribal pen techniques may be found in Viehmeyer (1971).
2. As in the case of the Latin and Greek alphabets, the letters of the Gothic alphabet are also used to symbolize numbers.
3. See Grienberger (1896).

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The Cue Summation Theory Tested with Meaningful Verbal Information

Donald R. Cushman

No previous studies pertaining to Hartman's Cue Summation Theory ("Redundant information simultaneously presented by the audio and the visual channels results in greater efficiency in learning than does the same information in either channel alone.") could be found which utilized meaningful verbal information as stimulus material. Students were presented material fitting this criterion and were tested for affective responses and cognitive recall. Comparisons of results were made between three separate presentation procedures: audio alone, visual alone, and combined audiovisual. Comparisons of affective responses did not indicate significant differences, but analyses of cognitive data showed the combined audiovisual treatment resulting in half the number of errors as either the audio or the visual treatments alone.

As new technological developments are introduced into the instructional milieu, students are exposed to an ever-widening range of mediated instruction involving sight and sound. It becomes important, therefore, that more be known about the technology, about its utilization, and especially about the sensory channels involved in communication.

Hartman's research (1961) dealt specifically with learning in the aural and visual channels. He posited that students could learn better if cues or "bits" of information were presented to them simultaneously in both channels rather than in either the aural or visual channels separately. From these ideas and researches he formulated the Cue Summation Theory, which states that redundant information simultaneously presented in the audio and the visual channels results in greater efficiency in learning than does the same information presented in either the audio or the visual channel.

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Definition of Terms

Hartman's theory explicitly identifies the audio and the visual communication channels. *Channels* in this connotation means the sensory vehicle through which information is received by an individual. That is to say, the eyes receive information in the visual channel, while the ears are the receptors for the aural channel.

Communication through these channels involves different modalities, i.e., the verbal and the non-verbal. These terms were more specifically labeled by Knowlton (1964) as *digital* and *iconic*. Digital refers to any verbal information, either spoken or printed; iconic information is a non-verbal representation of an object. Thus, the picture of a cow or the sound "moo" would represent a cow in the iconic mode, and the representations would be in the visual and the aural channels respectively. The printed word "c-o-w" (visual channel) and the spoken word "cow" (aural channel) are both classed in the digital mode. Conway (1968) grouped this information for research as in Figure 1.

		Channels	
		Audio	*Visual*
Modes	Iconic	Sound "moo"	Picture of a cow
	Digital	Spoken word "cow"	Printed word "c-o-w"

Figure 1. Classification of Channels and Modes

Where *learning* is referenced in this study, it will be considered in both the cognitive and the affective domains. In the cognitive sense it will refer to subjects' ability to respond correctly to a test of the specific information contained in the stimulus material. Learning will also be studied in the affective domain by determining the existence of and the degree to which the information creates an emotional response in each subject.

The efficiency referred to by Hartman implies the maximum information gain with the least time involved in presenting the information.

Theory and Statement of the Problem

The Cue Summation Theory refers specifically to the presentation of redundant information. The use of the word "redundant" gives rise to arguments for and against the existence of a condition of redundancy in different channels. It can be argued that separate channels or modalities cannot convey redundant information. If, for example, a person reads the word "cat" and hears someone else say the word "cat," he may be receiving the same contrived verbal message, but some particular inflection or other vocal treatment in the voice of the person speaking the word may supersede redundancy and add connotative meaning that may not exist in the sterile word "cat." Thus, there is a summation of both similar and dissimilar cues.

On the other hand, it can be argued that if the second channel adds no new cues to the first channel, there can be no summation. Those arguing in support of this point contend that this redundancy does not transmit additional information to the receiver.

Since its proposal by Hartman, the Cue Summation Theory has been challenged, tested, supported, and refuted by various researchers with varying combinations of channels and modalities. Support for it has come from Loveless, Brebner, and Hamilton (1970) who found that bi-sensory presentation results in a higher detection rate than is obtained from presentations in either unisensory channel. Van-Mondfrans and Travers (1964) partially supported the theory by finding that the audio channel was inferior to the visual channel or a combined presentation, but they did not find significant differences between the visual and the combined presentations.

Refutations of the Cue Summation Theory have come from several sources. Some refutations are the result of failures to support hypotheses related to the theory, while others come from studies closely related to Hartman's work with opposing conclusions. Notable among researchers who did not support the theory is Severin (1967) who found only a limited application for the theory. He states that the theory applies only when there is an actual summation of cues. Conway (1968) is another researcher who does not support the Cue Summation Theory on the basis of his findings.

A review of the Cue Summation Theory research indicates no instance in which the researchers used meaningful stimulus material in their studies. Typical stimuli have been nonsense syllables, digits,

and simple isolated words. The dependent variables have all been cognitive measures, which tested recall, recognition, and detection of some stimulus. An examination of the literature has pointed to a great inconsistency in the types of measures or the design of the different studies. The lack of standardization in the types of stimulus materials and in the measures and dependent variables emphasizes the inequalities in these studies. A lack of immediate relevance and basis for generalization to an instructional situation is another characteristic of some previous studies.

Previous research indicates there is a need to test the theory with the use of meaningful stimulus material. This would facilitate testing in both the cognitive and the affective domains. It would also provide data that may offer tentative general guidance for instructional settings.

This researcher found no reference to affective measuring in any of the previous studies. The possibility exists, it was reasoned, that some of the differences which may have occurred in the subjects' learning in those experiments may have occurred in the affective domain. Therefore, measurement of an affective variable was introduced.

Questions arising out of classroom experiences and problems generated by research in education have served as the basis for developing the two hypotheses posed for this study. These hypotheses are as follows:

Hypothesis 1: Subjects presented meaningful verbal information in a combined audiovisual presentation will respond more accurately to questions regarding the content than subjects receiving the same information in either the audio or the visual channel alone.

Hypothesis 2: Subjects will display greater affective responses for information received through the combined audiovisual presentation than will subjects who receive the same information through the individual audio and visual channels alone.

METHODOLOGY

Introduction

The purpose of this study was to determine whether or not significant differences in learning would occur in subjects exposed to the same

meaningful verbal stimulus material via different combinations of audio and visual treatments. The stimulus materials were selected to provide as near equivalence as possible between the separate selections that were presented to the subjects in the various treatments. The three treatments involved were reading (visual), listening (aural), and reading and listening simultaneously (audiovisual).

In the design for presentations subjects were selected randomly to receive the stimulus materials in one of nine combinations and sequences.

Two sets of tests, one cognitive and the other affective, were given at the conclusion of each presentation. Comparisons were based on (1) the number of errors to questions in the cognitive portions of the tests, and (2) the measures of scores on the semantic differential scales which quantified the affective responses.

The Stimulus Material

The main consideration used in selecting the stimulus material was that it be meaningful to the subjects. It was decided to use a poem that was appropriate for the junior high school student population. Some of the factors involved in selecting the particular poem were as follows:

First, poetry is typically written with a high affective content. Since affective learning was to be a dependent variable in this study, a stimulus was needed that would have sufficient affective content to provide a response that could be measured.

Second, since each subject was to be exposed to three separate treatments of the material, it was necessary to have a near equivalence in the content of the three separate presentations. Thus, differences in learning, if any existed, could be attributed to the presentation treatment and not to varying content differences in the stimulus material.

Third, poetry is written (in a traditional sense) with regular meter and consistent line or stanza length, and this regularity was desired for control. A six-stanza poem, "The Pardon," provided this constancy and could be divided into three pairs of stanzas (Fig. 2). The poem also provided an equivalence of content of material as explained above.

Exposure time is an important factor in the comprehension of verbal materials. For example, a person who slows down his reading

THE PARDON

My dog lay dead five days without a grave
In the thick of summer, hid in a clump of pine
And a jungle of grass and honeysuckle-vine.
I who had loved him while he kept alive

Went only close enough to where he was
To sniff the heavy honeysuckle-smell
Twined with another odor heavier still
And hear the flies' intolerable buzz.

Well, I was ten and very much afraid.
In my kind world the dead were out of range
And I could not forgive the sad or strange
In beast or man. My father took the spade

And buried him. Last night I saw the grass
Slowly divide (it was the same scene
But now it glowed a fierce and mortal green)
And saw the dog emerging.

I confess
I felt afraid again, but still he came
In the carnal sun, clothed in a hymn of flies,
And death was breeding in his lively eyes.
I started in to cry and call his name,

Asking forgiveness of his tongueless head.
. . . I dreamt the past was never past redeeming:
But whether this was false or honest dreaming
I beg death's pardon now. And mourn the dead.

Figure 2. The stimulus material.

pace considerably in order to try to comprehend more of what he reads is distorting the measure by his increased exposure time (VanMondfrans and Travers, 1964). In an attempt to keep the exposure times as consistent as possible, a pilot study was run to determine the approximate amount of time required for a subject to read one pair of stanzas. The times required by each subject in the pilot study were quite consistent and the range of times was narrow.

The total time of the narrative tape recording was matched with the time required by the subjects to read the stimulus.

Process and Measures of the Experiment

Two types of measures were taken of the subjects in this study, cognitive and affective. The methodology for obtaining these measures was as follows:

Each subject was tested individually in one of nine possible treatment combinations. Before the tests began, each subject was instructed in the use of the semantic differential scale and was given a practice exercise. The practice exercise involved a different poem from that used in the actual test. Following the exposure to the sample poem each subject filled out the semantic differential scale. This practice exercise served to familiarize the student with the terms in the scale. It also afforded practice in completing the scale and helped make the subject feel at ease before the actual test began.

After the first set of two stanzas from the poem had been presented and the subject had been tested over it, the process was repeated a second and a third time to complete the presentation and testing of the six-stanza poem. At the conclusion of the six-stanza presentation and testing each subject was asked additional questions. The twenty-four subjects who received all three different treatments were asked to state their preferences for the types of treatments to which they had

GOOD	—:—:—:—:—:—:—	BAD
BEAUTIFUL	—:—:—:—:—:—:—	UGLY
SWEET	—:—:—:—:—:—:—	SOUR
KIND	—:—:—:—:—:—:—	CRUEL
PLEASANT	—:—:—:—:—:—:—	UNPLEASANT
BITTER	—:—:—:—:—:—:—	SWEET
HAPPY	—:—:—:—:—:—:—	SAD
SACRED	—:—:—:—:—:—:—	PROFANE
NICE	—:—:—:—:—:—:—	AWFUL
FRAGRANT	—:—:—:—:—:—:—	FOUL

Figure 3. The semantic differential scale.

been exposed. The purpose of this question and response was to provide data for a correlation of student performance to preference.

Sixteen subjects preferred the combined treatment over the audio and the visual treatments alone. Six placed the audio alone treatment first, and two rated the visual alone treatment as their preference.

The Pearson Product-Moment Correlation was applied to each set of choices, correlating the preferences with the actual performances of the subjects. For first presentations the correlation of preference with performance was +.41. For the second and third presentations the correlations were, respectively, +.10 and +.13. Subjects were more positive of their first choice than of their second or third choices. The relative indecision in the second and third choices was regarded as a factor in the low correlations.

The second question was asked to determine the subjects' opinions regarding the use of the audio channel for the transmission of the affective elements in the poem. Twenty-three of twenty-four subjects indicated that they felt the audio treatment added more meaning than was present without it, and the twenty-fourth stated that there were "about one-half and one-half" of the instances when the voice would help and when it wouldn't.

Notations were kept of any non-verbal expressions exhibited by subjects during the presentations. Seen occasionally were frowns (either of puzzlement or of distaste), winces, shrugs, tongues being stuck out, and wrinkled noses. In general there were few overt reactions such as these. When they did occur, however, the majority of them were during presentations involving the audio channel.

Statistical Design

For the cause of statistical reinforcement and to determine if an ordering and/or improvement-through-practice effect (Design # 2) would occur, two statistical designs of twenty-four subjects each were selected for this study. Subjects were randomly assigned to treatment types and sequences.

In the first design, involving twenty-four subjects, each received all three treatments—the audio, the visual, and the audiovisual—in one of the following sequences: A–V–AV, V–AV–A, V–A–AV, AV–A–V, AV–V–A, or A–AV–V. A one-way analysis of variance was used to determine statistical significance between treatments.

With this design it was possible to compare all subject performances at the end of the first two-stanza treatment. For example, it was possible to compare all the audio presentations with all the video presentations and with all the combined presentations for all twenty-four subjects.

The second design utilized in this study was a repeated measures design for testing each subject in only one treatment in all three presentations; i.e., each subject was presented all three pairs of stanzas via either A–A–A, V–V–V, or AV–AV–AV.

In addition to the repeated measures analysis which compared differences in subjects' scores, a comparison was made to determine the equivalence of the scores from the three two-stanza presentations; i.e., the equivalence of the difficulty of questions for presentation #1 compared to #2 and compared to #3. The test showed a high degree of equivalence.

The semantic differential scores were assigned to the same types of statistical design and analysis as explicated in the previous discussion. The results of the analyses of the findings follow.

FINDINGS

Cognitive Results

The data collected in this study provided a basis for comparing the amount of learning exhibited by the subjects in each of three presentation treatments of meaningful verbal stimulus material. Subjects' responses stimulated by reading, listening, or reading and listening simultaneously provided affective and cognitive data for study and interpretation.

Scores from the first presentation of the various treatments provided the only comparative data in which all forty-eight subjects were included. The mean number of errors per treatment was as follows: Audio: 6.44. Visual: 5.94. Audiovisual: 2.88.

A one-way analysis of variance was used to analyze this data. The results of the analysis, shown in Table I, proved to favor significantly the combined presentation over either individual presentation.

The first experiment which was designed so each subject received the stimulus in three separate units, A, V, and AV, yielded the analysis in Table II.

Table I. Analysis of First Presentations for All Subjects

Source of variation	*Sum of squares*	*Degrees of freedom*	*Mean squares*	*F-Ratio*
Between	327.4	2	163.7	88.96*
Within	82.6	45	1.836	
Total	410.0	47		

*p < .001

Table II. Analysis of Variance for Subjects Receiving All Three Treatments

Source of variation	*Sum of squares*	*Degrees of freedom*	*Mean squares*	*F-ratio*
Between	204.749	2	102.375	34.58*
Within	204.126	69	2.96	
Total	408.875	71		

*p < .001

Table III. Analysis of Variance for Repeated Measures

*Source of variation**	*Sum of squares*	*Degrees of freedom*	*Mean squares*	*F-ratio*
Mean	1880.8889	1	1880.8889	
T	148.3611	2	74.1806	23.107†
R:T	67.4167	21	3.2103	
M:T	14.5000	6	2.4167	1.070‡
RM:T	94.8333	42	2.2579	

* This table is to be read as follows:
T = treatments, R = replications per treatment,
M = measures per replication
† p < .001 ‡ n.s.d.

Table IV. Total Scores and Mean Scores on Semantic Differential Scales

	*1st design: one way analysis of variance**			*2nd design: repeated measures analysis of variance*		
SCORES						
	A	V	AV	A	V	AV
TOTAL	281	279	271	265	281	279
Mean	11.7	11.6	11.3	11.0	11.7	11.6

* Each design included twenty-four subjects

The second experimental design included eight subjects within each of the three treatments, with each subject assigned to only one treatment, audio only, visual only, or audiovisual. The mean number of errors in this design was as follows: Audio: 6.33. Visual: 5.96. Audiovisual: 2.58.

The analysis of this data is presented in Table III.

The analysis in Table III shows that at the .001 level of confidence the combined presentation had significantly fewer errors than either the audio or the visual presentations alone.

Affective Results

The second hypothesis proposed in this study was that subjects would show greater affective learning when the stimulus was presented via the combined presentation than when it was presented via the audio or the visual channels alone. On the basis of data from the semantic differential scales, no significance was found between treatments for the affective data.

DISCUSSION

Data shows that the combined audiovisual presentations were significantly superior to either the audio or the visual presentations alone at the .001 level of confidence. This high level of significance indicated that the Cue Summation Theory is supported when tested with meaningful information.

Further support for the Cue Summation Theory came from the comments made by the subjects during the testing sessions. Most of the subjects (96%) preferred the combined presentation, indicating they felt the treatment was superior. Some validity can be accredited to these subjects' opinions, because there was a +.41 correlation between their preferences and their performances on "best" treatments.

In order to be consistent with Severin's (1967) limitations on the term "cue summation," the stimulus material in the present study utilized only one coding system or modality. Within this verbal mode, the actual text of materials presented was identical in both channels. In the visual form the overt cues to the subjects were the printed words which the subjects read. Any other cues that were utilized by the subjects were covert and supplied by them.

In the audio presentation it was assumed that the narrator's voice cued more information than just the printed text. This assumption was supported by statements from the independent evaluators for this study who agreed that the narrator's inflection was appropriate for the stimulus. Additional evidence that cues were supplying "more" information was reported by the subjects themselves, many of whom stated that the parts with the voice sounded "more emotional" or "sadder."

The above statements which report increased learning from the audio presentations are not supported by the affective data. These data show the audio treatment was consistently inferior to the visual treatment. However, the differences were not statistically significant. The combined treatment also showed no superiority.

A concern in the present study was for the so-called "visual learners" and "listeners" and the pace of the presentations. The "visual learners" are those who contend they learn better by seeing than by any other method, while the "listeners" learn better through aural means. Involved in either the visual or the audio preference is pacing. While few comments were made regarding the pacing of the stimulus during this study, some students did mention they prefer to read at their own pace rather than being held to the pace of a narrator. Important to a reader is the control he has over his own pace. He can, if he chooses, revert to points not comprehended during a first reading and accelerate or decelerate at his own pace. Subjects who were presented the visual treatment had this freedom during the study and may have exercised it (or they may have been influenced by the "Hawthorne Effect") even though they were asked to read once through the stimulus at their "normal" reading pace.

By contrast, the students listening to the audio treatment may have been restricted to the pace of the narration. Even though the students indicated that the narration communicated a greater degree of emotion and feeling than the visual presentation, they did not display a greater comprehension of the content as determined by the affective tests.

The semantic differential data did not support the Cue Summation Theory, because of a lack of significant differences between the pairwise combinations of treatments. As evidenced by analyses of the two designs, no method was consistently superior.

Several reasons can be offered for the lack of differences appearing on these scales. First, it might be reasoned that the semantic differential technique is not a very sensitive measuring instrument. Thus, when the affective measures are small, the semantic differential scale is not capable of quantifying the affective data.

A second possibility is that differences in affective learning did not actually occur for the separate treatments. While this suggestion is a possibility, it seems unlikely in view of the subjects' responses during the open-ended questioning. Most of the subjects stated that during the audio presentations their emotions were heightened more than during the visual alone presentations.

A third possibility for the lack of variance in the affective measure between treatments would be the relative lack of experience the subjects had had with the semantic differential scale. No subject admitted having used such a scale prior to this study. This lack of prior experience in the use of the scale made it necessary to have the explanatory and practice sessions for each subject prior to testing. After each subject had completed a scale, the experimenter occasionally asked questions regarding clarification of some of their checkmarks. Their explanations of the checks and elaborations of their feelings indicated that the marks were accurate.

Conclusions

The first hypothesis posited for this study was that a combined audio-visual presentation of redundant meaningful verbal information would result in a greater comprehension of the material than would either the audio or the visual presentations alone. The cognitive data, with a high level of significance, support this hypothesis.

The second hypothesis stated that subjects would display greater affective responses to the stimulus when both channels were used simultaneously for the presentation of redundant meaningful verbal information than when they were used alone. This hypothesis was not supported by data from the semantic differential scale.

This study has shown that bi-sensory communication which combines words in two channels (words aurally and words in print) will result in significantly greater information gains than single-channel communications. This does not support the predictions and findings of Severin (1967), who concluded that multi-channel communications are no better when they are merely redundant.

Summary

For cognitive data, the findings of the present study support the Cue Summation Theory. Students receiving redundant meaningful verbal information through both the audio and the visual channels simultaneously performed significantly better on tests of information recall than did subjects receiving the same information in either the audio or the visual channel alone.

With the same stimuli, there were no significant differences between treatments with affective data from semantic differential scales.

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Excerpt: Learning from Las Vegas

Robert Venturi, Denise Scott Brown, Steven Izenour

Learning from the existing landscape is a way of being revolutionary for an architect. Not the obvious way, which is to tear down Paris and begin again, as Le Corbusier suggested in the 1920s, but another, more tolerant way; that is, to question how we look at things.

The commercial strip, the Las Vegas Strip in particular—the example par excellence—challenges the architect to take a positive, non-chip-on the-shoulder view. Architects are out of the habit of looking nonjudgmentally at the environment, because orthodox Modern architecture is progressive, if not revolutionary, utopian, and puristic; it is dissatisfied with *existing* conditions. Modern architecture has been anything but permissive; architects have preferred to change the existing environment rather than enhance what is there.

But to gain insight from the commonplace is nothing new: fine art often follows folk art. Romantic architects of the eighteenth century discovered an existing and conventional rustic architecture. Early modern architects appropriated an existing and conventional industrial vocabulary without much adaptation. Le Corbusier loved grain elevators and steamships; the Bauhaus looked like a factory; Mies refined the details of American steel factories for concrete buildings. Modern architects work through analogy, symbol, and image—although they have gone to lengths to disclaim almost all determinants of their forms except structural necessity and the program—and they derive insights, analogies, and stimulation from unexpected images. There is a perversity in the learning process: we look backward at history and tradition to go forward; we can also look downward to go upward. And withholding judgment may be used as a tool to

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make later judgment more sensitive. This is a way of learning from everything.

Commercial Values and Commercial Methods

Las Vegas is analyzed here only as a phenomenon of architectural communication. Just as an analysis of the structure of a gothic cathedral need not include a debate on the morality of medieval religion, so Las Vegas's values are not questioned here. The morality of commercial advertising, gambling interests, and the competitive instinct is not at issue here; although, indeed, we believe it should be in the architect's broader, *synthetic* tasks of which an analysis such as this is but one aspect. The analysis of a drive-in church in this context would match that of a drive-in restaurant, because this is a study of method, not content. Analysis of one of the architectural variables in isolation from the others is a respectable scientific and humanistic activity, so long as all are resynthesized in design. Analysis of existing American urbanism is a socially desirable activity to the extent that it teaches us architects to be more understanding and less authoritarian in the plans we make for both inner-city renewal and new development. In addition, there is no reason why the methods of commercial persuasion and the skyline of signs analyzed here should not serve the purpose of civic and cultural enhancement. But this is not entirely up to the architect.

Billboards Are Almost All Right

Architects who can accept the lessons of primitive vernacular architecture —so easy to take in an exhibit like "Architecture without Architects," and of industrial, vernacular architecture, so easy to adapt to an electronic and space vernacular as elaborate neo-Brutalist or neo-Constructivist megastructures—do not easily acknowledge the validity of the commercial vernacular. For the artist, creating the new may mean choosing the old or the existing. Pop artists have relearned this. Our acknowledgment of existing, commercial architecture at the scale of the highway is within this tradition. Modern architecture has not so much excluded the commercial vernacular as it has tried to take it over by inventing and enforcing a vernacular of its own, improved and universal. It has rejected the combination of fine art and crude art. . . .

Modern architects abandoned a tradition of iconology in which painting, sculpture, and graphics were combined with architecture. The delicate hieroglyphics on a bold pylon, the archetypal inscriptions of a Roman architrave, the mosaic processions in Sant' Apollinare, the ubiquitous tattoos over a Giotto chapel, the enshrined hierarchies around a gothic

portal, even the illusionistic frescoes in a Venetian villa all contain messages beyond their ornamental contribution to architectural space. The integration of the arts in Modern architecture has always been called a good thing. But one did not paint *on* Mies. Painted panels were floated independently of the structure by means of shadow joints; sculpture was in or near but seldom on the building. Objects of art were used to reinforce architectural space at the expense of their own content. The Kolbe in the Barcelona Pavilion was a foil to the directed spaces: the message was mainly architectural. The diminutive signs in most Modern buildings contained only the most necessary messages, like LADIES—minor accents begrudgingly applied.

Architecture as Symbol

Critics and historians, who documented the "decline of popular symbols" in art, supported orthodox Modern architects, who shunned symbolism of form as an expression or reinforcement of content; meaning was to be communicated, not through allusion to previously known forms but through the inherent, physiognomic characteristics of form. The creation of architectural form was to be a logical process, free from images of past experience, determined solely by program and structure, with an occasional assist, as Alan Colquhoun has suggested,[1] from intuition.

But some recent critics have questioned the possible level of content to be derived from abstract forms. Others have demonstrated that the functionalists, despite their protestations, derived a formal vocabulary of their own, mainly from current art movements and the industrial vernacular; and latter-day followers such as the Archigram group have turned, while similarly protesting, to Pop Art and the space industry. However, most critics have slighted a continuing iconology in popular commercial art, the persuasive heraldry that pervades our environment from the advertising pages of *The New Yorker* to the superbillboards of Houston. And their theory of the "debasement" of symbolic architecture in nineteenth-century eclecticism has blinded them to the value of the representational architecture along highways. Those who acknowledge this roadside eclecticism denigrate it, because it flaunts the cliché of a decade ago as well as the style of a century ago. But why not? Time travels fast today. . . .

Symbol in Space Before Form in Space: Las Vegas as a Communication System

The sign for the Motel Monticello, a silhouette of an enormous Chippendale highboy, is visible on the highway before the motel itself. This architecture of styles and signs is antispatial; it is an architecture of

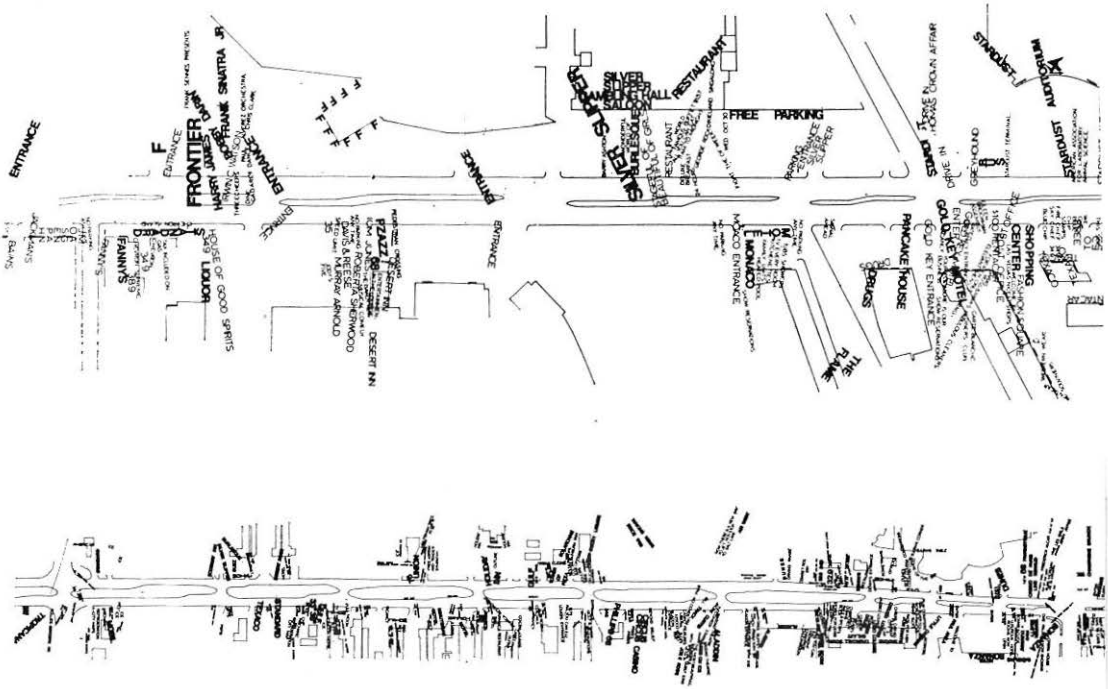
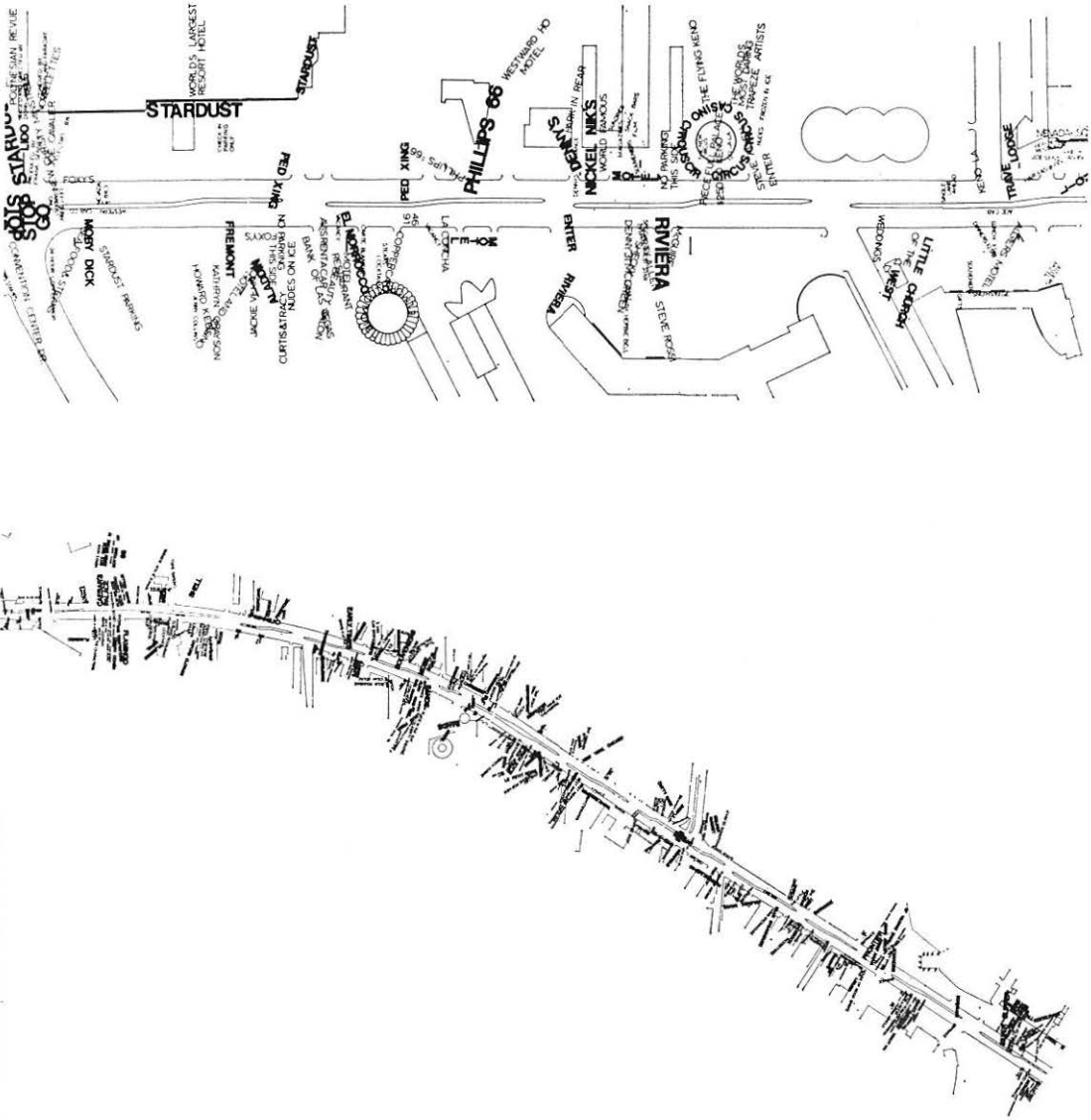


Figure 1. Map of Las Vegas Strip showing every written word seen from the road.


STARDUST
WORLD'S LARGEST RESORT HOTEL
STARDUST
FED XING
PHILLIPS 66
WESTWARD HO MOTEL
DENNY'S
NICKEL NIKS
WORLD FAMOUS
CIRCUS CIRCUS
TRAVEL LODGE
KENO
MOBY DICK
FREMONT
BINION'S
CURTIS & TRACY
NUDES ON ICE
EL MORROCO
BANK OF LAS VEGAS
LA CONCHA MOTEL
ENTER RIVIERA
RIVIERA
STEVE ROSS
LITTLE CHURCH OF THE WEST

communication over space; communication dominates space as an element in the architecture and in the landscape. But it is for a new scale of landscape. The philosophical associations of the old eclecticism evoked subtle and complex meanings to be savored in the docile spaces of a traditional landscape. The commercial persuasion of roadside eclecticism provokes bold impact in the vast and complex setting of a new landscape of big spaces, high speeds, and complex programs. Styles and signs make connections among many elements, far apart and seen fast. The message is basely commercial; the context is basically new.

A driver 30 years ago could maintain a sense of orientation in space. At the simple crossroad a little sign with an arrow confirmed what he already knew. He knew where he was. Today the crossroad is a cloverleaf. To turn left he must turn right. But the driver has no time to ponder paradoxical subtleties within a dangerous, sinuous maze. He relies on signs to guide him—enormous signs in vast spaces at high speeds.

The dominance of signs over space at a pedestrian scale occurs in big airports. Circulation in a big railroad station required little more than a simple axial system from taxi to train, by ticket window, stores, waiting room, and platform—all virtually without signs. Architects object to signs in buildings: "If the plan is clear, you can see where to go." But complex programs and settings require complex combinations of media beyond the purer architectural triad of structure, form, and light at the service of space. They suggest an architecture of bold communication rather than one of subtle expression.

The Architecture of Persuasion

The cloverleaf and airport communicate with moving crowds in cars or on foot for efficiency and safety. But words and symbols may be used in space for commercial persuasion. The Middle Eastern bazaar contains no signs; the Strip is virtually all signs. In the bazaar, communication works through proximity; along its narrow aisles, buyers feel and smell the merchandise, and the merchant applies explicit oral persuasion. In the narrow streets of the medieval town, although signs occur, persuasion is mainly through the sight and smell of the real cakes through the doors and windows of the bakery. On Main Street, shop-window displays for pedestrians along the sidewalks and exterior signs, perpendicular to the street for motorists, dominate the scene almost equally.

On the commercial strip the supermarket windows contain no merchandise. There may be signs announcing the day's bargains, but they are to be read by pedestrians approaching from the parking lot. The building itself is set back from the highway and half hidden, as is most of

the urban environment, by parked cars. The vast parking lot is in front, not at the rear, since it is a symbol as well as a convenience. The building is low because air conditioning demands low spaces, and merchandising techniques discourage second floors; its architecture is neutral because it can hardly be seen from the road. Both merchandise and architecture are disconnected from the road. The big sign leaps to connect the driver to the store, and down the road the cake mixes and detergents are advertised by their national manufacturers on enormous billboards inflected toward the highway. The graphic sign in space has become the architecture of this landscape. Inside, the A&P has reverted to the bazaar except that graphic packaging has replaced the oral persuasion of the merchant. At another scale, the shopping center off the highway returns in its pedestrian malls to the medieval street.

The A&P parking lot is a current phase in the evolution of vast space since Versailles. The space that divides high-speed highway and low, sparse buildings produces no enclosure and little direction. To move through a piazza is to move between high enclosing forms. To move through this landscape is to move over vast expansive texture: the megatexture of the commercial landscape. . . . But it is the highway signs through their sculptural forms or pictorial silhouettes, their particular positions in space, their inflected shapes, and their graphic meanings that identify and unify the megatexture. They make verbal and symbolic connections through space, communicating a complexity of meanings through hundreds of associations in few seconds from far away. Symbol dominates space. Architecture is not enough. Because the spatial relationships are made by symbols more than by forms, architecture in this landscape becomes symbol in space rather than form in space. Architecture defines very little: the big sign and the little building is the rule of Route 66.

Change and Permanence on the Strip

The rate of obsolescence of a sign seems to be nearer to that of an automobile than that of a building. The reason is not physical degeneration but what competitors are doing around you. The leasing system operated by the sign companies and the possibility of total tax write-off may have something to do with it. The most unique, most monumental parts of the Strip, the signs and casino facades, are also the most changeable; it is the neutral, systems-motel structures behind that survive a succession of facelifts and a series of themes up front. The Aladdin Hotel and Casino is Moorish in front and Tudor behind.

Las Vegas's greatest growth has been since World War II. There are

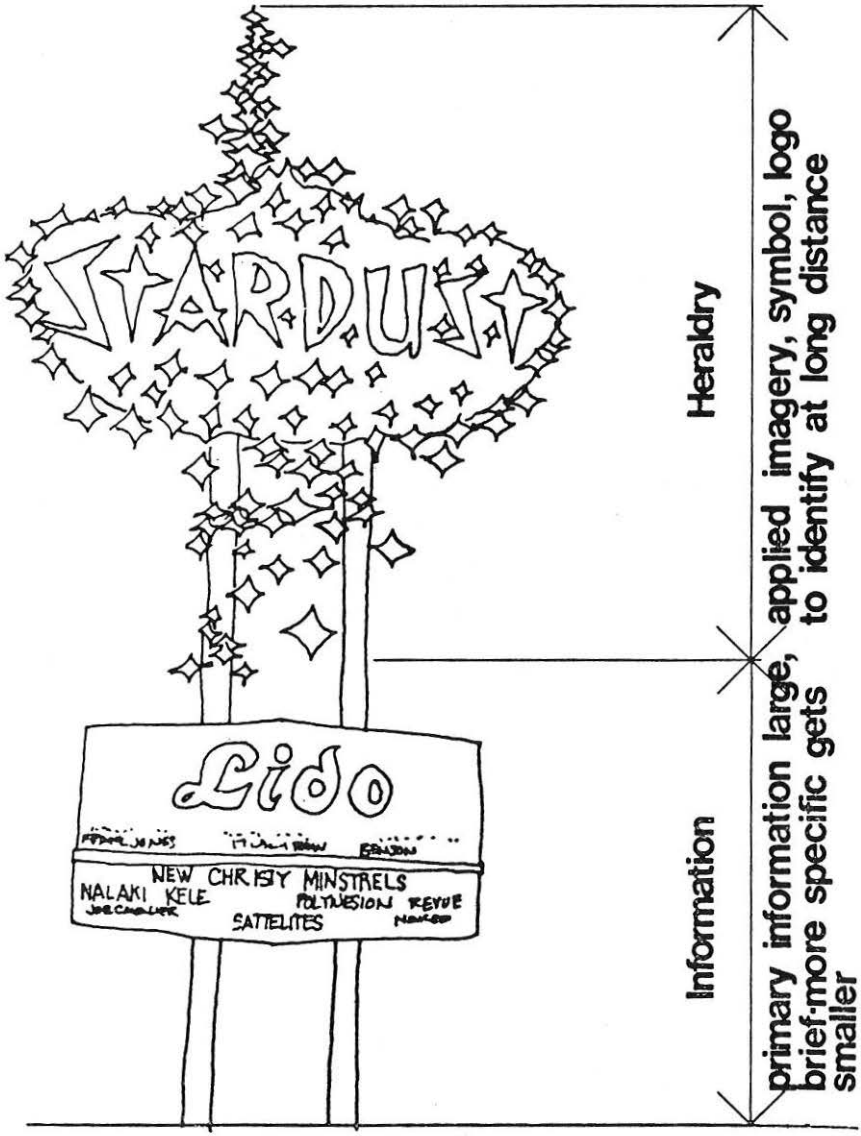


Figure 2. Physiognomy of a typical casino sign.

noticeable changes every year: new hotels and signs as well as neon-embossed parking structures replacing on-lot parking on and behind Fremont Street. Like the agglomeration of chapels in a Roman church and the stylistic sequence of piers in a gothic cathedral, the Golden Nugget casino has evolved over 30 years from a building with a sign on it to a totally sign-covered building. The Stardust Hotel has engulfed a small restaurant and a second hotel in its expansion and has united the three-piece facade with 600 feet of computer-programmed animated neon. . . .

Las Vegas Signs

Signs inflect toward the highway even more than buildings. The big sign—independent of the building and more or less sculptural or pictorial—inflects by its position, perpendicular to and at the edge of the highway, by its scale and sometimes by its shape. The sign of the Aladdin Hotel and Casino seems to bow toward the highway through the inflection in its shape. It also is three dimensional, and parts of it revolve. The sign at the Dunes Hotel is more chaste: it is only two dimensional, and its back echoes its front, but it is an erection 22 stories high that pulsates at night. The sign for The Mint Hotel on Route 91 at Fremont Street inflects toward the Casino several blocks away. Signs in Las Vegas use mixed media—words, pictures, and sculpture—to persuade and inform. A sign is, contradictorily, for day and night. The same sign works as polychrome sculpture in the sun and as black silhouette against the sun; at night it is a source of light. It revolves by day and becomes a play of lights at night. It contains scales for close-up and for distance. Las Vegas has the longest sign in the world, the Thunderbird, and the highest, the Dunes. Some signs are hardly distinguishable at a distance from the occasional high-rise hotels along the Strip. The sign of the Pioneer Club on Fremont Street talks. Its cowboy, 60 feet high, says "Howdy Pardner" every 30 seconds. The big sign at the Aladdin Hotel has spawned a little sign with similar proportions to mark the entrance to the parking. "But such signs!" says Tom Wolfe. "They soar in shapes before which the existing vocabulary of art history is helpless. I can only attempt to supply names—Boomerang Modern, Palette Curvilinear, Flash Gordon Ming-Alert Spiral, McDonald's Hamburger Parabola, Mint Casino Elliptical, Miami Beach Kidney."[2] . . .

The sign is more important than the architecture. This is reflected in the proprietor's budget: The sign at the front is a vulgar extravaganza, the building at the back, a modest necessity. The architecture is what is cheap. Sometimes the building *is* the sign. Contradiction between outside

and inside was common in architecture before the Modern movement, particularly in urban and monumental architecture. Baroque domes were symbols as well as spatial constructions, and they are bigger in scale and higher outside than inside in order to dominate their urban setting and communicate their symbolic message. The false fronts of western stores did the same thing: they were bigger and taller than the interiors they fronted to communicate the store's importance and to enhance the quality and unity of the street. But false fronts are of the order and scale of Main Street. From the desert town on the highway in the West of today, we can learn new and vivid lessons about an impure architecture of communication. The little low buildings, grey-brown like the desert, separate and recede from the street that is now the highway, their false fronts disengaged and turned perpendicular to the highway as big, high signs. If you take the signs away, there is no place. The desert town is intensified communication along the highway. . . .

1. Alan Colquhoun, "Typology and Design Method," *Arena*, Journal of the Architectural Association (June 1967), pp. 11–14.
2. Tom Wolfe, *The Kandy-Colored Tangerine-Flake Streamline Baby* (New York: Noonday Press, 1966), p. 8.

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Ode to Typography

Pablo Neruda

Letters, long, severe,
vertical,
made
of pure
line,
erect
like a ship's
mast
in the middle
of the page
filled
with confusion and turbulence;
algebraic
Bodoni,
complete
letters,
lean
as greyhounds,
subject
to the white rectangle
of Geometry;
Elzevirian
vowels
cast
in the minute steel
of the printshop by the water,
in Flanders, in the North
of the canals,
ciphers
of the anchor;
Aldine characters,
firm as
the marine
stature
of Venice,
in whose mother waters,
like a leaning
sail,
navigates the cursive
curving the alphabet:
the air
of the oceanic
discovers
bent down
forever the profile of writing.

From
medieval hands
to your eyes advanced
this
N,
this double
8,
this
J,
this
R
of regal and rain.
There
they were shaped
like
teeth, nails,
metallic hammers
of language.
They beat each letter,
erected it,
a small black statue
on the whiteness,

a petal
or a starry foot
of thought taking the form
of a swollen river,
rushing to a sea of people
with all
the alphabet
illuminating
the outlet.
The hearts, the eyes
of men
became filled with letters,
messages,
words,
and the passing or permanent
wind
raised mad
or sacred
books.
Beneath
the newly written pyramids
the letter
was alive,
the alphabet burning,
the vowels,
the consonants like
curved flowers.
The paper's
eyes, which looked
at men
seeking
their gifts,
their history, their loves;
extending
the accumulated
treasure;
spreading suddenly
the slowness of wisdom
over the printer's word
like a deck of cards;
all
the secret
humus
of the ages,
song, memories,
revolt,
blind parable,
suddenly
were
fecundity,
granary,
letters,
letters
that travelled
and kindled,
letters
that sailed
and conquered,
letters
that awakened
and climbed,
letters
that liberated,
letters
dove-shaped
that flew,
letters
scarlet in the snow;
punctuation,
roads,
buildings
of letters,
and Villon and Berceo,
troubadours
of memory
faintly
written on leather
as on battle
drum,
arrived
at the spacious nave
of books,
at the sailing
typography.

Yet
the letter
was not beauty alone,
but life,
peace for the soldier;
it went down to the solitudes
of the mine,

and the miner
read
the hard and
clandestine leaflet,
hid it in the folds
of the secret
heart
and above,
on earth,
he was different
and different
was his word.
The letter
was the mother
of the new banners;
the letters
begot
the terrestrial
stars
and the song, the ardent hymn
that unites
peoples;
from
one
letter
added
to another
letter
and another,
from people to people went bearing
its sonorous authority,
and welling in the throats of men
it imposed the clarity of the song.

But,
typography,
let me
celebrate you
in the purity
of your
pure profiles,
in the retort
of the letter
O,
in the fresh
flower vase
of the
Greek
Y,
in the
Q
of Quevedo,
(how can my poetry
pass
before that letter
and not feel the ancient shudder
of the dying sage?),
in the lily
multiplied
of the
V
of victory,
in the
E
echeloned
to climb to heaven,
in the
Z
with its thunderbolt face,
in the orange shaped
P.

Love,
I love
the letters
of your hair,
the
U
of your glance,
the
S
of your figure.
In the leaves
of the young springtime
sparkles the diamantine
alphabet;
emeralds
write your name
with the fresh initials of dew.
My love,
your hair
profound

as jungle or dictionary
covers me
with its totality
of red
language.
In everything,
in the wake
of the worm,
one reads,
in the rose, one reads,
the roots
are filled with letters
twisted
by the dampness of the forest
and in the heavens
of the Black Isle, in the night,
I read,
read
in
the cold firmament
of the coast,
intense
diaphanous with beauty
unfurled,
with capital
and lower case stars
and exclamations
of frozen diamond;
I read, read
in the night of austral
Chile, lost
in the celestial solitudes
of heaven,
as in a book
I read
all
the adventures
and in the grass
I read,
read
the green, the sandy
typography
of the rustic earth,
I read
the ships, the faces
and the hands,
I read
your heart
where
live
entwined
the provincial
initial
of your name
and
the
reef
of my surnames.
I read
your forehead,
I read
your hair
and in the jasmine
the hidden
letters
elevate
the unceasing
springtime
until I decipher
the buried
punctuation
the poppy
and the scarlet
letter
of summer:
they are
the exact flowers of my song.
But,
when
writing
unfolds
its roses,
and the letter
its essential
gardening,
when you read
the old and the new
words, the truths
and the explorations,
I beg
a thought
for the one who orders

and raises them,
for the one who sets
type,
for the linotypist
and his lamp
like a pilot
over
the waves of language
ordering
winds and foam,
shadow and stars
in the book:
man
and steel
once more united
against the nocturnal wing
of mystery,
sailing,
perforating
composing.
Typography,
I am
only a poet
and you are
the flowery
play of reason,
the movement
of the chess bishops
of intelligence.
You rest
neither night
nor winter,
you circulate
in the veins
of our
anatomy
and if you sleep,
flying
during
some night or strike
or fatigue or break
of linotype,
you go down anew to the book
or newspaper
like a cloud
of birds to their nest.
You return
to the system,
to the unappealable
order
of intelligence.
Letters,
continue to fall
like precise rain
along my way.
Oh, letters of all
that lives
and dies,
letters of light, of moon,
of silence,
of water,
I love you,
and in you
I gather
not only thought
and combat,
but your dress,
senses,
and sounds:
A
of glorious avena,
T
of trigo and tower,
and
M
like your name
of manzana.

Pablo Neruda, a native of Chile, can fairly be called one of the most influential living men of letters. His poem is translated from the Spanish by Carlos Lozano and appeared in the *Chicago Review*, Vol. 17, No. 1 (1964). It is reprinted here with kind permission of the publishers.

Correspondence

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

To the Editor:

I would like to correct Myrtle Scott's (Spring 1972) misleading description of my researches on the orthography factor in literacy acquisition. She makes three important errors:

(1) She describes my research as being concerned with *methods* of teaching reading. But the truth is that from the beginning in 1960 I reported clearly that my research was designed to investigate the *orthography variable* and not teaching methodology. Only the former was manipulated in my experiments.

(2) She describes me as an "advocate" of i.t.a. who put forward "very enthusiastic arguments" for its use. I have never perceived myself in that role. In actual fact I was appointed by the University of London to design and conduct experiments to provide objective data on the question, "Does the complexity of the English orthographic system cause difficulty in learning to read?" The Initial Teaching Alphabet was merely an experimental instrument which would permit a comparison with the more complex traditional orthography. The research had its origins in Parliamentary debates on spelling reform. I was selected to direct the research because of my qualifications in experimental and applied psychology, and because my previous interest in either i.t.a. or spelling reform was *nil*.

(3) The third error is the extraordinary omission of the most fundamental report of research in this field, in her review of relevant past findings for readers who may not be familiar with the literature. She mentions that my investigations were "sharply criticised" on matters of experimental design and data analysis. But she cites no precise bibliographical references for any such criticisms. Also she fails to mention the warm commendations accorded to my research methodology by other reviewers of senior status in the profession. But Myrtle Scott's much more serious error is her failure to include the most important publication of all on this whole problem. That is the book *i.t.a.: An Independent Evaluation*, which was sponsored by the official curriculum body for England and Wales—the Schools Council. In it, the well known British authority on the design of psychological research, the late Frank Warburton, reviewed 17 British and American investigations which have employed i.t.a. Warburton did this in a detached

manner after the heat of controversy over my report had subsided. He concluded that my research was "the most closely controlled in the literature" (p. 232).

As to the findings, Warburton's final conclusion on the orthography question derived from a thorough sifting of a mass of data from the 17 studies is:

> "There is no evidence whatsoever for the belief that the best way to learn to read in traditional orthography is to learn to read in traditional orthography. It would appear rather that the best way to learn to read in traditional orthography is to learn to read in the initial teaching alphabet." (pp. 234–235)

It is interesting to note that Warburton's partner in *i.t.a.: An Independent Evaluation* was Vera Southgate, one of the people who had criticized my earlier research reports, and presumably one of the critics referred to anonymously by Myrtle Scott. Vera Southgate carried out an independent survey in schools in England for the Schools Council. In her report she *then* criticized my research reports for being *insufficiently* enthusiastic regarding the success of i.t.a. students in transferring their literacy skills from i.t.a. to T.O.! Her own studies led her independently to a similar conclusion to Warburton's. She states:

> "When i.t.a. is used with infants, better progress is made than when T.O. is used. The observed results include easier and earlier reading skill acquired without frustrations for the child; an increase in the time children choose to spend on reading, in the number of books they read and on their understanding of the contents of the books; an increase in the quantity and quality of children's free writing; an improvement in children's attitudes and behaviour; and beneficial effects on other school subjects and the general life of the school." (p. 156)

From the above quotations it is clear that Myrtle Scott's review of the previous research on i.t.a. is seriously inadequate. Numerous other recent studies (unlike the small one she reports) have confirmed my earlier findings. It is impossible to evaluate Myrtle Scott's own study because her article breaks the basic methodological rule of replicability. It is curious that a report of such a small experiment should require 4,500 words, and yet the 40 test words which might explain her unusual result were not included.

John Downing
University of Victoria
British Columbia, Canada

Reference: Warburton, F. W., and Southgate, Vera. *i.t.a.: An Independent Evaluation* (The Schools Council Report). London: Murray and Chambers, 1969.

Résumé des Articles

Traduction: Fernand Baudin

Les "typographs" *par Frank Harary*

Les "typographs" sont des graphiques dérivés des leitres. Une méthode de classification des caractères selon leur structure graphique est présentée notamment au moyen d'un alphabet de capitales et de "typographs". Tant pour les chiffres romains que pour les bas-de-casse d'un caractère de la famille des scriptes. Il est également question de créer de nouveaux caractères par cette méthode.

La lecture optique d'après les caractéristiques phénoménologiques *par B. Blesser, R. Shillman, C. Cox, T. Kuklinski. J. Ventura, M. Eden*

Il s'agit d'une méthode qui permettrait de décrire les capitales non plus par les caractéristiques physiques de leurs archétypes, mais bien par leurs représentations en termes plus généraux. On montre comment dégager ces termes par l'examen des caractères de lecture ambigüe. Les fonctions fournissent les termes de la description. Les rapports entre les éléments physiques des lettres et les caractéristiques fonctionnelles qui permettront leur identification sont définis par des instructions qui englobent la parenté stylistique de chaque caractère avec ses voisins. Les auteurs tirent les conséquences de leur théorie dans le domaine de la lecture optique.

Lire entre les lignes et au-delà *par Malcolm P. Douglass*

Au lieu de rester prisonniers des préjugés traditionnels, selon lesquels l'apprentissage de la lecture serait contraire aux tendances naturelles de l'enfant, il faudrait adopter un point de vue holistique, c'est-à-dire global. Les premières manipulations des symboles d'un langage visuel sont contemporaines chez l'enfant de ses premiers balbutiements et de ses premiers efforts pour écouter. Tout cela, spontanément, dans le cours naturel de sa croissance. La lecture ne peut s'enseigner qu'indirectement. Nous devrions nous efforcer de favoriser l'acquisition spontanée du langage. Et créer un milieu dans lequel l'enfant puisse trouver à lire et à écrire au sens le plus large: "lecture" et "écriture" de symboles, de gestes, d'oeuvres d'art, etc . . .

Le Codex Vindobonensis et l'écriture gothique *par L. Allen Viehmeyer*

On attribue généralement à l'évêque Wulfila (± 311–± 383) l'invention de l'alphabet gothique. Les documents en caractères gothiques qui nous sont parvenus, du ve et du début du vie siècle, présentent des formes de lettres et des usages scripturaires qui ont donné lieu à bien des conjectures concernant les origines des lettres gothiques. On sait depuis longtemps qu'il y a des alphabets gothiques dans le Codex Vindobonensis, mais ils ont été négligés faute d'un examen approfondi. C'est ce qui est fait dans cet article qui leur attribue la plus grande importance parce qu'ils représentent les formes primitives de l'écriture gothique dont ils éclairent par conséquent les origines.

Kurzfassung der Beiträge

Übersetzung: Dirk Wendt

Typo-Graphen *von Frank Harrary*

"Typo-Graphen" (typographs) werden als Graphen definiert, die von Buchstaben hergeleitet werden. Es wird eine Methode zur Klassifizierung von Buchstaben anhand ihrer zugrundeliegenden graphischen Struktur vorgeschlagen. Eine Klassifikation der Antiqua-Großbuchstaben wird vorgeführt, und Tafeln von "Typo-Graphen" werden ebenfalls für Antiqua-Zahlen und geschriebene Kleinbuchstaben aufgestellt. Es wird auf die Möglichkeit zur Entwicklung neuer Alphabete hingewiesen.

Die Erkennung von Buchstaben aufgrund ihres Erscheinungsbildes *von B. Blesser, R. Shillman, C. Cox, T. Kuklinski, J. Ventura, M. Eden*

Es wird ein theoretischer Ansatz vorgeschlagen, nach dem Großbuchstaben nicht aufgrund der physischen Eigenschaften ihrer Urbilder beschrieben werden sollen, sondern aufgrund allgemeinerer Angaben über die zugrundeliegende Abbildung. Es wird eine Methode vorgeschlagen, diese allgemeinen Beschreibungen durch die Untersuchung mehrdeutiger Schriftzeichen zu gewinnen. Funktionale Eigenschaften kennzeichnen die zugrundeliegende Abbildung der Buchstaben. Die Beziehungen zwischen den physischen Eigenschaften eines vorgegebenen Buchstaben und den funktionalen Eigenschaften, die seine Identität kennzeichnen, sind teilweise durch graphische Kontext-Regeln gegeben, welche stilistische Einheitlichkeit innerhalb des Buchstaben selbst und mit seinen Nachbarn einschließen. Es wird auf die Folgen der Theorie für das Gebiet der Buchstaben-Erkennung durch Computer und für den Schriftentwurf hingewiesen.

Lesen zwischen den Zeilen und darüber hinaus *von Malcolm P. Douglass*

Wir sollten das Lesen ganzheitlich sehen, statt uns an die traditionellen Annahmen gebunden zu fühlen—d.h. daß es eine schwere Aufgabe für ein Kind sei, lesen zu lernen, und daß es gegen seine natürlichen Lernvorgänge gehe. Die ersten Versuche des Kindes, sichtbare sprachliche Symbole zu meistern, finden parallel zu seinen ersten Bemühungen statt, zu sprechen und zuzuhören, und diese Versuche treten als Teil der normalen menschlichen Entwicklung auf. Wir können lesen nur indirekt lehren. Unsere Bemühungen sollten die spontane Natur des Spracherwerbs fördern und eine Umwelt mit Gelegenheiten für das Kind schaffen, in der es in möglichst weit gestreutem Zusammenhang schreiben und lesen kann—einschließlich des "Lesens" von Symbolen, Gesten, Kunstwerken usw.

Gothische Buchstabenformen und der Codex Vindebonensis *von L. Allen Viehmeyer*

Traditionsgemäß wird dem gothischen Bischof Ulfilas (ca. 311–ca. 383) die Entwicklung der Buchstaben des gothischen Alphabets zugeschrieben. Die gothischen Schriftstücke, die aus dem fünften und frühen sechsten Jahrhundert überliefert sind, zeigen Buchstabenformen und Schreibtechniken, die zu zahlreichen Hypothesen über den Ursprung der gothischen Buchstabenformen geführt haben. Obwohl das Vorkommen gothischer Schriftzeichen im Codex Vindobonensis seit langem bekannt ist, hat doch der Mangel einer angemessenen Einschätzung des Alphabets dazu geführt, daß man sie außer acht gelassen hat. Hier wird eine Einschätzung vorgeschlagen, die diesem Alphabet große Bedeutung als Beweisstück für eine frühe Phase in der Entwicklung der gothischen Buchstaben beimißt und damit höchste Wichtigkeit für die Herleitung des gothischen Alphabets.

The Authors

Frank Harary is professor of mathematics at the University of Michigan (Ann Arbor, MI 48104), where he has been since 1948. He is also a faculty associate in the University's Research Center for Group Dynamics, Institute for Social Research. Dr. Harary's main interests are graph theory and combinatorics; he has edited six books on graph theory and is the author of three: *Graph Theory* (Addison-Wesley, 1969), *Structural Models* (Wiley, 1965) with Dorwin Cartwright and Robert Norman, and *Graphical Enumeration* (Academic Press, 1973) with E. M. Palmer.

B. Blesser, R. Shillman, C. Cox, M. Eden, T. Kuklinski, and J. Ventura are members of the Cognitive Information Processing Group at Massachusetts Institute of Technology (Cambridge, MA 02139). This group has been pursuing research associated with the psychological basis of automated recognition machines for the last fifteen years. They are also involved in handwriting analysis, blood cell identification, and chromosome classification. Professors Blesser and Eden teach in the Department of Electrical Engineering; Messrs. Shillman and Ventura are doctoral students at MIT and Brandeis respectively; Messrs. Cox and Kuklinski are graduate students at MIT.

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