Readability as a Function of the Straightness of Right-Hand Margins

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The relation between typographic arrangement and readability has been the object of much research.[1] Several formats have been proposed to enhance readability. Emphasis has centered on the grouping of words into meaningful phrases and phrases into meaningful clauses.

Another consideration in typography is the straightness of the right-hand margin. Documents frequently are reproduced by photo-offset from typewritten manuscripts. A typed page normally has an irregular right margin. The margin can be made straight by justification, i.e., by retyping the page, spacing the letters so that every line is the same length. Such retyping improves the appearance of the copy but materially increases its cost. The question may be raised whether straightness also enhances readability. One can hypothesize that an even margin signals the end of a line to the reader's peripheral vision better than an irregular margin. Even if this is true, however, it may not be necessary to retype. A straight line printed alongside an irregular margin might produce the same effect much more economically.

The purpose of this study was to test the effects of different right-hand margins on reading performance.[2] Toward this end, two related experiments were conducted. In Experiment I reading performance was assessed with standardized multiple-choice tests designed to measure

[1] Coleman and Kim, 1961; Klare, Nichols, and Shuford, 1957; Nahinsky, 1956; North and Jenkins, 1951; Tinker, 1955.

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speed and level of comprehension. In Experiment II eye movements were recorded to determine reading rate.

EXPERIMENT I: MULTIPLE-CHOICE TEST

Method

Subjects. Two hundred sixteen enlisted naval personnel enrolled in the Submarine School at Groton, Connecticut, served as *Ss*.[3] Their ages ranged from 17 to 30 years with a median of 19.5 years. Forty-nine *Ss* had not completed high school and 167 were high school graduates. Twenty-six *Ss* had taken some college courses.

Materials. Series I of the Davis Reading Test [4] was adapted for use in this experiment. The series comprises four parallel test forms (A, B, C, and D), which are designed to measure reading performance at the late high school and early college level. The test yields two scores: speed of comprehension and level of comprehension. Both scores are derived from a single administration of the test. Each form of the test contains 80 items which examinees have 40 minutes to complete. Most persons have time to complete the first 40 items, but few answer all 80. The speed score is based on all items, whereas the level score is obtained from only the first 40. Accordingly, the level score provides a measure of understanding which is independent of speed. Scores on the Davis Reading Test are corrected for guessing by the formula: Score = number right minus one-fourth number wrong.

For the purpose of this experiment, forms A, B, and C were typed with three different right-hand margins: an irregular margin, an irregular margin with a printed guideline, and a straight margin produced by justification.

Procedure. During a three-hour session each *S* was tested on the three forms, each form in a different margin type. In order to balance out practice and other serial effects, a factorial design was used in which margin types (irregular, printed, and justified) and test forms A, B, and C were presented in all possible orders. Accordingly, a total of 36 orders were assigned to the 216 *Ss*, six *Ss* for each order.

[3] Our appreciation is extended to the officers and enlisted men of the Submarine School for their cooperation in this study.

[4] We are grateful for permission to reproduce the Davis Reading Test by F. B. Davis and C. C. Davis, Copyright 1956, 1957, Psychological Corporation, New York.

Results

The mean scores for speed and level of comprehension are given in Table I. The effects of margins were smaller than the effects of either test form or order of presentation. An analysis of variance for speed scores is shown in Table II. The effects of margins were not significant, while those of forms, order, and *S*s were all significant beyond the .01 level. Table III summarizes an analysis of variance for level scores. The margin effects again were not significant. The F ratios were significant for both forms and *S*s at the .01 level, and for order at the .05 level.

EXPERIMENT II: EYE MOVEMENTS

Method

Subjects. Eighteen of the *S*s who participated in Experiment I were selected for Experiment II. Those chosen were *S*s whose speed and level scores on the standardized reading tests fell closest to the over-all group averages.

Apparatus. In order to record eye movements in reading, a stand-mounted version of the Eye-Marker Camera (Mackworth and Thomas, 1962) was used. This device photographs both the scene before *S* and a small spot of light reflected from *S*'s cornea. The corneal reflection marks the location of *S*'s gaze on the scene. A 16-mm motion picture camera operated at 9 frames/sec. recorded all fixations made in reading. Film speed was verified by photographing a clock in the scene.

Test Materials. Portions of form D of the Davis Reading Test were used in Experiment II. Four short passages were chosen, all semi-technical in content. They contained 129 to 140 words in 15 to 16 lines of text. The unjustified lines averaged 4-1/4 inches in length; the justified were all 4-1/4 inches long. One of the passages was a practice sample used for all *S*s to familiarize them with the experimental procedure. This sample was typed in the irregular margin only. The test passages were typed in all three margins (irregular, printed, and justified). To encourage reading for comprehension, *S* was required to answer a multiple-choice question after each passage.

Procedure. *S*s were tested individually. After the sample passage, they read three test passages: all different in format and content. The order of presentation was balanced for both margins and content.

TABLE I: *Mean Scores for Speed and Level of Comprehension* (N = 216)

	Speed of Comprehension	*Level of Comprehension*
Margin Type		
Irregular	22.9	15.6
Printed	23.5	16.1
Justified	23.2	15.9
Test Form		
A	25.0	16.9
B	23.0	15.7
C	21.7	14.9
Order of Presentation		
First	22.1	16.1
Second	23.6	16.2
Third	24.0	15.3

TABLE II: *Analysis of Variance for Speed of Comprehension*

Source	*df*	*MS*	*F*
Margins	2	20.50	0.77
Forms	2	592.50	22.29**
Order	2	202.00	7.60**
Subjects	215	370.62	13.94**
Error (residual)	426	26.58	

** $p < .01$

TABLE III: *Analysis of Variance for Level of Comprehension*

Source	*df*	*MS*	*F*
Margins	2	11.50	.82
Forms	2	220.50	15.79**
Order	2	51.00	3.65*
Subjects	215	134.64	9.64**
Error (residual)	426	13.96	

* $p < .05$
** $p < .01$

Results

The time required to read each passage was measured from the beginning of the first fixation to the end of the last fixation on the passage. To compensate for the different number of lines in each passage, reading time is expressed as a rate, viz., seconds per line of text. Mean reading rates for margins, passages, and orders of presentation are shown in Table IV. None of these factors had any significant effect, as shown by the analysis of variance in Table V. Only for *S*s was a significant F ratio found.

TABLE IV: *Mean Reading Rate in Seconds per Line* (N = 18)

Margin Type		*Passage*		*Order of Presentation*	
Irregular	2.54	A	2.49	First	2.54
Printed	2.49	B	2.46	Second	2.45
Justified	2.45	C	2.54	Third	2.49

TABLE V: *Analysis of Variance for Reading Rate*

Source	*df*	*MS*	*F*
Margins	2	.055	2.89
Passages	2	.055	2.89
Order	2	.055	2.89
Subjects	17	.691	36.37**
Error (residual)	30	.019	

** $p < .01$

CONCLUSION

All measures of reading performance applied in this study gave essentially equal scores for three different right-hand margins: irregular, irregular with a printed guideline, and justified. Neither speed of comprehension nor level of comprehension, as measured by the Davis Reading Test, differed significantly among margin types. Reading rate, measured by ocular photography, also showed no significant differences for margins.

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