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Reading Speed and Comprehension as a Function of Typography

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Recently a student of journalism, R. B. Andrews (1), proposed a style of typography called "square span" in which the material is arranged in double-line blocks, as in the following:

This is of the style of
an example square span presentation

According to Andrews, square span should aid reading speed and comprehension by effectively utilizing both the horizontal and vertical visual span and by grouping the words into thought units. In Andrews' study 12 subjects were tested. Six of these were timed on each of five pages of square span text. A week later they were timed on the same five pages in standard form. The other six subjects were timed over the same materials, but in the reverse order. Of the 60 pairs of timings, 32 were in favor of square span, 24 in favor of standard form, and 4 indifferent. Although indicative, these results are not conclusive, and further research is required.

Some unpublished preliminary work by the junior author seems relevant. When material in square span form was tachistoscopically presented, perception was found to depend more on the familiarity and unity of the thought content than on the sheer amount of material. **Perhaps, then, the main advantage, if any, of square span lies in the grouping of words into thought units.**

In general, the typographical arrangement of material may provide cues for the appropriate organization of the thought content. In addition to square span, a second style of typography utilizing this principle was devised and was called "spaced unit."

This is an example of the spaced unit style of presentation

Note that the spaced unit style is like the square span style in grouping the words according to thought units, but more closely approximates standard typography in its unilinear arrangement.

The purpose of the present study, then, was to **compare square span, spaced unit, and standard typography in terms of reading speed and comprehension.** A secondary purpose was to determine the influence of two limited degrees of practice with a specified style of typography.

Method

The subjects were 180 university freshmen enrolled in two large sections of a social science course. The materials, which were mimeographed and then assembled in booklet form, consisted of three articles selected from a popular magazine (2, 5, 6) together with an objective test. Articles 1 and 2 were used for practice reading, and Article 3 was used as the test article; i.e., the one to which the reading test pertained. According to the revised Flesch formula (4), this test article had a "reading ease" score of 36.9 and a "human interest" score of 11.6. These scores indicate a moderately difficult style. The reading test consisted of 23 questions over the factual content of the test Article 3.

The design of the experiment is shown in Table 1. One experimental variable was style of typography of the test article. The subjects were divided at random into three groups. Group I read the test article in square span form; Group II, in spaced unit form; and Group III, in standard form. In breaking the material into smaller units for use of square span and spaced unit styles, an attempt was made to group words into thought units.

Table 1
Design of the Experiment

Condition	Style of Typography on Practice Articles		Style of Typography on Test Article
	Article 1	Article 2	Article 3
IA	Square span	Square span	Square span
IB	Standard	Square span	Square span
IIA	Spaced unit	Spaced unit	Spaced unit
IIB	Standard	Spaced unit	Spaced unit
IIIA	Standard	Standard	Standard
IIIB	Square span	Standard	Standard

The text was broken down into the same word groups in square span and spaced unit styles.

The second experimental variable was the amount of prior practice on whichever style of typography was used in the test article. Each of the three major groups was divided at random into two subgroups. Subgroup A had *four* minutes of practice (on Article 2) and Subgroup B had *eight* minutes of practice (on Articles 1 and 2) with the style used in the test article. Thus it was possible to determine whether the advantage, if any, of a given style of typography was a function of the amount of practice with it, at least within the limited range studied. It is realized, of course, that subjects were highly practiced with the standard style even before the experiment began.

The procedure was as follows. Each subject was given a mimeographed booklet containing the materials and instructions. All subjects

began simultaneously and read Article 1 for four minutes until the signal "stop" was given. Then Article 2 was read for four minutes. Next test Article 3 was read for two minutes. After the signal to stop had been given, the subjects were told to mark the place in Article 3 which they had reached in their reading. Finally the subjects turned to the objective test and answered the questions over test Article 3.

Results

The data were analyzed with respect to three measures of performance: (1) *reading speed*, as measured by the number of words read in two minutes on the test article (indicated by place in text marked by subject), (2) *comprehension*, as measured by the number of questions answered correctly in the test, and (3) *accuracy*, as measured by the per cent of

Table 2
Means of Reading Speed, Comprehension, and Accuracy Scores*

Condition	Sub-group	N	Reading Speed (No. of Words)	Comprehension (Items Correct)	Accuracy (Per Cent)
Square span	IA	30	434.3	7.5	87.1
	IB	30	416.3	7.3	82.8
Spaced unit	IIA	30	491.5	8.5	87.1
	IIB	30	495.0	8.6	86.9
Standard	IIIA	30	438.9	7.3	85.6
	IIIB	30	450.5	7.8	84.9

* Unfortunately S.D.'s were lost in moving but original work sheets showed S.D.'s of the groups and subgroups were sufficiently similar to satisfy the assumption of homogeneity of variance, which is involved in analysis of variance.

Table 3

Analysis of Variance of Reading Speed Scores

Source of Variation	SS	DF	Variance Estimate	F Ratio
Styles	155,700	2	77,850.0	9.36*
Practice	80	1	80.0	.01
Styles \times Practice	7,103	2	3,551.5	.43
Error	1,488,263	179	8,314.3	

* Significant beyond 1% level of confidence. Difference between spaced unit and square span means is significant at 1% level; between spaced unit and standard, 1% level; between square span and standard, non-significant.

correct answers to questions pertaining only to that portion of the test article marked by a subject as read.

The mean performance of each group and subgroup in terms of each of these measures is shown in Table 2. The apparent differences were then tested for statistical significance by the analysis of variance method. The results of the analysis of variance of reading speed scores appear in Table 3. Significantly more words were read with spaced unit typography than with either square span or standard typography. There were no significant differences attributable to amount of practice with a given style.

The analysis of variance of comprehension scores is reported in Table 4. The results parallel those for reading speed,—significantly more questions were answered correctly by the spaced unit group than by either the square span or standard groups. And again the amount of practice with a style resulted in no significant differences.

Table 4

Analysis of Variance of Comprehension Scores

Source of Variation	SS	DF	Variance Estimate	F Ratio
Styles	44	2	22.00	3.81*
Practice	2	1	2.00	.35
Styles \times Practice	5	2	2.50	.43
Error	1,032	179	5.77	

* Significant at 5% level of confidence. Difference between spaced unit and square span means is significant; between spaced unit and standard, significant; between square span and standard, non-significant.

Table 5

Analysis of Variance of Accuracy Scores

Source of Variation	SS	DF	Variance Estimate	F Ratio
Styles	152	2	76.0	.70
Practice	129	1	129.0	1.18
Styles \times Practice	164	2	82.0	.75
Error	19,557	179	109.3	

The analysis of variance of accuracy scores is shown in Table 5. No significant differences attributable to style of typography or amount of prior practice were found. There was no evidence that the faster reading of the spaced unit group was associated with lower accuracy.

Discussion

In terms of both reading speed and comprehension measures of performance, spaced unit typography was superior to either square span or standard typography. Although the amount of superiority was not marked, it nevertheless was statistically significant and appeared even after but a minimal amount of practice.

How may this advantage of spaced unit typography be explained? Let us assume that reading, the perception of printed text, involves the organization of the material into a meaningful structure. This point of view is similar to that of Dolch (3). This process of organization of the thought depends on many factors or cues. The hypothesis is offered that spaced unit typography provides cues for the organization of the thought, and hence aids reading. As such, spaced unit style is functionally equivalent to punctuation and grammatical elements such as prepositions and conjunctions. It might be said that the present study demonstrates that our present punctuational and grammatical cues may be supplemented to an advantage when the material is relatively complex.

If the hypothesis that typographical arrangement may provide cues for the organization of thought is correct, why was square span inferior to spaced unit and possibly even standard typography? The probable answer

is that square span is a radical departure from standard typography and thus interferes with established reading habits. Original or intensive training with square span might have other results.

The hypothesis that typographical and other cues for the organization of thought aid reading suggests a number of lines of further research. The value of the spaced unit style could be studied as a function of the difficulty of the material. Presumably more auxiliary cues are required for the perception of difficult and unfamiliar material than for easy and familiar material. The material of the present study was moderately difficult; with highly technical material the advantages of spaced unit typography might be more dramatic.

Another line of research would be to examine a variety of styles of typography in order to determine which furnishes optimal cues for the organization of thought. Wider separations between groups of words or a system of slashes or dots (as used in symbolic logic notation) are possibilities. In addition, it would be desirable to work with various age groups and with subjects who had been given intensive training with such a set of cues.

Finally, fundamental research is required to determine the appropriate meaningful structuring of the text. Presumably textual material does not consist of a string of coordinate units, but has a complex hierarchical structure. When this structure is better understood, typographical and other cues may be applied with greater objectivity and efficiency.

Summary

In a factorial design experiment, three styles of typography were compared. In terms of reading speed and comprehension measures, spaced unit was superior to square span or standard typography. This advantage in reading speed was not accompanied by a loss in accuracy of retention. No differences attributable to the two limited degrees of practice were found.

The hypothesis is offered that spaced unit typography facilitates reading by providing auxiliary cues for the organization of the thought. Further research with materials of various levels of difficulty, other typographical cues, and trained subjects is recommended. The study of the organization of thought in reading is prerequisite to objective and efficient utilization of typographical and other cues.

Finally, the spaced unit style as used in the present study may have immediate practical application, perhaps in academic and military instructional materials.

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