The Classic Readability Studies

William H. DuBay, Editor

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"A Method for Measuring the 'Vocabulary Burden' of Textbooks" by Bertha A. Lively and Sidney L. Pressey in 1923 in the *Educational Administration and Supervision*, Vol. 9, pp. 389-398.

"An objective method of determining grade placement of children's reading material" by Vogel, M. and C. Washburne published in 1928 in the *Elementary school journal*, Vol. 28, pp. 373-381.

"A Technique for Measuring the Vocabulary Burden of Textbooks" by W. W. Patty, W. W. and W. I. Painter in 1931 in the *Journal of Educational Tesearch* Vol. 24, pp. 127-134.

"Predicting Readability" by Irving Lorge, published March, 1944, in the *Teachers College Record*, Vol. 45, pp. 404-419.

"A Formula for Predicting Readability" by Edgar Dale and Jeanne S. Chall, published January 21, 1948, in in *Educational Research Bulletin,* Vol. 27, No.1, pp. 11-20, 28.

"A Formula for Predicting Readability: Instructions" by Edgar Dale and Jeanne S. Chall, published February 28, 1948, in *Educational Research Bulletin,* Vol. 27, No. 2, pp. 37-54.

"A New Readability Yardstick" by Rudolf Flesh, published June, 1948, in *Journal of Applied Psychology*, Vol. 32. No. 3, pp. 221-233.

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1893—L.A. Sherman: The Analytics of Literature

Down through the centuries, many had written about the differences between an “ornate” and “plain” style in English.

In 1880, a professor of English Literature at the University of Nebraska, Lucius Adelno Sherman, began to teach literature from a historical and statistical point of view.

Sherman, like other teachers of his time, saw literature as a method for the moral and spiritual edification of citizens. He was one of the first to recruit science for this task and to advocate an “objective” approach to literature. In 1893, he published *Analytics of Literature*: *A Manual for the Objective Study of English Prose and Poetry*.

He found his approach was highly effective in giving his students an appreciation for great literature:

> Students apparently without taste for reading, or capacity to discern common literary excellencies, were enabled to appreciate and enjoy poetry as well as the best. Bright scholars were also in their way benefited not less than the undiscerning. Things vague were made definite. Grounds of judgment before indeterminate or hidden were made plain. Criticism was rendered confident; and no little enthusiasm was aroused (p. xi).
>
> In general, this method, if tried intelligently and fairly, will discover to those who suppose they have no taste for the best literature that they have such taste; and it will make those who have never found anything in poetry both feel and know something of its power (p. xii).

In defending his method against critics, he wrote:

> There is a very natural antipathy to treating aesthetics by scientific methods. Yet there is in the nature of things no reason why we may not as well analyze the tissues of human speech and though as the tissues of the human body. Within a generation science has been broadened by the use of imagination, and there is no good reason why aesthetics in turn should not have the material aid of facts and statistics (p. xiii).

The proof, he claimed, is in the results. His method immediately engages students with the text on a practical level they can understand. A more refined appreciation of the content-grows out of the familiarity with the form and structure of the text:

Sherman's work makes modern use of statistics, charts, and graphs. Most notable are his findings about the streamlining of language.

In comparing the older prose writers with the then-current writers such as Macaulay and Ralph Waldo Emerson, Sherman noticed a progressive shortening of sentences over time.

He decided to look at this statistically and began by counting average sentence length per 100 periods. In his book he showed how sentence-length averages shortened over time:

- Pre-Elizabethan times: 50 words per sentence
- Elizabethan times: 45 words per sentence
- Victorian times: 29 words per sentence
- Sherman's time: 23 words per sentence.

In our time, the average is down to 20 words per sentence.

Sherman's work set the agenda for a century of research in reading. It proposed the following:

- Literature is a subject for statistical analysis.
- Shorter sentences and concrete terms increase readability.
- Spoken language is more efficient than written language.
- Over time, written language becomes more efficient by becoming more like spoken language.

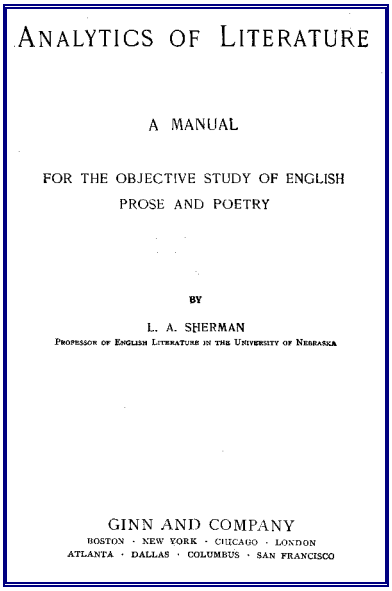
Sherman also showed how individual writers are remarkably consistent in their **average** sentence lengths. This consistency was to become the basis for the validity of using samples of a text rather than the whole thing for readability prediction.

Another of Sherman's discoveries was that over time sentences not only became shorter but also simpler and less abstract. He believed this process was due to the influence of the spoken language on written English. He wrote:

> Literary English, in short, will follow the forms of the standard spoken English from which it comes. No man should talk worse than he writes, no man writes better than he should talk…. The oral sentence is clearest because it is the product of millions of daily efforts to be clear and strong. It represents the work of the race for thousands of years in perfecting an effective instrument of communication (p. 312).

Linguistic research later confirmed Sherman's view of the re-

lationship between spoken and written language.


ANALYTICS OF LITERATURE

A MANUAL

FOR THE OBJECTIVE STUDY OF ENGLISH PROSE AND POETRY

BY

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In Analytics of Literature*, L.A. Sherman showed the importance of average sentence length and the relationship between spoken and written English.*

Sherman's most important point was the need to involve the reader. He wrote:

> The universally best style is not a thing of form merely, but must regard the expectations of the reader as to the spirit and occasion of what is written. It is not addressed to the learned, but to all minds. Avoiding book-words, it will use only the standard terms and expressions of common life… It will not run in long and involved sentences that cannot readily be understood. Correct in all respects, it will not be stiff; familiar, but safely beyond all associations of vulgarity (p. 327).

—WHD

1921—E. L. Thorndike: The Teachers' Book of Words

During the 1920s, two major trends stimulated a new interest in readability:

1. A changing school population, especially an increase in "first generation" secondary school students, the children of immigrants. Teachers reported that these students found textbooks too difficult.
2. The growing use of scientific tools for studying and objectively measuring educational problems.

One such tool, Thorndike's *Teacher's Word Book*, which came out in 1921, was the first extensive listing of words in English by frequency. It provided teachers with an objective means for measuring the difficulty of words and texts. It laid the foundation for almost all the research on readability that would follow. It was also the basis for the first readability formulas.

Its author, psychologist Edward L. Thorndike of Columbia University, noticed that teachers of languages in Germany and Russia were using word counts to match texts with students. The more frequent a word is used, they found, the more familiar it is and the easier to use. As we learn and grow, our vocabulary grows as does our ability to master longer and more complex sentences. How much that continues to grow depends on how much reading is done throughout life.

Around 1911, Thorndike began to count the frequency of words in English texts. In 1921, he published *The Teacher's Word Book,* which listed 10,000 words by frequency of use. In 1932, he followed up with *A Teacher's Word Book of 20,000 Words*, and in 1944 with Irving Lorge, *A Teacher's Word Book of 30,000 Words*.

A vocabulary test on the meaning of words is the strongest predictor of verbal and abstract intellectual development. The knowledge of words has always been a strong measure of a reader's development, reading comprehension, and verbal intelligence. Chall and Dale wrote in 1995, "It is no accident that vocabulary is also a strong predictor of text difficulty."

It happens that the first words we learn are the simplest and shortest. These first, easy words are also the words we use most frequently. Most people do not realize the extent of this frequency. Twenty-five percent of the 67,200 words used in the 24 life stories written by university freshmen consisted of these ten words: *the, I, and, to, was, my, in, of, a*, and *it*. The first 100 most frequent words make up almost half of all writ-

ten material. The first 300 words make up about 65 percent of it.

Educators, publishers, and teachers still use word-frequency lists to evaluate reading materials for schools. After Thorndike, there was extensive research on vocabulary. The high mark came in 1949 with *Human Behavior and The Principle of Least Effort* by Harvard's George Kingsley Zipf.

Zipf used a statistical analysis of language to show how the principle of least effort works in human speech. Zipf showed that, in many languages, there is a mathematical relationship between the hard and easy words, now called Zipf's curve. This notion of saving energy is a central feature of language and is one of the principle bases of research on the frequency of words.

In 1968, psychologist George Klare wrote, "Not only do humans tend to used some words much more often than others, they recognize more frequent words more rapidly than less frequent, prefer them, and understand and learn them more readily. It is not surprising, therefore, that this variable has such a central role in the measurement of readability."

—WHD

1923—The Lively and Pressey Measuring Method

Introduction

Bertha A. Lively and Sidney L. Pressey of Ohio State University were concerned with the practical problem of selecting science textbooks for junior high school. Books at that time were so overlaid with technical words that teachers spent all class time teaching vocabulary.

In 1923, they published their study, "A Method for Measuring the 'Vocabulary Burden' of Textbooks" in the journal *Educational Administration and Supervision*.[1]

They argued that it would be helpful to have a way to measure and reduce the "vocabulary burden" of textbooks.

Their study tested three different methods for measuring the vocabulary load of a thousand words of text:

1. The first method used the number of different words (the vocabulary range).
2. The second method used the number of "zero-index words," words **not** in *The Teacher's Word Book*, the Thorndike list of 10,000 words.
3. The third method used the median of the index numbers of the words taken from the same Thorndike list of 10,000 words.

They tested the three methods on 15 textbooks of different difficulties, along with one newspaper. The low end included a second and a fourth-grade reader and Stevenson's *Kidnapped*. The high end included a college physics textbook and an elementary chemistry textbook.

They found that the median index number was the best indicator of the vocabulary burden of these reading materials: the higher the index number, the easier the vocabulary; the lower the index, the harder the vocabulary.

The Lively-Pressey study demonstrated the effectiveness of a statistical approach for predicting text difficulty. It had a great influence on the readability formulas that would follow and also use the Thorndike word list. As the authors announced, "The fundamental value of Thorndike's contribution is obvious; the 'Word Book' has opened up a whole new field for investigation."

—WHD

[1] Vol. 9, No. 7 (October 1923), pp. 389-398.

EDUCATIONAL
ADMINISTRATION AND SUPERVISION

INCLUDING TEACHER TRAINING

Vol. IX | October, 1923 | No. 7

A Method for Measuring the "Vocabulary Burden" of Textbooks

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Ohio State University

I. Need for a Systematic Method for Investigating Vocabulary Burden

The present study was begun as a result of a minor investigation regarding the number of technical words in a certain junior high school science book. The study revealed an astounding number of technical terms—a number so large (as testified by teachers using this book) that the course often became quite as much a study of scientific vocabulary as of scientific facts. This investigation brought out in striking fashion the importance of the question as to comparative vocabulary burden, in public school textbooks. The problem is perhaps most acute in connection with junior high school science books. But it is also an important problem in reading; some method for measuring vocabulary difficulty in supplementary reading material should be decidedly worth while. The present paper presents an effort to develop a method capable of dealing with these problems, together with results of application of this method to certain representative textbooks from second grade readers to a medical school physiology.[1]

II. Method and Material

The method finally adopted, after an extended series of preliminary investigations which need not be presented here, may be briefly described. Two questions were involved in the elaboration of procedure; (*a*) How many words must be included in any sampling from a textbook in order to obtain a reliable indication regarding vocabulary—and how should these words be selected? (*b*) How can the difficulty of the words in this sampling be best measured?

[1] The writers wish to acknowledge their obligations to the Graduate Council of the University for funds to assist in the clerical labor.

The method of vocabulary sampling finally adopted dealt with thousand word units obtained from a systematic sampling throughout the text. First of all, the investigator noted the number of pages in the book and the approximate number of words per line; he then estimated the number of pages which should be sampled, taking one line per page, in order to cover 1000 words, and chose pages so that the sampling would be evenly distributed throughout the book. Thus if the book contained approximately 500 pages, and there were about 10 words to the line, a line on each fifth page throughout the book would make up about a thousand words. The investigator then went through the book, counting up the number of words found on the third line of each fifth page until exactly 1000 words were obtained. The third line was used as conveniently found on a page. If the book were shorter, every other page might be taken, if much longer, every tenth; pages were chosen simply to give a systematic sampling throughout the book. The lines chosen through to the thousandth word were now gone over, and all the different words found in this thousand listed and alphabetized.

Once the thousand-word count was made, the total number of different words per thousand was first noted. This gave what has been called vocabulary range. Next, these words were looked up in the Thorndike "Word Book"[2] and the index number for each word was found. The number of words was now counted, in the thousand-word sampling, not appearing among the most common 10,000 words; these words were listed as zero value words and may be taken to indicate the size of the technical vocabulary. The weighted median index number was finally calculated. This is simply the median index number with zero value words counted twice. Evidently the higher the median index number the easier the vocabulary.

Sixteen different types of reading matter were thus studied; Three second-grade readers (Jones, Aldine, Horace Mann), three fourth-grade readers (Jones, Aldine, Horace Mann), Stevenson's "Kidnapped/" Thackeray's "Vanity Fair" the Colum-

[2] Thorndike, E. L.: "The Teacher's Word Book," Teacher's College, Bureau of Publications, Columbia University, New York City. This book lists the 10,000 most common words of the English language, as determined on the basis of an elaborate investigation by Professor Thorndike. In this "Word Book" each word is followed by an index number indicative of its commonness. Thus such a common word as "and" has an index number of 210; a relatively uncommon word like "atom" has an index number of 4; still more rare words such as "neolithic'[1] do not appear in the word book at all—those are listed as zero value words. Words with credit numbers of 49 or over occur in the first 1000 words, in frequency. Words with index numbers of 10 or over occur in the first 5000 words-~and so on; for a more detailed statement, the reader is referred to the "Word Book" itself.

bus *Dispatch* (as a sampling of newspaper vocabulary—only the first page was taken), Muzzey's "American History" Clark's "General Science" and "Introduction to Science" (as representative of Junior High School books in science), Hunter's "Elements of Biology" McPherson and Henderson's "Elements of Chemistry," Kimball's "College Physics," and Howell's "Physiology."

The results below summarize the findings regarding these materials as to (*a*) range of vocabulary, (*b*) size of highly technical vocabulary (zero value words), and (*c*) weighted median index number. For each book two counts were made, in order to determine the reliability of the method. The second samp-

SUMMARY REGARDING VOCABULARY BURDEN—16 TYPES OF MATERIAL

	Range		Zero value words		Weighted median	
Counts	1	2	1	2	1	2
Second readers: Jones	371	350	4	4	86	88
Horace Mann.	412	421	9	9	78	83
Aldine	367	353	7	6	77	79
Fourth readers: Jones.	471	454	12	20	71	62
Aldine.	450	455	24	11	63	69
Horace Mann.	466	472	15	17	65	66
Stevenson: Kidnapped.	402	415	21	30	67	65
Thackeray: Vanity Fair	490	459	43	34	43	54
Columbus Dispatch	528	581	49	45	33	37
without local names.	514	560	35	24	38	45
Muzzy: American History	533	506	24	30	38	40
Clark: Introduction to Science	483	491	22	25	52	50
Clark: General Science.	480	463	30	30	43	45
Hunter: Elements of Biology	464	467	57	57	28	34
Elementary Chemistry	399	358	67	69	22	14
Kimball: College Physics	393	405	60	59	24	22
Howell: Physiology	422	473	108	94	4	10

sampling was made exactly as the first except that a different page was used. Thus, if the first count used the pages 5, 10, 15, 20, then the second count used pages 1, 6, 11, 16, the third line on each page being studied in each case. As will be noted, the method seems fairly reliable. If it is desired to increase the reliability it is suggested that additional thousand-word counts be made and the results averaged. This would seem more satisfactory than increase in the size of a single sampling since the thousands-word count is a very convenient unit, and after

a number of thousand-word counts are made, comparisons from one count to another are of some interest.

III. Results

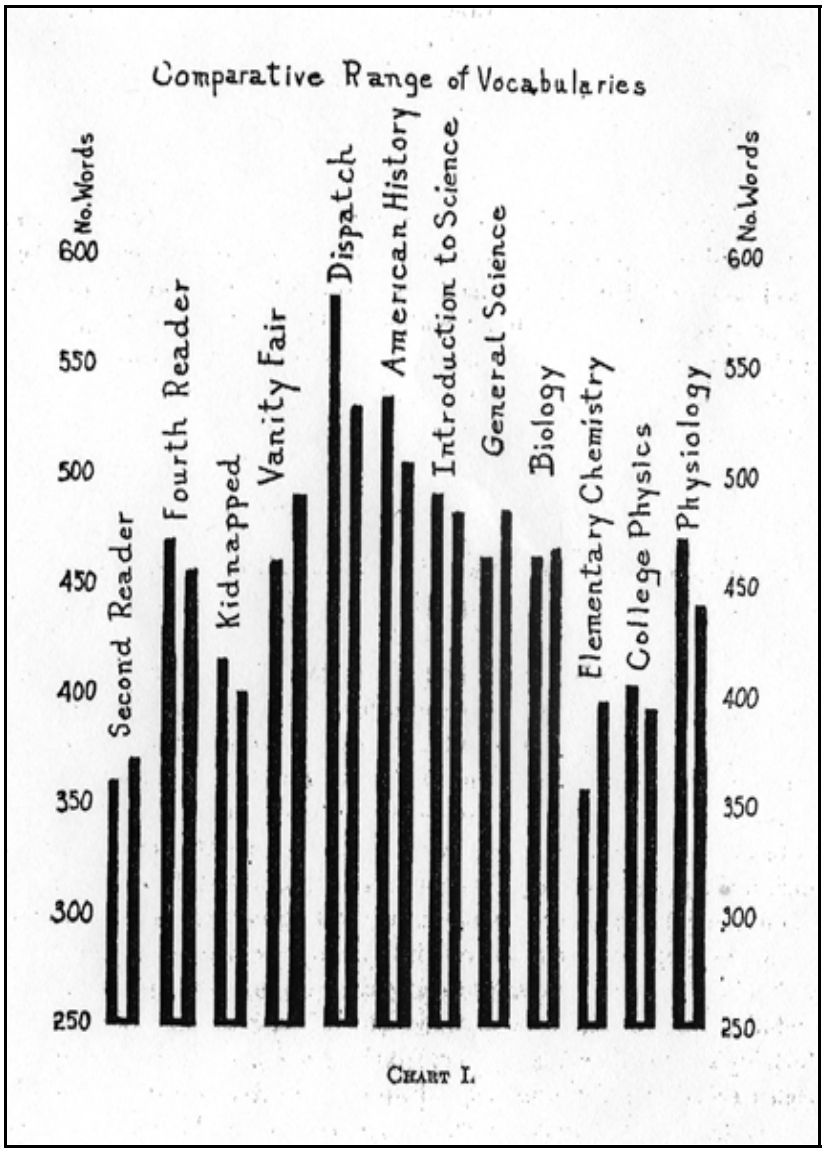
(***a***) Range of Vocabulary.—The following table summarizes all results for these materials. As will be noted, the table shows (*a*) range, (*b*) zero value words, and (*c*) weighted median index numbers—and for each one of these items the results of the two counts are shown.

The results are, however, best shown in graphic form. Chart I shows the difference in range.

As might be expected, the range of vocabulary in second-grade readers is small. But two or three unexpected findings do appear. Thus the range of vocabulary in "Kidnapped" is also small. Stevenson evidently gets his effects not by using a large number of words, but by sentence structure, and other devices. Range in the science books is low; these books apparently use their technical terms over and over again, and use besides these technical terms relatively simple words. It is suggested that these figures may be used as tentative bases for comparison in further counts, the average range of the two samplings being employed. If the method seems of value, it is intended that norms for readers in the various grades, and for various types of books, should be developed.

(**b**) *Number of Zero Value Words*.—Again, graphical presentation is the most satisfactory.

As would be expected, the second readers show the smallest number of words outside the 10,000 most common words. It; is somewhat startling, however, to find that second readers do include a few such terms. The number of zero value words in the newspaper is somewhat high. This is due in part to the number of local names included; the table presents also - figures for the newspapers with these local names left out. It was found very difficult, however, to decide just which names might best be eliminated; so the chart presents the results without such elimination. The large number of technical trams in the Junior High School biology is of decided interest, and is indicative of the vocabulary burden of this book. The Medical School physiology also has a huge number of such terms, as would be expected.



(**c**) *Weighted Median Index Numbers.*—These results are presented in graphical form in Chart III. It is felt that the weighted median index number is probably the best measure of vocabulary burden. It will be noted that "Kidnapped" is about at fourth grade reading difficulty; it is suggested that "Kidnapped" might well be used as supplementary reading at about the fourth or fifth grade. Other details regarding the comparative standing of the various books are obvious from the chart and need no comment.

IV. Possible Developments Of The Method

The question now is as to the values and limitations of the method as thus illustrated. But perhaps the limitations should be pointed out first.

It should be re-called in the first place that the reliability of these thousand-word samplings—as determined by comparisons of two samplings for each book—was called “fair.” From trying experience in the field of tests, it has come to be realized that reliabilities first considered fair might be by no means as good as they should be. It can at least be said of the present study that data are presented which make possible some judgment as to what reliability, in a given instance, may be expected. More important, however, is the possibility (as was suggested), that the reliability may be increased as desired by taking further thousand-word samplings. Presumably, the reliability desired will depend upon the nicety of the distinctions which it is desired to make; very likely also the reliability of the weighted median index number and number of zero value words will be conditioned somewhat by the range of vocabulary. It is one important merit of the general procedure suggested that it is elastic, and thus adapted to such various demands or conditions.

It should also be listed in the catalogue of limitations that the description of the sampling in terms of range, number of zero value words, and weighted median index number is undoubtedly a description which leaves out certain important elements. This is, of course true of any method of statistical summary; features appear, when the complete distribution is studied, which are lost in the scheme of averaging: Thus in the present study, the history seems to involve a greater proportional number of words in the last 5000 of the 10,000 most common words than any of the other books studied. But no special features of any of the distributions have appeared of sufficient prominence to demand special treatment.

It should also be mentioned as a third handicap that the method is so involved in use of the Thorndike "Word Book" as to partake of any faults that that book may have. The writers' work has emphasized the extent which Thorndike has weighted his investigation in the direction of literary and even poetical vocabularies.[3] The study has also made clear the advantages which would have accrued to Thorndike's work, if a more systematic sampling on his part had permitted the inclusion, with the index numbers, of the frequencies with which each word occurred, per 1,000,000 words. The interpretation of median index numbers, and of other features of the total distributions of thousand word counts, would be much easier,

[3] Comparisons of thousand-word .counts. (not reported here) on the "Golden Treasury" and other literary materials with the newspaper vocabularies, as to overlapping, have brought out this feature.

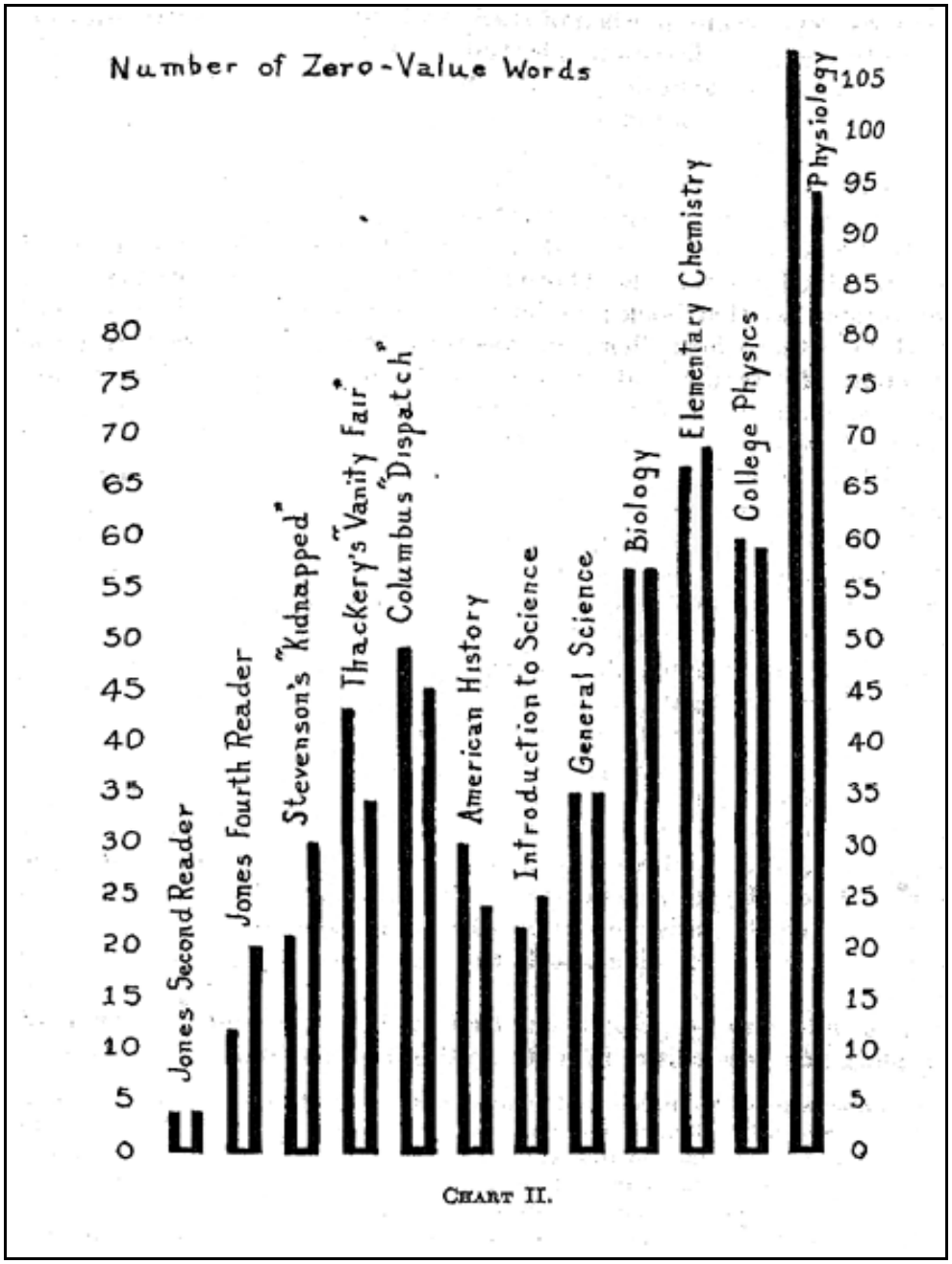


CHART II.

and the significance of all results much enriched.[4] However, these are matters of relatively minor detail. The fundamental value of Thorndike's contribution is obvious; the "Word Book" has opened up a whole new field for investigation.

[4] Or suppose Thorndike had used for index numbers a scale of ten, for the ten thousand words, using decimals to distinguish the position of a word within each thousand. It would then be possible to read directly, from the index number, the place of each word in the ten thousand, and interpretation would be greatly facilitated.

But now for some of the potentialities of .the method. It - would seem obvious in the first place that, with the development of such further data as might be considered to establish norms, such procedure should be of considerable use in evaluating texts or other reading material. A thousand-word count can be put through in about three hours. Even though several counts might be necessary, in order to obtain sufficient consistency from one count to another to give one confidence in the' findings, still the time cost would not appear excessive.

It should also be pointed out that such a systematic method of sampling has possibilities in investigating the distribution of vocabulary burden through a book. Many texts appear to have the vocabulary load at the beginning. A thousand-word count in each chapter should make possible interesting comparisons regarding this matter. Finally, it should be mentioned that certain further developments of the method are possible. For instance, under certain circumstances over-lapping from one book to another may be of importance. Thus in studying the additions to technical vocabularies involved in chemistry, after a course in general science has been taken, comparison of a thousand-word counts for over-lapping, from one book to another yields many interesting figures. :

The reader will doubtless feel that these are great: expectations on the basis of a few facts. Quite so it is. But the study has seemed distinctly suggestive; the writers are therefore presenting what results they have obtained, with the hope that others may be interested to work along these lines.

SUMMARY

The paper may be briefly summarized.

1. It is suggested that .the vocabulary difficulty or vocabulary burden of a book or other piece of reading material, may be evaluated by taking thousand-word; samplings of the vocabularies used and examining these samplings with reference to the type of word employed.

2. Three methods are suggested for summarizing the facts with regard to such a sampling: (*a*) Range of vocabulary, or number of different words per 1000 words sampled, (*b*) number of words not occurring in the Thorndike list of the 10,000 most common words, and (*c*) weighted median Thorndike “Word Book" index number.

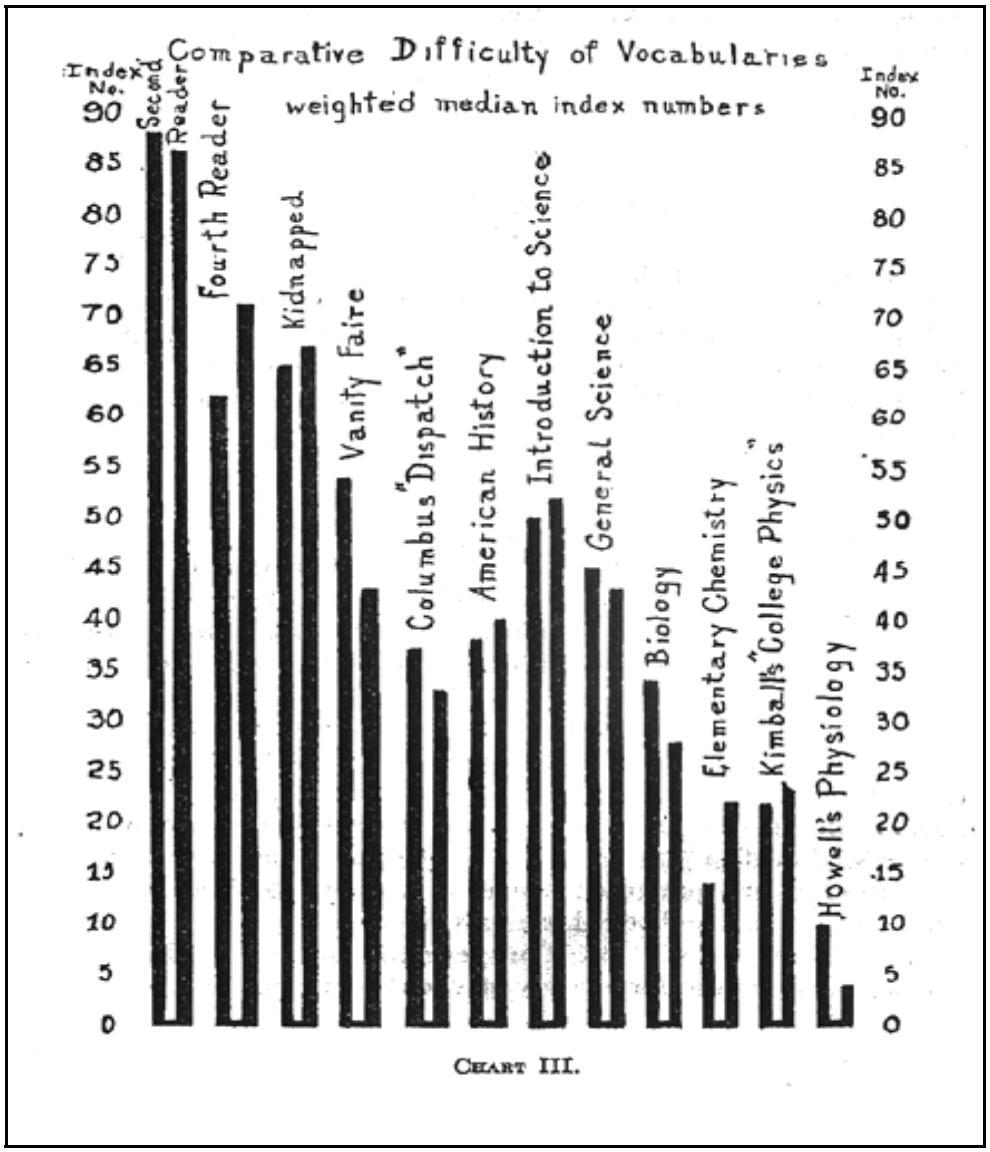


CHART III.

3. Results are presented from study of, 15 books, and one newspaper, by the methods above indicated.

4. It is; suggested that the general procedure has decided possibilities, as a basis for a study of vocabulary burden.

1928—Vogel and Washburne: The Winnetka Formula

Introduction

In 1928, Mabel Vogel and Carleton Washburne of Winnetka, Illinois, published one of the most important studies of readability.[1]

They were the first to study the structural characteristics of the text and the first to use a criterion based on an empirical evaluation of text. They studied ten different factors including kinds of sentences and prepositional phrases, as well as word difficulty and sentence length. Since, however, many factors correlated highly with one another, they chose four for their new formula.

Following Lively and Pressey, they validated their formula, called the Winnetka formula, against 700 books that had been named by at least 25 out of almost 37,000 children as ones they had read and *liked*. They also had the mean reading scores of the children, which they used as a difficulty measure in developing their formula. Their new formula correlated highly (***r*** = .845) with the reading test scores.

With this formula, investigators knew that they could objectively match the grade level of a text with the reading ability of the reader. The match was not perfect, but it was better than subjective judgments. The Winnetka formula, the first one to predict difficulty by grade levels, became the prototype of modern readability formulas.

A Word about Correlations

In reading research, investigators look for **correlations** instead of **causes**. A correlation coefficient (***r* =**) is a descriptive statistic that can go from +1.00 to 0.0 or from 0.0 to –1.00. Both +1.00 and –1.00 represent a perfect correlation, depending on whether the elements are positively or negatively correlated.

A coefficient of 1.00 shows that, as one element changes, the other element changes in the same (+) or opposite (-) direction by a corresponding amount. A coefficient of .00 means no correlation, that is, no corresponding relationship through a series of changes.

For example, if a formula should predict a 9th-grade level of difficulty on a 7th-grade text, and, if at all grade levels, the er-

[1] Vogel, M. and Washburne, C. 1928. "An Objective Method of Determining Grade Placement of Children's Reading Material." *The Elementary School Journal,* Vol. 28, pp. 373-381.

ror is in the same direction and by a corresponding amount, the correlation could be +1.00 or at least quite high. If, on the other hand, a formula predicts a 9th-grade level for a 6th-grade text, an 8th grade level for a 10th-grade text, and has similar variability in both directions, the correlation would be very low, or even 0.00.

Squaring the correlation coefficient (r^2 =) gives the percentage of accountability for the variance. For example, the Vogel and Washburne formula above accounts for 71% ($.845^2$) of the variance of the text difficulty.

—WHD

ELEMENTARY SCHOOL JOURNAL

Vol. XXVIII **January, 1928**

An Objective Method of Determining Grade Placement of Children's Reading Material

MABEL VOGEL[2]
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CARLETON WASHBURNE
Superintendent of Schools, Winnetka, Illinois

Every teacher has to face the problem of fitting reading material to children's reading ability. Any attempt in the past to give children suitable material has been largely a matter of guesswork. An objective method of determining what material is appropriate for children of given reading ability is needed by classroom teachers. Similarly, in selecting textbooks and supplementary-reading material, the superintendent or supervisor should have a means of knowing whether the books are within the reading grasp of the children for whom they are intended. The writers of textbooks and other books for children need to have an objective method of determining whether their vocabulary and sentence structure are such as will offer no serious obstacles to the children who are to read what they write.

Two years ago the foundation was laid for a study of the objectively measurable differences that exist among books read and enjoyed by children of various levels of reading ability. Thirty-six thousand seven hundred and fifty widely scattered children reported on all the books which they had read during the preceding year. The ballots which they filled out were brought together, and the results of their judgments make up the *Winnetka Graded Book List.*[3]

The *Winnetka Graded Book List* is a list of seven hundred books on each of which twenty-five or more children's judgments were received. This list is graded not according to the actual school grade of the children but according to the grade to which their reading ability corresponds. The para-

[2] Originally published 1928, *Elementary School Journal,* Vol. 28, pp. 373-381.
[3] Carleton Washburne and Mabel Vogel, *Winnetka Graded Book List,* Chicago: American Library Association, 1926.

graph-meaning section of the Stanford Achievement Test was used as a measure of silent-reading ability. The reliability and the validity of the grading of the books in the *Winnetka Graded Book List* have been amply checked. Since the grade placement of these seven hundred books is known, it is possible to use this information in determining the grade placement of other books.

One hundred and fifty-two books were chosen from the *Winnetka Graded Book List* as a basis for the present study. About half of them are the most popular books in the various grades. The other half are books well liked by both sexes and read by an equal number of boys and girls closely concentrated around the median in reading ability. This number of books was chosen arbitrarily as a fairly good representation of the books in the list.

The Winnetka teachers' seminar, composed of twenty volunteer teachers, examined these books for every conceivable element of difficulty which might influence the grade placement. Examination was made of the following elements:

1. Vocabulary difficulty (according to Pressey's technique[4])
   - *a*) Number of different words occurring in a sampling of 1,000 words
   - *b*) Median index number (based on Thorndike's indexed word list[5]) of 1,000-word sampling
   - c) Number of words in 1,000-word sampling not occurring in Thorndike's list
2. Sentence structure of seventy-five sample sentences
   - *a*) Sentence use—declarative, exclamatory, imperative, and interrogative
   - *b*) Sentence form—simple, complex, compound, and complex-compound
   - *c)* Dependent clauses—noun, adjective, and adverbial
   - *d)* Phrases—adjective, adverbial, infinitive, and participial
3. Parts of speech occurring in. 1,000-word sampling—nouns (common and proper, abstract and concrete), pronouns, verbs (action and non-action, transitive and intran-

[4] Bertha A. Lively and S. L. Pressey, "A Method for Measuring the "Vocabulary Burden* of Textbooks," *Educational Administration and Supervision*, IX (October, 1923), 389-98.

[5] Edward L. Thorndike, *The Teacher's Word Book*, New York: Teachers College, Columbia University, 1921.

sitive), infinitives, participles, gerunds, adjectives (sensory and non-sensory), articles, adverbs, prepositions, conjunctions, interjections, and expletives

4. Paragraph construction
   - *a)* Number of sentences and words per paragraph of conversation and non-conversation
   - *b*) Percentage of seventy-five sentences containing conversation
5. General structure
   - *a)* Number of words to a line, number of lines to a book, and number of words to a book.
   - *b*) Length of chapters
6. Physical makeup [6]
   - a) Weight
   - b) Size of type
   - *c)* Length of line
   - *d)* Distance between lines

After all the elements were tabulated and counted for each book, each element was graphed to determine whether there was a definite rise or fall from grade to grade. Those elements showing the most definite rise or fall from grade to grade were chosen for further study, and the others were cast aside.

Table I[7] shows the correlation between each of the elements selected for further study and the median reading score of the children who read the 152 books. Table II shows the intercorrelations of the ten most promising elements in Table I. The aim in choosing these ten elements was to find elements which would correlate as little as possible with one another and as highly as possible with the median reading score of the children who read and enjoyed the books measured.

[6] The items under this heading were not fully explored as it was felt that a different technique of study was needed to determine optimum size of type, length of line; and leading appropriate to each grade. A separate study of these elements is being made.

[7] This is one of a number of similar tables constructed during the study. One table showed correlations with the reading grade instead of the reading score; another showed correlations with chronological age; etc. More than one hundred coefficients of correlation were found. The most satisfactory correlations were with the reading score, as shown in Table I.

TABLE I

CORRELATION OF VARIOUS ELEMENTS WITH MEDIAN READING SCORE*

Element	Correlation
Number of different words occurring in a sampling of 1,000 words	.770
Median index number (based on Thorndike's list) of 1,000-word sampling	— .704
Number of words in 1,000-word sampling not occurring in Thorndike's list	.674
Number of words in book	.592
Number of phrases in 1,000-word sampling	.576
Number of verbs in 1,000-word sampling	— .527
Number of words per paragraph	.518
Number of prepositions in 1,000-word sampling	.518
Number of phrases of all kinds in 75 sample sentences	.518
Number of phrases and clauses of all kinds in 75 sample sentences	.474
Number of adverbial phrases and clauses in 75 sample sentences	.467
Number of adverbial phrases and clauses in 1,000-word sampling	.463
Number of adjective phrases and clauses in 75 sample sentences	.461
Number of adverbial phrases in 75 sample sentences	.458
Number of words in 75 sample sentences	.453
Number of simple sentences in 75 sample sentences	— .371
Number of conjunctions in 1,000-word sampling	.296
Number of adverbial clauses in 75 sample sentences	.291
Number of nouns in 1,000-word sampling	— .262

*Because of the difference in sentence length, the number of words in seventy-five sample sentences varied greatly. To reduce phrase and clause counts to & common basis in certain cases, the number of phrases or clauses was divided by the number of words in seventy-five sentences and the quotient multiplied by 1,000. The result showed the number of phrases or clauses there would be in seventy-five sentences if these sentences contained exactly 1,000 words. This procedure was used only when it yielded a better correlation than did a simple phrase or clause count of seventy-five sentences. It was not used in the case of any of the four elements that make up the final regression equation.

Various combinations of the ten elements shown in Table II were tried and a series of multiple correlations found. The best multiple correlation (.845), combining four elements, was made the basis of a regression equation which predicts with a high degree of reliability the reading score necessary for the reading and understanding of any given book. The standard error of estimate in using this equation is 8 points on the paragraph-meaning section of the Standard Achievement Test. This means a difference of less than a grade in the lower grades ad a difference of slightly more than a grade in the upper grades. This is a very reasonable standard error since it was found that any book that was read and enjoyed by children in a given grade could be read and enjoyed by children one grade above or below.

TABLE II

INTERCORRELATION OF VARIOUS ELEMENTS

	Different Words in 1,000	Prepositions in 1,000 Words	Verbs in 1,000 Words	Words per Paragraph	Words in 75 Sentences	Simple Sentences in 75	Uncommon Words	Adverbial Clauses in 75 Sentences	Nouns in 1,000 Words
Median reading score	.770	.518	.527	.518	.453	–.371	.674	.291	–.262
Different words in 1,000		.546	–.572	.516	.442	–.306	.692	.308	–.177
Prepositions in 1,000 words			–.777	.462	.398	–.134	.412	.131	.002
Verbs in 1,000 words				–.517	–.543	.285	–.431	–.192	.017
Words per paragraph					.706	–.503	.322	.565	–.356
Words in 75 sentences						–.741	.244	.818	–.399
Simple sentences in 75							.106	.674	.552
Uncommon words in 1,000								.074	.069
Adverbial clauses in 75 sentences									–.424

The elements which have a multiple correlation of .845 are as follows: number of different words occurring in a sampling of 1,000 (X_2), number of prepositions (including duplicates) occurring in 1,000-word sampling (X_3), number of words (including duplicates) in 1,000-word sampling not occurring in Thorndike's list (X_4), and of simple sentences in 75 sample sentences (X_5).

By making a count of these elements, any teacher can determine the grade placement of any book. The technique used is as follows:

1. Make a sampling of 1,000 words from the book as follows:

   a) Determine the number of pages in the book.

   b) Determine the number of words per line by counting the number of words in ten lines scattered through the book and dividing by 10.

   c) Divide 1,000 (the number of words needed) by the number of words per line. For example, if there are eight words per line, Item *c* will be 1,000 divided by 8, or 125, the number of pages from which sample

lines are to be chosen.

d) Divide the number of pages in the book (for example, 432) by the number of pages from which samples are to be chosen (for example, 125). In the example given, the quotient is 3.5. Therefore, the sample lines will be taken from every third page.

e) Copy on a separate card (cards cut 2 inches by 3 inches are a convenient size) every word from the top line (or any other given line) of every page to be sampled. Put a *p* in the corner of each card containing a word used as a preposition.

f) After copying the words from a given line on the number of pages estimated in *c*, count the cards. If there is not an even thousand, discard any excess, or add cards by copying words from additional lines until an exact thousand is reached.

g) Arrange the cards in strictly alphabetical order so that all duplicates of any given word come together. Eliminate all duplicate cards, writing the total number of such cards on the one card that remains. For example, if there are thirty cards containing the word "the," write the number 30 on one “the” card and discard the other cards containing this word.

2. Count the cards after the duplicates have been eliminated, thus obtaining the number of different words in 1,000. Call this number X_2.

3. Count the total number of prepositions in the 1,000 words. If the preposition "in," for example, occurs fifteen times, it should count as fifteen prepositions. Record the total number of prepositions as X_3.

4. Check each word card with Thorndike's word list. Count the total number of words, including duplicates, which do not count in Thorndike's list. In this connection it must be remembered that derived forms of words included in the Thorndike list are considered as being themselves included in the list. For example, the word "sing" occurs In the Thorndike list, The word "singing" would be counted as being included in the Thorndike list although it will not be found there in this form. Thorndike's introduction to his word list should be carefully read to determine which derived farms he has not included. Record the total number of words not included in Thorndike's list as X_4.

5. Make a sampling of seventy-five sentences from the book as follows:

a) Count the total number of pages in the book, excluding picture pages.

b) Divide the number of pages in the book by 75 to determine which pages must be chosen. For example, if there are 150 pages in the book, a sentence should be taken from every other page to make up the 75 needed sentences. If there are 250 pages in the book, a sentence should be taken from every third page.

c) Tabulate as simple or not simple the first complete sentence on every page to be sampled. A simple sentence is defined as one in which there are no dependent or co-ordinate clauses; it contains only one subject and one predicate.

6. Count the number of simple sentences in the 75 sentences sampled. Record this number as X_5.

7. Apply the following regression equation to the data, X_1 being the reading score, X_2, the number of different words in 1,000; X_3, the number of prepositions in 1,000 words; X_4, the number of uncommon words in 1,000, and X_5, the number of simple sentences in 75:

$$X_1 = .085X_2 + .101X_3 + .604X_4 - .411X_5 + 17.43$$

The answer to the equation score will be the score on the paragraph-meaning section of the Stanford Achievement Test necessary for reading the book measured. The reading score may be translated into reading grade according to Table III.

TABLE III

GRADE STANDARDS—PARAGRAPH-MEANING SECTION OF THE STANFORD ACHIEVEMENT TEST

Score	Grade
4–16	II
18–34	III
36–52	IV
54–62	V
64–70	VI
72–78	VII
80–86	VIII
88–94	IX
96–102	X
104–112	XI

Let us take *The Japanese Empire*[8] by Harry A. Franck as an example of the application of the equation.

Number of different words in 1,000 = 445

Number of prepositions in 1,000 words = 117

Number of uncommon words in 1,000 = 22

Number of simple sentences in 75 = 20

X_1 =(.085)(445) + (.101)(117) + (.604)(22) – (.411)(20) + 17.43

The reading score necessary for the ready comprehension of the book is 72.14. As can be seen from Table III, this book is suitable for children whose reading ability is that of the average child at the beginning of Grade VII.

Any book for use in the elementary grades may be similarly analyzed. It is therefore possible to determine the correct grade placement for any book so far as structural difficulty is concerned. When books are so graded and children's reading ability is measured, it is possible to give children books which fit their ability. Furthermore, in writing a book for children in a given grade, an author can check his writing by the regression equation and simplify it if necessary. For the latter purpose Table IV will be found helpful. This table gives the medians and upper and lower quartiles, grade by grade, for each of the four elements measured. If, through the use of the regression equation, the author finds that his material is too difficult for the grade in which it is to be used, he can compare the word and sentence counts with Table IV and see which elements need simplification.

[8] Harry A. Franck, *The Japanese Empire:* A Geographical Reader. Dansville, New York: F. A. Owen Publishing Co., 1927.

TABLE IV

STANDARDS FOR USE IN WRITING BOOKS FOR CHILDREN

	Grades					
	III	IVs	V	VI	VII	VIII
Number of different words in 1,000:						
Upper quartile	338	401	417	435.5	457.5	460.8
Median	316	377	407.5	416.5	440.5	458
Lower quartile	258	329	386	397.5	411	447
Number of prepositions in 1,000 words:						
Upper quartile	79	106	110	114	116	123
Median	71.3	96	100	107	99	115.5
Lower quartile	63	79	83	100	93	101
Number of uncommon words in 1,000:						
Upper quartile	8	14	20	24.5	34.5	40
Median	6	11	14.5	19.5	26	32.5
Lower quartile	2	6	12	17	18.5	28.5
Number of simple sentences in 75:						
Upper quartile	49	42.5	26	25	29	34
Median	39	30	21.5	19	22.5	26
Lower quartile	36	22	18	11	18	21.5

Since reading is the most basic of all school subjects and giving children material which is too difficult in structure tends toward wrong methods of visual perception, lack of interest, and faulty understanding and is responsible for many school failures, an objective method of measuring the structural difficulty of reading matter for children in the elementary grades is of primary

The present study deals only with structure. A similar study dealing with content is well under way.

The Early 1930s—New Directions for Readability

Waples and Tyler: What Adults Want to Read About

During the Depression in the ‘30s, adult education and the increased use of libraries stimulated studies in reading. Sociologists studied “who reads what and why over consecutive periods,” looking at reading as an aspect of mass communication.

In 1931, Douglas Waples and Ralph W. Tyler published *What People Want to Read About*, a comprehensive, two-year study of adult reading interests. Instead of using the traditional library circulation records to determine reading patterns, they interviewed people divided by sex and occupation into 107 different groups. It showed the types and styles of materials that people not only read but also want to read. It also studied what they did not read and why.

They found that the reading of many people is limited because of the lack of suitable material. Readers often like to expand their knowledge, but the reading materials in which they are interested are too difficult.

Ralph Ojemann: The Difficulty of Adult Materials

The year 1934 marked the beginning of more rigorous standards for the formulas. Ralph Ojemann did not invent a formula, but in 1934, he did invent a method of assessing the difficulty of materials for adult parent-education materials. His criterion was 16 passages of about 500 words taken from magazines. He was the first to use adults to establish the difficulty of his criterion. He assigned each passage the grade level of adult readers who were able to answer at least one-half of the multiple-choice questions about the passage.

Ojemann was then able to correlate six factors of vocabulary difficulty and eight factors of composition and sentence structure with the difficulty of the criterion passages. He found that the best vocabulary factor was the difficulty of words as stated in the Thorndike word list.

Even more important was the emphasis that Ojemann put on the qualitative factors such as abstractness. He recommended using his 16 passages for comparing and judging the difficulty of other texts, a method that is now known as **scaling** (See “Text leveling” below). Although he was not able to express the qualitative variables in numeric terms, he succeeded in proving they could not be ignored.

Dale and Tyler: Adults of Limited Reading Ability

After working with Waples, Ralph Tyler became interested in adults of limited reading ability. He joined with Edgar Dale to publish in 1934 their own readability formula and the first study on adult readability formulas. Dale had found problems with the Thorndike *Word Book* and started looking for better alternatives. The specific contribution of this study was the use of materials specifically designed for adults of limited reading ability.

Their criterion for developing the formula was 74 selections on personal health taken from magazines, newspapers, textbooks, and adaptations from children's health textbooks. They determined the difficulty of the passages with multiple-choice questions based on the texts given to adults of limited reading ability.

From the 29 factors that had been found significant for children's comprehension, they found ten that were significant for adults. They found that three of these factors correlated so highly with the other factors that they alone gave almost the same prediction as the combined ten. They were:

- Number of different technical words.
- Number of different hard non-technical words.
- Number of indeterminate clauses.

They combined these three factors into a formula to predict the proportion of adult readers of limited reading ability who would be able to understand the material. The formula correlated .511 with difficulty as measured by multiple-choice reading tests based on the 74 criterion selections.

The Ojemann and Dale-Tyler studies mark the beginning of work on adult formulas that would continue unabated until the present time.

Lyman Bryson: Books for the Average Reader

During the depression of the 1930's, the government in the U.S. put enormous resources into adult education. Bryson Lyman first became interested in non-fiction materials written for the average adult reader while serving as a leader in adult-education meetings in New York City. What he found was that what kept people from reading more was not lack of intelligence, but the lack of reading skills, a direct result of limited schooling.

He also found out there is a tendency to judge adults by the education their children receive and to assume the great bulk

of people have been through high school. At that time, 40 to 50 million people had a 7th to 9th grade education and reading ability.

Writers had assumed that readers had an equal education to their own or at least an equal reading ability. Highly educated people failed to realize just how much easier it is for them to read than it is for an average person. They found it difficult to recognize difficult writing because they read so well themselves.

Although college and business courses had long promoted ideas expressed in a direct and lucid style, Bryson found that simple and clear language was rare. He said such language results from "a discipline and artistry which few people who have ideas will take the trouble to achieve… If simple writing were easy, many of our problems would have been solved long ago" (Klare and Buck, p. 58).

Bryson helped set up the Readability Laboratory of the Columbia University Teachers College with Charles Beard and M. A. Cartwright. Bryson understood that people with enough motivation and time could read difficult material and improve their reading ability. Experience, however, showed him that most people do not do that.

Perhaps Bryson's greatest contribution was the influence he had on his two students, Irving Lorge and Rudolf Flesch.

—WHD

1931—Patty and Painter: The Vocabulary Burden

Introduction

In 1931, W. W. Patty and W. I. Painter discovered the year of highest vocabulary burden in high school is the sophomore year.

Believing that the length of a text affects the vocabulary burden, they questioned the Lively and Pressey method of sampling 1,000-word passages from a text,

They believed that taking a percentage of words from each text would give a better sample. The new method they devised took the words from the third line of each fifth page.

Their formula determined the relative difficulty of textbooks using a combination of frequency as determined by the Thorndike list and vocabulary diversity (the number of different words in a text).

—WHD

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A Technique for Measuring the Vocabulary Burden of Textbooks

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AMONG the important factors that should be considered when selecting textbook for high-school use is that of vocabulary burden. It seems evident that ease of reading and understanding the words of a textbook is an important index to its learning difficulty. A few studies have been made previously in this field.

LIMITATIONS OF SOME VOCABULARY STUDIES

Lively and Pressey[2] selected one thousand word units from each of fourteen different typos of reading material. These words were then assigned the values given in Thorndike's *Teachers' Word Book*[3] and comparison was made on the basis of total values for each type. Their method seems to be very effective for the comparison of the vocabulary difficulty of texts or of the vocabulary burden of units equal in length fails, however, to consider the extra burden imposed on the reader by additional length.

[1] Originally published in the Journal of Educational Research, 1931, Vol. 24, No. 2, pp. 127-134.

[2] Lively, Bertha A. and Pressey. S. L., "A Method for Measuring the Vocabulary Burden of Textbooks," *Educational Administration and Supervision,* IX (October, 1923), 389-98

[3] Thorndike's *The Teachers' Word Book* is an alphabetical list of ten thousand words which were found to occur most widely in a count of about 625,000 words from literature for children; about 8,000,000 words from the Bible and English classics; about 300,000 words from elementary school textbooks; about 50,000 words from books about cooking, sowing, farming, the trades, and the like; about 90,000 words from daily newspapers and about 500,000 words from correspondence. Forty-one different sources were used. A measure of the frequency of each word's occurrence is given by the credit-number following it. If this credit number is 49 or over, it means that the word is in the first 1,000 for importance. A credit-number of from 29 to 48 places it in the second 1,000. A credit-number from 19 to 28 places it in the third 1,000, and a credit-number o£ 14 to 18 places it in the fourth 1,000. A second column is given in the *Word Book* which indicates by number the thousand in which the first five thousand fall. It also indicates by the letters a and b whether the word is in the first or second half of that thousand.

Dolch[4] makes a very good point in working out a ratio between the number of different words to the number of total words in a book so as to take into consideration word repetition. He suggests that the book having the wider range of vocabulary is certain to possess a vocabulary farther from the region of everyday language. This is undoubtedly true in the majority of cases, but it would not seem to be necessarily an absolute fact.

Ward[5] took the total count of words in a section of a text and compared it with the Lively and Pressey method. He found a wider range of words in the total count and assumed that a thousand word count would not be a sufficient measure of any book. Since he has attempted to compare the results of two different techniques, it does not seem that he has proved his point. The average difficulty of words within samples would seem more desirable as a basis for comparing the vocabulary difficulty of one book with that of another than would the extreme ranges of words within the whole texts.

It is not to be expected that, in any sampling method, we will arrive at results which we can set up as a fixed standard. Instead, we should only expect to arrive at results on various texts, which, when compared, would bear the same ratio as would a comparison of burdens of the entire vocabularies of these texts.

A SUGGESTED TECHNIQUE

The following is suggested as a desirable technique for measuring the factor of vocabulary burden of high-school textbooks written in tie English language. This technique was developed and used in a research project at Indiana University, - in which all state-adopted texts for Indiana, with the exception of foreign language texts, were measured.

LENGTH OF TEXT MUST BE CONSIDERED

Word samples were taken from each of the texts studied. Since some of the books are considerably longer than others, it did not seem quite fair to compare their reading burden by selecting a definite unit of words from each book as a sample. The length of a book would undoubtedly affect the vocabulary burden of that book as compared with other books of different lengths. Where the difficulty of the average word is approxi-

[4] Dolch, Edward William. "Vocabulary Burden," *Journal of Educational Research,* XVII (March, 1928), 170.

[5] Ward, J. L. ”Measuring Vocabulary Burden,” *American School Board Journal*, LXXI, page 98.

mately equal, it, at least, is a greater task to read a long book than it is to read a short one. Also, by taking a definite unit, we would not take into consideration the proportional repetition of these words in any other unit similarly selected from the same text.

Thus, the different words in a one-thousand-word unit from a short text bear a lower ratio to the total one thousand than the different words in the entire text might bear to the total words in it. In other words, the longer the text the greater is the probability of its having a high percentage of word repetition. By taking a definite percent sample from each text, the ratio o£ different words to total words in the sample would be more nearly representative of the actual ratio of different words to total words in the entire book. It, therefore, seems that a proportionate word sample is the only valid sampling basis for comparing texts of unequal length and that the results so derived are more reliable than where a definite unit is used.

SELECTION OF THE SAMPLE

In order to get what was considered a fair proportionate word sample each book, the words from the third line of each fifth page were listed. If this were not a full line, the next full line was taken except in cases where the previous five pages were partly given over to pictures, graphs, diagrams, etc. If this piece of line seemed to be proportionately comparable to the amount of printed matter on those pages, it was used. When the fifth page was given over entirely to non-printed material, then the next printed page was sampled; the regular order, however, was resumed in taking the succeeding samples. These words were then tabulated alphabetically and their frequency numbered as they appeared in each sample. The number of words then in each list was the number of different words in each sample. This was called the range of the words.

USING THE TEACHERS' WORD BOOK

Each of these different words was then looked up in Thorndike's *Teachers' Word Book*. The values that Thorndike had estimated were set down opposite each word in column arrangement, as is shown in the sample following.

The figures in the column at the left indicate the frequency of the word as found in this word sample. The figures in the first column to the right indicate the word value or the Thorndike-index number. Where there are figures in the next column the first figure to the left represents the ranking of a thousand of the most common ten thousand words to which this particular word belongs; the letters *a* and *b* indicate whether it belongs to

the first or the second half of this thousand; and the number at the right, when such number is found in this column, indicates the quarter of that thousand into which the word falls.

SAMPLE PAGE OF WORD SAMPLE TABULATION

F.	Word	T.I.N.	Position of in thousand	W.V.
14	are	181	1a1	2534
1	accounts	63	1b	63
41	and	210	1a1	8610
61	a	208	1a1	12688
1	against	114	1a1	114
1	Archimedes	0		0
1	acetylene	0		0
19	as	204	1a1	2652
8	at	203	1a1	1624
2	atmosphere	11	5b	22
5	air	91	1a4	455
1	also	119	1a2	119
8	another	116	1a2	348
1	attached	20	3b	20
1	apparatus	7		7
2	arrange	35	2b	70
1	away	125	1a2	125
1	absorbed	8		8
1	aids	47	2a	47
1	along	99	1a3	99
1	animals	70	1b	70
1	act	70	1b	70

A WORD WEIGHTED VALUE

In the last column we find what we have termed a weighted value of each word. This weighted value is a product of the Thorndike-index-number and the frequency of the word in that particular sample. We might represent this by the following formula: W.V. = T.I.N. X F. In this formula, W.T. represents the weighted value; T.I.N., the Thorndike-index-number and F., the frequency. The purpose of calculating such a weighted value is to take care of word repetition within, the sample, permitting each word to be considered in proportion to the frequency of its use.

DIFFICULTY VARIES INVERSELY "WITH RECORDED VALUES

It must be borne in mind that Thorndike's index numbers were

based largely on the frequency of the use of the words included in his *Word Book;* the higher the value which he places on a word, the more commonly that word is used in everyday language. The lower values found throughout this study, then, indicate a greater difficulty, or a greater vocabulary burden; that is, the difficulty or burden varies inversely with the values recorded.

COMPARISON OF AVERAGE WORD DIFFICULTY

The next step undertaken was to calculate an average-word-weighted-value so that it would be possible to compare the average word difficulty of one book with that of another as accurately as this is possible by a sampling method. This was done by totaling the weighted values for all words of a sample and dividing the result by the total number of words in the sample. This might be represented by the formula: A.W.W.V. = T.W.V. ÷ T.W.S. In this formula, A.W.W.V. represents the average-word-related-value; T.W.V., the total weighted values; and T.W.S., the total words in the sample. It can be readily seen that this average-word-weighted-value is merely the arithmetic mean of the Thorndike-index-numbers for all - words of the sample.

INCLUSION OF THE RANGE OF THE WORDS

This average-word-weighted-value, however, does not seem to be quite a fair measure for the total burden of one book as compared with that of another, since it does not take into consideration the relation of the number of different words, or range, to the total number of words in the sample. We would riot know whether the A.W.W.Y. was the result of a few words used a number of times, or whether it was the result of a number of different words of about the same degree of difficulty used only a few times each. The reader will undoubtedly concede that the latter would he the greater burden, and that it would be especially noticeable in reading a long book of such proportionate range.

In order to take this range of words into consideration, an index number was found by dividing the average-word-weighted-value by the range of the words within the sample. This gives the ratio of the different words to the difficulty of the average word, as is shown in the following example:

Text	T.W.S	R.	T.W.V.	A.W.W.V.	I.N.
Book I	646	379	77.045	119.26	.315
Book II	1051	433	125.289	119.20	.275

In this example, T.W.S. equals total words in the sample; R. equals the range; T.W.V. equals the total weighted value; A.W.W.V. equals the average word weighted value; and I.N. equals the index number. It can be readily seen that, in the sample given, the A.W.W.V. is approximately equal in both books, but that Book II is considerably longer and has a larger range of words; consequently its reading burden would be heavier. By dividing our A.W.W.V.'s by their respective ranges we reduce these books, which have approximately an equal A.W.W.V., to index numbers which include not only the weighted of the words, but also the total words in the sample and the range of these words, varying inversely with the latter; that is, the larger the range the smaller is the index number, indicating a greater reading burden. We might develop this into a formula, as follows:

A.W.W.V. = T.W.V. ÷ T.W.S.

I.N. = (T.W.V. ÷ T.W.S.) ÷ R or

I.N. = (T.W.V. ÷ T.W.S.) × (1 ÷ R) or

I.N. = T.W.V. ÷ (T.W.S. × R)

This same process should give satisfactory results in all eases.

A 8UB-CLASSIFICATION OF THE SAMPLE •

Each sample list was next gone over, and the number of words found in each of the first three thousand was totaled, as well as was the number of those found between the third and tenth thousand, and of those which were not found at all in Thorndike's most common ten thousand words. The last group were called the zero value words, since there were no values listed for them. Each of these numbers was then divided by the total number of words in the sample in which it was found in order-to determine the percent which each was of the total. This can be used to compare the difficulty of the words in each book according to their distribution. It will also help to clarify the meaning of the index number which was first determined as well as to serve as a check on it

DETERMINING THE MOST DIFFICULT YEAR OF SCHOOL

Another phase of the procedure was the sending out of a questionnaire to one hundred commissioned high schools in the state of Indiana. These schools were selected by taking every eighth commissioned high school, regardless of size, from the Indiana state school directory. The apparent range was from the smallest to the largest commissioned high schools of the

state.

The final form of the questionnaire resolved itself into a check list containing the names of the forty-three different texts adopted by the state, and space for the of those used within the school and for checking the year or years of school in which each was used. Replies were received from seventy percent of the schools. A tabulation of the results gave us the frequencies of the use of each text in each year of high, school. By comparing this with our index number, as worked out in the first division of our procedure, we were able to find out in which year the texts having the greatest vocabulary burden were used.

SAMPLE OP TEXTBOOK CHECK LIST

		Year of H.S.			
		1	2	3	4
Our English					
Written and Spoken					
English Literature	Clippinger				
Outlines of English Lit.	Long				
Outlines of English Lit. readings	Long				
American Literature	Long				
Outlines of American Lit	Long				
Outline of American Lit. Readings	Long				
Early American History, Rev.	Webster				
Modern European History, Rev.	Webster				
Modern Times and Living Past	Elson				
History of the U.S.	Beard, etc.				
Government in the U.S.	Smith, etc.				
Elementary Principles of Chem.	Brownlee, etc.				
First Book in Chem., 1928 ed	Bradbury				
Chemistry and Its Uses	McPherson, etc.				
Beginners Chem. and Its Uses	Irwin, etc.				
Elem. Prin. of Physics	Fuller, etc.				
Elements of Physics	Millikan, etc.				
Essentials of Mod. Physics	Dull				
Physics in Everyday Life	Henderson				
Commerce and Industry	Smith				
High-School Geography	Whitbeck				
First Course in Algebra	Nyberg				
Second Course in Algebra	Nyberg				
Modern Plane Geometry	Clark, etc.				
Modern Solid Geometry	Clark, etc.				
Arithmetic of Business	Smith				
Applied Arithmetic	Smith				
Farm Projects and Problems	Davis				
Animal Husbandry	Harper				
Soils and Crops	Mosier				
Studies in Horticulture	Lloyd				
Engineering on the Farm	Stewart				
Practical Botany (Agri.)	Bergen				
Plant Life and Plant Uses	Coulter				
Elem. Studies in Botany	Coulter				
First Course in Botany	Pool, etc.				
Textbook in Botany	Allen, etc.				
Animal Studies	Jordan, etc.				
General Zoology	Linville, etc.				
Healthful Living	Williams				
Practical Zoology	Hegner				

Please be especially careful to check whether you are using the text or would use it, if you were not using an old adoption, and whether you are or would use it in years 1, 2, 3, or 4.

In order that we might more objectively compare the diffi-

culty of one year of high school with that of another, we worked out an average index number, or an arithmetic mean of the index numbers, of the total state adopted texts used in any one year. First, we multiplied the frequency that a text was used in each year by the index number for that text, deriving what we called a frequency-index-product for that text for each year used. The frequency-index-products for each year, as well as the frequencies of the use of state adopted texts in each year, were then totaled. Finally these four total-frequency-index-products were divided by the total of the frequencies for their respective years. The result was an average-index-number which indicated the average vocabulary burden for each year of high school. We might also work this out as a formula, as follows:

B.F. × I.N. equals F.I.P., in which B.F. represents the book frequency; I.N., the index number; and F.I.P., the frequency index product.

A.I.N. equals T.F.I.P. ÷ N. in which A.I.N. represents the average index number or the arithmetic mean of the index numbers; T.F.I.P., the total frequency index products; and N., the total number of book frequencies in each year.

It is recognized that the measurement of vocabulary burden of high-school textbooks is only one of several desirable devices for ascertaining their relative suitability for class use. The foregoing method is presented only as an apparent improvement in technique in one phase of measurement of the quality of the texts. Methods of equal or better quality should be developed for evaluating other features that affect the worth of books as aids to learning.

1935—Gray and Leary: What Makes a Book Readable

In 1935, William S. Gray and Bernice Leary published their landmark work in reading research, *What Makes a Book Readable*. Like Dale and Tyler's work, it attempted to discover what makes a book readable for adults of limited reading ability.

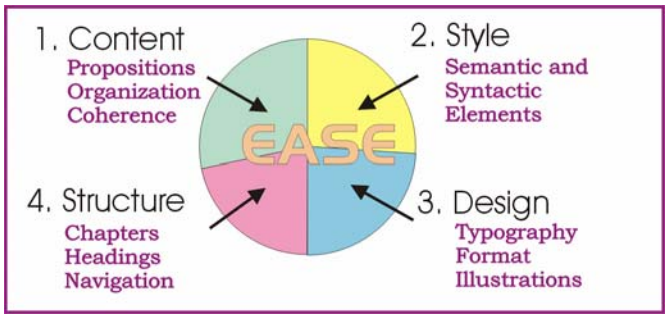
Their criterion included 48 selections of about 100 words each, half of them fiction, taken from the books, magazines, and newspapers most widely read by adults. They established the difficulty of these selections by a reading-comprehension test given to about 800 adults designed to test their ability to get the main idea of the passage.

No subsequent work has examined readability so thoroughly or investigated so many style elements or the relationships between them. The authors first identified 228 elements that affect readability and grouped them under these four headings:

1. Content
2. Style
3. Format
4. Features of Organization

The authors found that content, with a slight margin over style, was most important. Third in importance was format, and almost equal to it, "features of organization," referring to the chapters, sections, headings, and paragraphs that show the organization of ideas (See Table I on the next page).

They found they could not measure content, format, or organization statistically, though many would later try (See below, "The measurement of content"). While not ignoring the other three causes, Gray and Leary concentrated on 80 variables of style, 64 of which they could reliably count. They gave several tests to about a thousand people. Each test included several passages and questions to show how well the subjects understood them.



The four basic elements of reading ease.

TABLE I

SUMMARY OF JUDGMENT CONCERNING THE RELATIVE INFLUENCE ON READABILITY OF THE FOUR MAJOR CATEGORIES

Major Category	All Persons			Librarians			Publishers			Others Interested in Adult Education		
	M.	σ	Range	M.	σ	Range	M.	σ	Range	M.	σ	Range
I. Format	20.26	7.68	45–5	24.13	7.64	45–7	17.08	5.20	25–10	17.92	6.27	30–5
II. General Features of Organization	15.38	7.04	40–3	15.71	6.59	26–3	15.42	6.27	30–5	15.20	7.24	40–5
III. Style of Expression and Presentation	30.71	9.17	50–0	32.74	8.39	50–20	32.92	8.27	50–25	27.50	9.24	40–5
IV. Content	33.64	13.11	75–7	27.42	9.95	50–7	34.58	12.83	50–10	39.37	12.54	75–20

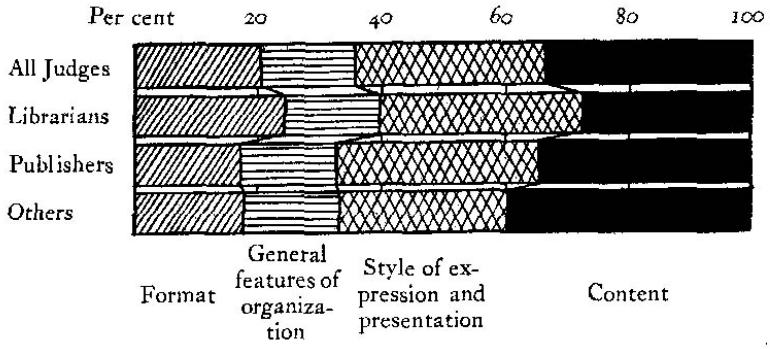


FIG. 1.—Opinion concerning the influence of classified factors on readability

The four major categories of readability (Gray and Leary, p. 31).

Having a measure, now, of the difficulty of each passage, they were able to see what style variables changed as the passage got harder. They used correlation coefficients to show those relationships.

Of the 64 countable variables related to reading difficulty, those with correlations of .35 or above were the following (p.115):

1. Average sentence length in words: -.52 (a negative correlation, that is, the longer the sentence the more difficult it is).
2. Percentage of easy words: .52 (the larger the number of easy words the easier the material).
3. Number of words not known to 90% of sixth-grade students: -.51
4. Number of “easy” words: .51
5. Number of different “hard” words: -.50
6. Minimum syllabic sentence length: -.49

7. Number of explicit sentences: .48
8. Number of first, second, and third-person pronouns: .48
9. Maximum syllabic sentence length, -.47
10. Average sentence length in syllables, -.47
11. Percentage of monosyllables: .43
12. Number of sentences per paragraph: .43
13. Percentage of different words not known to 90% of sixth-grade students: -.40
14. Number of simple sentences: .39
15. Percentage of different words: -.38
16. Percentage of polysyllables: -.38
17. Number of prepositional phrases: -35

Although none of the variables studied had a higher correlation than .52, the authors knew by combining variables, they could reach higher levels of correlation. Because combining variables that were tightly related to each other did not raise the correlation coefficient, they needed to find which elements were highly predictive but not related to each other.

Gray and Leary used five of the above variables, numbers 1, 5, 8, 15, and 17, to create a formula, which has a correlation of .645 with reading-difficulty scores. An important characteristic of readability formulas is that one that uses more variables may be only minutely more accurate but much more difficult to measure and apply. Later formulas that use fewer variables may have higher correlations.

Gray and Leary's work stimulated an enormous effort to find the perfect formula, using different combinations of the style variables. In 1954, Klare and Buck listed 25 formulas for children and another 14 for adult readers. By 1981, Klare noted there were over 200 published formulas.

Research eventually established that the two variables commonly used in readability formulas–a semantic (meaning) measure such as difficulty of vocabulary and a syntactic (sentence structure) measure such as average sentence length–are the best predictors of textual difficulty.

Some experts consider the number of morphemes for each 100 words to be a major contributor to semantic (meaning) difficulty and the number of Yngve word depths (branches) in each sentence to be a major contributor to syntactic (sentence) difficulty. One study (Coleman 1971) showed that Flesch's index of syllables for each 100 words correlates .95 with mor-

pheme counts. Another study (Bormuth 1966) found that the number of words in each sentence correlates .86 with counts of Yngve word depths. Measuring the average number of syllables per word and the number of words in each sentence is a much easier method and almost as accurate as measuring morphemes and word depths.

1944—The Lorge Readability Index

Introduction

Irving Lorge was interested in psychological studies of language and human learning. At Columbia University's Teachers College, he came under the influence of Lymon Bryson.

In 1938, Irving Lorge published *The Semantic Count of the 570 Commonest English Words*, a frequency count of the meaning of words rather than the words themselves. In 1944, he was co-author of E. L. Thorndike's last book, *The Teacher's Word Book of 30,000 Words*.

Lorge wanted a simpler formula for predicting the difficulty of children's books in terms of grade scores.

In a 1939 article, "Predicting Reading Difficulty of Selections for Children,"[1] he demonstrated that new combinations of variables gave predictions of higher accuracy than the Gray-Leary formula. Lorge again established that "vocabulary load is the most important concomitant of difficulty."

In 1944, Lorge published his new Lorge Index in the *Teachers College Record* in an article entitled, "Predicting Readability," reprinted here. In 1948, Lorge[2] published corrections to his formula, which are given here in the footnote on p. 56.

Though created for children's reading, Lorge's Index was soon widely used for adult material as well. Where Gray and Leary's formula had five elements, Lorge's had these three, setting a trend for simplifying the formulas that was to follow:

- Average sentence length in words
- Number of prepositional phrases per 100 words
- Number of hard words not on the Dale list of 769 easy words.

Lorge's use of the McCall-Crabbs *Standard Test Lessons in Reading* as a criterion of difficulty greatly simplified the problem of matching readers to texts. Although these passages were far from ideal, they remained the standard criteria for readability studies until the studies published by John Bormuth of the University of Chicago in 1969.

During and after World War II, the government bureaus and the Armed Services of the U.S. searched for efficient ways of

[1] Lorge, I. 1939. "Predicting Reading Difficulty of Selections for Children." *The Elementary English Review*. Vol. 16, 229-233.
[2] Lorge, I. 1948. "The Lorge and Flesch Readability Formulae: A Correction." *School and Society*, Vol. 67, pp. 141-142.

assessing the readability of their materials. Lorge's formula was one of the best available, and it came into wide use.

Lorge's work established the principles for the readability research that would follow and set the stage for the Dale-Chall and Flesch Reading Ease formulae, which were introduced in 1948.
—WHD

TEACHERS COLLEGE RECORD

Vol. XLV March, 1944

Predicting Readability

IRVING LORGE[1]

Associate Professor Of Education, Teachers College

WHAT a person understands of the material he reads depends upon his general reading ability and the readability of the text he is reading.. His reading ability, moreover, depends upon his intelligence, education, environment, and .upon his interest and purpose in reading. The readability of a text depends upon the kind and number of ideas it expresses, the vocabulary and its style, and upon format and typography.[1]

Reading .comprehension must be viewed as the interaction between reading ability and readability. Reading ability can usually be estimated by a. person's success with an adequate reading test. Readability, however, must be measured in terms of the success that large numbers of persons have in comprehending the text. In measuring the readability of-texts, the material is presented-to a random sample of persons whose reading, ability is known.-The readability of the text is assigned the average reading ability score of the sample. In assigning the average reading ability score as an estimate of the readability of a text, one must assume, of course, that the variations in people's interests and purposes in-reading are balanced.

THE CRITERION OF READABILITY

Research in readability originated in the desire to grade textbooks and other materials for use in the elementary grades. Subsequently, the research activities were extended not only to demonstrate the lack of adequate reading materials for adults, but also to suggest how more adequate materials might be prepared. The research in readability became a search for a relationship between structural elements of the text and some measure of success with that text by large groups of readers. The literature of readability is concerned with the criterion for readability as well as with predictors of readability. In terms of the definition of readability, the criterion must be a measure of success that a large number of readers would have with the text. Such a criterion may be obtained by judgment or by more objective methods of appraisal. The method of judgment utilizes ratings of estimated difficulty of texts. Recently, Flesch,2 using the method of judgment, assumed that the text in. magazines like The American Scholar, Foreign Affairs, and The Yale Review, was more difficult (less comprehensible to a random sampling of readers) than the text in magazines' like True Confessions, Modern Screen, and. Romantic Story.

Therefore, on the assumption that magazines are written on different levels of readability, he assigned criterion level scores to groups of magazines. More objective measures of readability, however, have been used, Vogel and Washburne's criterion for the readability of a book was the average paragraph meaning score on the Stanford Achievement Test of children who had read and liked that book. Gray and

[1] Originally published as "Predicting Readability" in the *Teachers College Record,* Vol. 45, 404-419, March 1944—W.H.D.

[2] Studies referred to in this article, together with other pertinent references, are listed in the Bibliography, page 59.

Leary used the criterion of the average reading comprehension test score of a group of adults as an estimate of readability.

Variables Used To Predict Readability

The variables used to predict readability are aspects of the text, e.g., vocabulary load, sentence structure and style, and interest. One or more measures of vocabulary load is used as a predictor in every study of readability. The more usual measures are the following:

(*a*) Number of running words.
(*b*) Percentage of different words.
(*c*) Percentage of different infrequent, uncommon, or hard words,
(*d*) Percentage of polysyllabic words.
(*e*) Some weighted measure of vocabulary difficulty.
(*f*) Vocabulary diversity (related to b).
(*g*) Number of abstract words.
(*h*) Number of affixed morphemes (prefixes, inflectional endings, etc.).

Most studies also predict readability on the basis of one or more measures of sentence structure or style, e.g.,

(i) Percentage of prepositional phrases.
(j) Percentage of indeterminate clauses.
(k) Number of simple sentences.
(l) Average sentence length.

Less frequently, the prediction of readability is based on some measure of human interest, e.g.

(m) Number of personal pronouns.
(n) Number of words expressing human interest.
(o) Percentage of colorful words.
(p) Number of words representing fundamental life experiences.
(q) Number of words usually learned early in life (related to b).

Essentially, the prediction of readability requires calculation by means of an empirical formula relating specific variables of readability to the criterion for readability. Vogel and Washburne developed their equation predicting the average grade level equivalent of the paragraph meaning score of those children who read and *liked* specified books from four predictors: percentage of different uncommon words, number of prepositional phrases, and the relative number of simple sentences.[3]

Gray and Leary, after relating more than forty different predictors to their criterion, empirically chose five variables to predict readability: the number of different words, the percentage of uncommon words, the relative number of personal pronouns, the relative number of prepositional phrases, and the average sentence length.[4]

Gray and Leary's predicted readability score was a number which was transmuted into, a letter representing areas of difficulty of readability from A (very easy) to E (very difficult): Lorge, basing his work on that of Gray and Leary, tried to obtain a prediction in terms of grade level of reading. The sample of materials chosen for analysis was the 376 passages in the four books of McCall and Crabbs' *Standard Test Lessons in Reading.* The criterion was the grade level score, equivalent for a group of readers who would get half of the test questions right on each passage. The predictors studied by Lorge were the five used: by Gray and Leary: a weighted score for-vocabulary based on Thorndike's 20,000 word list, and four elements used by' Morriss and Holversen (percentage of elemental words, percentage of simple localisms, percentage of concrete word-labels, and percentage of abstract word-labels). Later, Flesch's two factors, (affixed morphemes and human interest) were also used.[5]

[3] The multiple correlations between the criterion and the weighted composite of the predictors was .845. Subsequently, Washburne and Vogel reported a multiple correlation of .869 on the basis of certain modifications.

[4] The multiple correlations between the five predictors and the criterion used by Gray and Leary was .644.

[5] The multiple correlations were obtained predicting the criterion from various combinations of these factors. Empirically, the best prediction using the fewest factors was obtained with three factors (also used by Gray and Leary): the average sentence length, the relative number of prepositional phrases, and the relative number of different words not com-

The simple three-factor prediction equation of Lorge's was modified by the addition of a constant to give an estimate of the grade level score equivalent to passing three-quarters of the questions on a given passage. The formula is given on the, work sheet. (see page 56) for computing the readability index. A reasonably good prediction of readability can be obtained by using a weighted composite of vocabulary and sentence structure. Of these, the most important is some measure of vocabulary load. It should be recognized, however, that such elements as the number of abstract words, the number of uncommon words, the number of polysyllabic words, and the weighted index of .difficulty of vocabulary are all intercorrelated. Any one of them could be used in place of any other, provided suitable adjustment were made in the empirical formula. Certainly some aspect of vocabulary load must be used as a predictor.

Structural elements of the passage provide the second most important basis for estimating the readability of text. As in measures of vocabulary, most measures of sentence structure are interrelated, so that little additional information is yielded by several measures of sentence structure.

Lorge's formula, as described in the following pages, uses as predictors the factor of uncommon words (vocabulary) and the factors of average sentence length, and the relative number of prepositional phrases (sentence structure.)

Formula For Judging Readability

The Lorge formula, therefore, is a means .of judging the relative difficulty or readability of either read or spoken passages. Readability is based upon the comprehension of passages by school children. Comprehension is judged by the correctness and completeness of responses to questions about a passage. Such questions usually deal with specific details, general import, appreciation, knowledge of vocabulary, and understanding of concepts.

It is obvious that the purpose of the reader in reading and the kinds of questions asked in estimating reading comprehension will influence greatly the estimate of reading difficulty. Since the Lorge formula is based on a criterion derived from responses to questions of the five types listed above, it tends to overestimate the difficulty of passages to be read primarily for appreciation or for general import and to underestimate the difficulty of passages to be read primarily for specific details or for following directions. Nevertheless, the formula provides an overall estimate which should be useful in grading reading materials. As an estimate, it should not be considered definitive nor used blindly.

As developed in the work sheet, the readability index is an estimate of the reading grade at which the average school child will be able to answer with adequate completeness and correctness about three-fourths of the questions concerning detail, appreciation, import, vocabulary, and concept. The reading grade so obtained may be thought of in terms of reading grade scores on a test of reading comprehension. A readability index of 5.2 for a passage may be considered indicative of the material of the fifth grade; it may be thought in terms of placemen of the material as within the reading comprehension of average fifth grade children. Such placement, however, should consider the interest of pupils, the suitability of subject matter, and other factors. The readability index is an estimate and not a rigorous determination.

The Lorge formula, in addition to its use in estimating the reading difficulty of passages for children, may be used to advantage in estimating the difficulty of silent and oral passages for adults. It yields a readability index which places materials in relative order; that is, a reading passage with an index of 7.1, etc. Moreover, the suitability of texts for adults can

mon to Dale's list of 769 words. The multiple correlation coefficient between the average grade score on the Thorndike-McCall Reading Test and the three predictors was .77. Adding as predictors the weighted index for word frequency and/or the four factors of Morriss and Holversen, separately or in combination, and/or the two factors of Flesch, separately or in combination, did not increase the multiple correlation significantly.

be interpreted in terms of the reading grade scores of adults on acceptable reading tests.

Teachers of adults, or indeed, any person choosing tests for specific audiences, might give a reading test to a sample of adults to determine the average reading grade score (as well as the range of such scores). They then could choose texts within the demonstrated range of comprehension of such adults.

THE READABILITY INDEX

The Lorge Readability Index, in addition to its utility in grading text materials, may also be used for passage: simplification. If the text for children is, let us say, designed for grade level 6.0 and on the basis of the formula has a reading index of 7.6, then the text may be revised by simplifying sentence structure, by substituting simple sentences for prepositional phrases, and by an adequate choice of vocabulary. Since vocabulary is the most important factor in passage difficulty, care must be taken to indicate the meaning of more difficult words by definition, example, or context. Choice of vocabulary, furthermore, may-be controlled by use of *The Teacher's Word Book of 30,000 Words,* a new word book compiled by Thorndike and Lorge, in which every word is given a value according to .relative frequency in the English language. The value of AA indicates words that occurred a hundred or more times per million words; the value of A indicates words that occurred from fifty to ninety-nine times per million words; the values 49, 48, 47, etc., indicate the number of times the word occurred-per million words, In selecting vocabularies for the revision of texts, a safe rule is to utilize, in addition to the information given by the index, these values recommended by Thorndike and. Lorge.

In actual practice, the formula has proved, to be very serviceable in the simplification of texts for adult use, The grade placement of the text may be compared with the average highest grade reached by adults for whom it is designed. The median highest grade reached, for adults, twenty years and over is reported by the Bureau of the Census for the year 1940. For the adult population "20 years old and over" the median highest grade (number of years of school completed) was 8.8. In writing for such an average population, it may safely be assumed that the reading ability as measured by grade score on a reading test will be somewhat lower, let us say, about eight-tenths of a school year. Hence, in writing for a population with an assumed grade level score or a reading rest score of 8.0, steps should be taken to select vocabulary, simplify sentence structure, and reduce the number of prepositional phrases. Again, *The Teacher's Word. Book of 30,00 Words* should be of considerable help, since it gives separate evaluation for vocabularies found in adult magazines, e.g., *Saturday Evening Post, Ladies' Home Journal, Woman's Home Companion*, *True Story,* and *Reader's Digest.*

COMPUTING THE READABILITY INDEX

The following are directions for computing the readability index.

A. Selecting the sample:

1. Short passages of 100 words or less.

   When a short passage is to be appraised, it is advisable to analyze the entire passage.

2. Longer passages.

   When longer passages are to be appraised, it is advisable to analyze samples of the material. Select a sample near the beginning, another sample, near the middle, and another sample near the end of the passage. Each of these samples should be approximately one hundred words in length.

   A good procedure might be to number the lines of text serially and then count the number of words per line (about ten lines) to get an estimate of the number of words. For instance, a passage has 141 lines; ten lines chosen at random have 11, 12, 13, 13, 12, 12, 12, 12, 16, and 16 words, or an average of 13

words to the line. The passage thus has approximately 1,833 words. A sample of 100 words would then be approximately eight lines in length. The three samples could be chosen in a variety of ways: e.g., beginning at or near line 3 through line 11; at or near line 53 through line 61; and at or near line 103 through line 111. In this way, a sample is chosen in each third of the passage.

It should be noted, moreover, that each sample should start with the beginning of a sentence and should stop at the end of a sentence. When, the samples have been located with beginning and end points, the remainder of the analysis can be made.

3. Books

When books are to be appraised, it would be advisable to analyze samples of the book, say, from 5 per cent to 10 per cent of the book (but never less than five samples). These samples should be chosen throughout the book. For instance, a book has 92 pages of text with an average of 195 words per page. This indicates an approximate wordage of 18,000 words. A 5 per cent sample would be 900 words; a 10 per cent sample would be 1,800 words. For the 5 per cent sample this would require approximately five pages; for the 10 per cent sample, approximately nine pages. Thus every eighteenth page should be chosen for the 5 per cent sample; every tenth page, for the 10 per cent sample. Thus the sample might be pages 3, 21, 39, 57, 75 in the one instance; or 4, 14, 24, 34, 44, 54, 64, 74, 84 in the other. Of course, a sample must start with the beginning of a sentence and stop at the end of a sentence.

B. Labeling the work sheet.

1. Fill out the information about the title, author, edition, publisher, and date, of publication (latest copyright year listed).
2. Carefully identify the location of the sample, thus: “p. 14, line 2, The answer...p. 14 line 26, ever after.”

C. Counting the number of words.

1. Begin with the beginning of the sample and count (or number serially) each word in the sample. Observe the following rules:
   (a) Hyphenated words are counted as one word. When in doubt about uncommon hyphenations, follow Webster’s Unabridged Dictionary (2nd edition); if listed in dictionary as hyphenated, count as one word; if not listed, count as two words.
   (b) Words separated at the end of a line to the beginning of the next line are counted as one word.
   (c) Numbers are counted as words, e.g., in “January 3, 1940” 3 is counted as one word and interpreted as the word *three*, 1940 is counted as one word and interpreted as *nineteen-forty.*
   (d) Compound words like place names or persons’ names are counted as one word, e.g., New York, United States, van Loon, Santa Claus, St. Nicholas.
   (e) Contractions are counted as one word; e.g., don’t, he’s, they’ll, they’d, etc., are each counted as one word.
2. Record the count under Basic Data, number 1.

D. Counting the number of sentences.

1. Begin at the beginning of the sample and count the number of complete sentences.
2. Record the count under Basic Data, number 2.

E. Counting Prepositional Phrases.

1. Count each prepositional phrase in the sample. Observe the following rules:

(f) A phrase is made up of a preposition and a noun, or a preposition and a pronoun, or a preposition and a gerund, e.g., to the house (noun), for him (pronoun), in skating (gerund).

(g) Some common prepositions are:

about	from
above	in
across	inside
after	into
along	of
among	off
at	on
before	onto
behind	outside
below	till
beneath	to
beside	under
beyond	up
by	upon
during	with
except	within
for	without

(*h*) Less common prepositions are: despite (the opinion), concerning (the idea), notwithstanding (the opposition).

(*i*) Infinitive phrases are *not* to be counted. An infinitive phrase is made up of the word *to* and a verb, e.g., to swim, to sing, to answer.

(*j*) If a preposition word is followed by a clause, it is a conjunction, and hence is *not* counted, e.g., "*After* the storm had passed" is *not* counted.

2. Record the count under Basic Data, number 3.

F. Counting hard words.

1. Use the Dale list[6] to cross out in the sample every word on the Dale list, regardless of its meaning.[7] The list is given on pages 56 to 59.

2. Since the count is the number of different hard words, each hard word is counted only once. For instance, if in the passage *reliability* occurred three times, it still would be counted only once.

Observe the following rules:

(*k*) Nouns.

Separate counts are not made of plurals and possessives in *s,* plurals in *es*, or plurals in which y is replaced by *ies*: e.g., *boys*, *churches*, *berries* are counted with *boy*, *church*, *berry*; however, *knife* and *knives*, *goose* and *geese*, *man* and *men* are all counted as different words.

(*l*) Special cases.

An *s* added to a word in the text not forming a plural or possessive forms a different word from the root form: e.g., *Robert* and *Roberts* are two different words.

Proper nouns which seem to be composed of root and derived forms are not tabulated with the root form: e.g., *Wheeling*, the proper name is not counted with *wheel*. *Browning*, the proper name, is not counted with *brown*. Nouns formed by adding *r* or *er* to the other nouns or to verbs are not counted with the original word: e.g., *own* and *owner* are two different words.

(*m*) Adverbs.

Separate counts are not made of adverbs formed by adding *ly*: e.g.,

[6] The list is reproduced by permission of the author, Dr. Edgar Dale.

[7] That is, *spring*, meaning season, jump, water, or steel coil, is counted as one word.

badly, *sadly* are counted with *bad*, *sad*.

Adverbs formed from an adjective ending in *e*, as *gently* from *gentle*, t*ruly* from *true*, are counted as different words.

(*n*) Adjectives

Separate counts are not made of adjectives formed by adding *n* to proper nouns: e.g., *Austrian*, *Bavarian* are counted with *Austria*, *Bavaria*.

(*o*) Special cases.

An adjective formed by adding *ly* to a noun is counted as a different word from the noun: e.g., *home* and *homely* are two different words.

(*p*) Comparatives and superlatives of adjectives and adverbs.

Special counts are not made of comparatives and superlatives formed by adding *er* or *r* and *est* or by changing *y* to *ier* and *iest*: e.g., *longer*, *prettier*, *bravest* are counted with *long*, *pretty*, *brave*.

(*q*) Special cases.

The rule apples to adjectives doubling the final consonant and adding *er* and *est*: e.g., *red*, *redder*, *reddest* are counted as one word.

(*r*) Verbs.

Special counts are not made of verb forms ending in *ing* and in *s, d, ed*, or of forms changing *y* to *ies* and *ied* or of past participles formed by adding *n*: e.g., *plays*, *playing*, *played* are counted with *play*.

(*s*) Special cases.

Verb forms which drop the final *e* and add *ing* are counted with the root form: e.g., *pace* and *pacing* are counted as one word.

Verb forms which double the final consonant and add *ing* or *ed* are counted as one word: e.g., *drip, dripped*, and *dripping* are counted as one word.

Past participles formed by adding *en* to a verb are counted as different from the verb: e.g., *eat* and *eaten* are two different words.

(*t*) Hyphenated words.

In case of uncommon hyphenated words, follow Webster's Unabridged Dictionary (2nd edition). Any hyphenated word is considered as one word if it is listed thus in the dictionary; otherwise it is counted as two words.

(*u*) Compound words.

Compound names of persons or places, like *New York*, *United States, St. Louis, Santa Claus,* and *Van Dyke*, count as single words.

(*v*) Contractions

Count contractions as different words from those from which they are derived: e.g., *because* and *'cause* are two different words. *He's* is not counted with *he* or with *is*.

(*w*) Words which may be both common and proper.

In the case of words which may be both common and proper nouns, count the proper noun as being the same word as the common: e.g., *Jack* and *jack* are the same word.

(*x*) Miscellaneous special cases.

Words formed by adding *y* to a word in the list are counted as different from the root word: e.g., *snow* and *snowy* are different words. *German* and *Germany* are different words.

Words of different spelling listed in the dictionary as one word are counted as the same word: e.g., *honor* and *honour* are the same word. *Frankfort* and *Frankfurt* are the same word.

If a word is formed by adding two or more suffixes to a listed word, one of which when added to the listed word is counted with it, that word is different from the root word: e.g., *happen* and *happening* are the same word but *happenings* is a different word. *Excite* and *excited* are the same word, but *excitedly* is a different word.

Words formed by adding *en* are counted as different from the original word: e.g., *wool* and *woolen* are two different words, *bit* and *bitten* are two different words.

3. Record the count under Basic Data, number 4.

G. Proceed to computation. Watch decimal points carefully. Check all computations.

H. Record on the work sheet the index (R. I.) to one decimal place.

I Make sure that the analyst, computer, and checker have signed the record blank and dated their entries.

J. If a book or a long passage has had several samples selected from it, the average of the R. I.'s is the rating for the passage of the book.

The Dale list of easy words is made up of words which are common to Thorndike's first thousand most frequent English words and the first thousand most frequent words known by children entering the first grade. It is a list of words that are likely to be known by all children and adults. The Dale list, therefore, can be used to estimate ease of vocabulary; or, if the easy words are eliminated, an estimate of vocabulary difficulty can be made.

The passage chosen to illustrate the mechanics of estimating the readability index is the first revision of the Gettysburg Address.

LINCOLN'S GETTYSBURG ADDRESS

Four score and seven years ago our fathers brought forth on this continent a new nation, conceived in Liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives, that that nation might live. It is altogether fitting and proper that we should do this. But, in a larger sense, we cannot dedicate—we cannot consecrate—we cannot hallow—this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work which they who fought here, have thus far, so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they here gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain—that this nation, under God, shall have a new birth of freedom—and that, government of the people, by the people, for the people, shall not perish from the earth.

The usual procedure is to cross out all words on the Dale list, to encircle all prepositions, then to list the words not on the Dale list. An example of the listing of the hard words is given on the next page.

ILLUSTRATION OF LISTING OF HARD WORDS

A	altogether	add	advanced				3
B	battlefield	birth					2
C	continent	conceived /	created	civil	cannot //	consecrate /	6
D	dedicated /////	detract	devotion /				3
E	equal	engaged	endure				3
F	forth	final	fought	freedom			4
G	government						1
H	hallow	honored					2
I	increased						1
J							
K							
L	Liberty						1
M							
N	nation ////	nobly					2
O							
P	proposition	portion	proper	power	perish		5
Q							
R	remaining	resolve					2
S	score	sense	struggled				3
T	testing	thus	task				3
U	unfinished						1
V	vain						1
WXYZ							
							43

After the number of sentences has been counted, the work sheet may be completed as shown on page 56.

The Lorge, Readability Index was developed after an analysis of the relationship between the score of readability for each of 376 passages and three internal measures of vocabulary and sentence structure. The resulting formula predicts .readability well.

Teachers will find the directions for applying the formula simple and direct. The time required to analyze a passage is relatively short. Teachers will find that the expenditure of time and effort in grading materials is easily justified in terms of the increased understanding of, and the possible reduction of, difficulties in communication.

The meaning of the index is simply the school grade at which the passage can be understood. The index, therefore, can be used to place texts and other books in appropriate grades: further, it should indicate ways in which passages may be rewritten to be appropriately placed for designated readers.

FORMULA FOR ESTIMATING GRADE PLACEMENT OF READING MATERIAL

WORK SHEET

Title of article: Gettysburg Address Edition: first revision
Name of author: Abraham Lincoln
Publisher: Date of Publication: Nov. 19, 1863
Location of sample in text: Complete R. I. = 6.5

BASIC DATA

1. The number of words in the sample 269
2. The number of sentences in the sample 10
3. The number of prepositional phrases in the sample 26
4. The number of hard words in the sample 43

COMPUTATION[28]

Item 6, average sentence length:	Divide	1 by 2 = 26.90 x .07 = 1.8830
Item 8, ratio of propositional phrases:	Divide	3 by 1 = .0967 x 13.01 = 1.2581
Item 9, ratio of hard words:	Divide	4 by 1 = .1599 x 10.73 = 1.7151
		Constant = 1.6126
	Add 6, 8, 9, and C	
		Readability Index: 6.4694

NOTES

lives, n. called easy
Last sentence, although long, is broken up by adequate punctuation

Name of Analyst: I. D. L Date of analysis: Nov 23, 1943
Name of Computer: I. D. L. Date of computing: Nov. 23, 1943
Name of checker: J. C.

THE DALE LIST OF 769 EASY WORDS

A	along	around	bear	best	bone
a	already	as	beat	better	book
about	also	ask	beautiful	between	born
above	always	at	because	big	both
across	am	away	bed	bill	bottom
act	American		bee	bird	bow
afraid	an	B	been	bit	box
after	and	baby	before	black	boy
afternoon	animal	back	began	bless	branch
again	another	bad	begin	blind	brave
against	answer	bag	behind	blood	bread
ago	any	ball	being	blow	break
air	anything	band	believe	blue	breakfast
all	apple	bank	bell	board	bridge
almost	are	basket	belong	boat	bright
alone	arm	be	beside	body	bring

[28] 1948 Lorge corrections: In Item 6, change " x .07" to " x .06"
In Item 8, change " x 13.01" to " x .10"
In Item 9, change " x 10.37" to " x .10".
and for the Constant, change " = 1.6126" to " = 1.99" —WHD

broken
brother
brought
brown
building
built
burn
busy
but
butter
buy
by

C

cake
call
came
can
cap
captain
car
care
careful
carry
case
catch
cause
center
chair
chance
change
chief
child
children
choose
Christmas
church
circle
city
class
clean
clear
clock
close
cloth
clothes
cloud
coal
coat
cold
color
coming
company
cook
cool
corn
corner
cost
could
count
country
course
cover
cow
cried
cross
crowd
crown
cry
cap
cut

D

dance
day
dead
dear
deep
did
die
different
dinner
do
doctor
does
dog
done
don't
door
double
down
draw
dream
dress
drink
drive
drop
dry

E

each
ear
early
earth
east
easy
eat
edge
egg
eight
either
else
end
England
English
enough
even
evening
ever
every
everything
expect
eye

F

face
fair
fall
family
fancy
far
farm
farmer
fast
fat
father
feed
feel
feet
fell
fellow
felt
fence
few
field
fill
find
fine
finger
finish
fire
first
fish
fit
five
fix
floor
flower
fly
follow
food
foot
for
forget
fourth
found
four
fresh
from
front
fruit
full

G

game
garden
gate
gave
get
gift
girl
give
glad
glass
go
God
going
gold
golden
gone
good
got
grass
gray
great
green
grew
ground
grow
guess

H

had
hair
half
hall
hand
hang
happy
hard
has
hat
have
he
head
heard
heart
heavy
help
her
here
herself
hide
high
hill
him
himself
his
hold
hole
home
hope
horse
hot
house
how
hundred
hunt
hurry

I

I
ice
if
in
Indian
instead
into
iron
is
it
its

J

jump
just

K

keep
kept
kill
kind
king
knee
knew
know

L

lady
laid
lake
land
large
last
late
laugh
lay
lead
learn
leave
left
leg
lesson

let
letter
lie
lift
light
like
line
lion
lips
listen
little
live
lead
long
look
lost
lot
loud
love
low

M

made
mail
make
man
many
march
mark
market
matter
may
me
mean
measure
meat
meet
men
met
middle
might
mile
milk
mill
mind
mine
minute
miss
money
month
moon
more
morning
most
mother
mountain
mouth
move
Mr.
Mrs.
much
music
must
my
myself

N

name
near
neck
need
neighbor
neither
nest
never
new
New York
next
nice
night
nine
no
noise
none
noon
nor
north
nose
not
note
nothing
now
number

O

oak
ocean
of
off
office
often
old
on
once
one
only
open
or
other
out
out
outside
over
own

P

page
paint
pair
paper
part
party
pass
path
pay
pen
people
pick
picture
piece
place
plain
plan
play
please
point
poor
post
pound
present
press
pretty
pul
put

Q

quarter
queen
quick
quiet
quite

R

race
rain
ran
rather
reach
read
ready
real
reason
red
remember
rest
rich
ride
right
ring
river
road
rock
roll
roof
room
rose
round
row
run

S

said
sail
salt
same
sand
sat
save
saw
say
school
sea
season
seat
second
see
seed
seem
seen
self
sell
send
sent
serve
set
seven
several
shake
shall
shape
she
sheep
shine
ship
shoe
shop
short
should
shoulder
show
shut
sick
side
sign
silk
silver
sing
sir
sister
sit
six
size
skin
sky
sleep
slow
small
smile
smoke
snow
so
soft
sold
soldier
some
something
sometime
song
soon
sound
south
space
speak
spot
spread
spring
square
stand
star
start
station
stay
step
stick
still
stone
stood
stop
store
storm
story
straight
street
strike
strong
such
sugar
suit
summer
sun
suppose
sure
surprise
sweet

T

table
tail
take
talk
tall
taste
teach
teacher

tear	three	try	walk	wheel	without
tell	through	turn	wall	when	women
ten	throw	twelve	want	where	wonder
than	tie	twenty	war	whether	would
thank	till	two	warn	which	word
that	time		was	while	work
the	tire (d)	U	wash	white	world
their	to	uncle	waste	who	would
them	today	under	watch	whole	write
then	together	until	water	whom	wrong
there	told	up	wave	whose	
these	tomorrow	upon	way	why	
they	tongue	us	we	wide	Y
thick	too	use	wear	wild	yard
thin	took		weather	will	year
thing	top	V	week	win	yellow
think	touch	valley	well	wind	yes
this	town	very	went	window	yesterday
those	trade	visit	were	wing	yet
though	train		west	winter	you
thought	tree	W	what	wish	young
thousand	true	wait	wheat	with	your

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1948—The Dale-Chall Readability Formula

Introduction

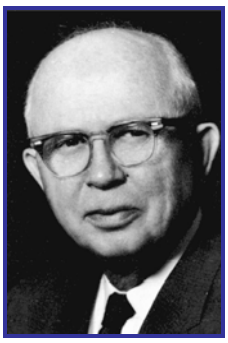
The Dale-Chall readability formula arrived at the end of a national research effort that began in the 1920s and that eventually resulted in over a thousand published studies on the readability formulas.

In the beginning, the purpose was to develop reading materials for first-generation immigrants coming into high school.

This research intensified in the Second World War as the U.S. war effort focused on the need for clear and expressive writing. After the war, scholars harvested those hard-won lessons, and they gave us a new set of readability formulas for creating written materials for adults with limited reading ability.

The formulas created at that time, including the Dale-Chall formula, the Flesch Reading Ease formula, and the Gunning Fog Index, have remained the workhorses of many sectors of commerce, education, the military, and government.

Of all the readability formulas, the Dale-Chall formula has consistently been the most reliable. It has a correlation coefficient of .92 with comprehension as measured by reading tests. Most of the readability formulas use a word variable and a sentence-length variable, Unlike most other modern formulas, the Dale-Chall formula uses a list of 3,000 easy words. Using the formula requires counting the number of "hard" words—those not on the list. Doing this manually becomes easy with practice. There are also a few computer programs available online that apply the formula for you.



Edgar Dale, a leading figure in communications, stressed the importance of vocabulary in assessing readability

For 25 years a professor of education at Ohio State University, **Edgar Dale** was a respected authority on communications. He worked his whole life to improve the readability of books, pamphlets, and newsletters—the stuff of everyday reading.

Dale was one of the first critics of the Thorndike vocabulary lists. He claimed it failed to measure the familiarity of words accurately. He subsequently developed new lists that were later used in readability formulas. Of major importance was *The Living Word Vocabulary: A National Vocabulary Inventory*, which he wrote with Joseph O'Rourke. This work, published by the publishers of *World Book Encyclopedi*a in 1981, lists the grade levels of 40,000 words.

In 1948, Dale published the formula he developed with **Jeanne Chall**. She later was the founder and director for 20 years of the Harvard Reading Laboratory. She also led the

Jeanne S. Chall created the Harvard Reading Lab and directed it for 20 years.

battle for teaching early reading systematically with phonics. Her 1967 book *Learning to Read: The Great Debate*, brought research to the forefront of the debate. For many years, she also was the reading consultant for TV's *Sesame Street* and *The Electric Company.*

Dale and Chall introduced their readability formula in two in two issues of the *Educational Research Bulletin*. They included this simple disclaimer, "We do not claim the formula developed here is definitive. The nature of the multiple-correlation coefficient makes this point rather obvious. We do believe, however, that it is a short cut in judging the difficulty of written materials."

Millions of readers, young and old, throughout the world have benefited immensely from the work of Edgar Dale and Jeanne S. Chall. No small measure of these benefits has resulted from the use of their easy-to-use and reliable readability formula.

—WHD

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A Formula for Predicting Readability

By EDGAR DALE and JEANNE S.CHALL

SEVERAL months ago the editor of the Wall Street Journal ran a full-page advertisement, in one of the leading literary magazines, announcing two honors recently awarded to it. One of these honors was a statement made by Robert P. Gunning that the Wall Street Journal had "the most readable front page in the country." [1]

How did Mr. Gunning come to this conclusion? Did he actually sample a cross section of the readers, have them read the front pages of leading, newspapers, and then compare their ability to read and understand the various front pages? No. He used an accepted short cut. He predicted the reading difficulty of the various front pages by using a readability formula and found that the Wall Street Journal was the "most readable."

This recognition by leading journalists that readability is an important selling point for their newspapers is an event that is still quite new on the publishing horizon. Although some objective techniques for measuring readability have been known for at least twenty-five years, they have been neatly buried in educational and psychological journals, doctoral dissertations, Masters' theses, and the like. If the techniques were used at all, they were confined to children's textbooks. What has taken the dust off the technical journals and made readability a household word in the writing and publishing field?

As in the rise in popularity of any technique, there was a critical need for this one. The war period made us realize more than ever the importance of reaching large audiences. More, people had to fill out tax forms; more people had to be appealed to to buy war bonds; more people had to co-operate in numerous activities to help win the war. Because a larger audience had to be reached, the writers had to use a style that could be understood by more persons than the usual book readers. They could no longer afford to hit or miss with printed materials.

[1] Originally published January 21, 1948 in *Educational Research Bulletin*, Vol. 27, No. 1, pp. 11-20, 28.

Along with the growing need for more scientific means of verbal communication, there was a growing fund of practical objective measurement of readability. The Lorge formula was one of the first easy-to-apply readability formulas.[2] By the use of this formula we could predict in a fairly short time how difficult a piece of written material was to read and understand. It was no longer necessary to guess. By counting the relative number of different uncommon words, the average sentence length, and the relative number of prepositional phrases, we could get a good index of readability in terms of grade scores.

In 1943 Rudolf Flesch produced his readability formula.3 He presented a very convincing argument for the superiority of his formula over the previous ones, especially for use with materials for adult readers. With numerous correlation tables he showed that the Lorge formula, in its use of the Dale List of 769 Easy Words as a measure of vocabulary difficulty, failed to discriminate satisfactorily between materials that were above the eighth-grade level in difficulty. Since the average adult has approximately eighth- or ninth-grade reading ability, he thought that another technique was needed to predict the readability of materials for adult readers. In his formula, Mr. Flesch used three factors: average sentence length, relative number of affixed morphemes (prefixes, suffixes, inflectional endings) and relative number of personal references.

When the Flesch formula was first released, we were evaluating the educational materials published by the National Tuberculosis Association. It was our job to analyze the pamphlets already published and to find ways of writing them so that they could be understood by the average adult. We used the Flesch formula to help us evaluate the reading difficulty of the pamphlets.

On the whole, we found the formula adequate. However, we also found some shortcomings. The most serious shortcoming was the count of affixes, which we found to be rather arbitrary, in the sense that two people making a count on the same sample would usually come out with a different number of affixes. If we were extremely careful and consulted a dictionary to be certain that all affixes were included and that no non-affixes were included, we found that the work was too time-

[2] Lorge, Irving. "Predicting Reading Difficulty of Selections for Children," *Elementary English Review,* XVI (October, 1939), pp. 229-33, and "Predicting Readability," *Teachers College Record*, XL (March, 1944), pp. 404-19.

[3] Flesch, Rudolf. *Marks of a Readable Style*. New York: Teachers College, Columbia University, 1943. (Teachers College, Columbia University, Contributions to Education, No. 897).

consuming.

Mr. Flesch's reasons for using affixes as a count of difficulty are very well stated, with statistical evidence, in both his books.[4] His logic was that word recognition, although an important factor in reading for beginning or poor readers, is of practically no importance for more mature readers. For the better readers, it is the relationship between the words and abstractness of the words that contribute to difficulty. He actually computed the affixes (as a measure of verbal relationship) and the abstract words contained in five levels of magazines and found that both of these factors were a good measure of difficulty. He dropped the count of abstract words in his formula because the magazine experiment "had shown that the count of affixes was a practically equivalent measure of abstractness (r = .7849) and the latter method was far less cumbersome."[5] In fact, in another section of his book, he refers to the count of affixes as "a simple short cut to the count of abstractions."[6]

If Mr. Flesch used a correlation of .7849 to justify his calling the affixes a "simple short cut to the count of abstractions," could we not also call the Dale List of 769 Easy Words a short cut to the count of abstractions, since Mr. Lorge found a high correlation between affixed morphemes and words outside this list? Or could we not argue that Mr. Flesch's count of affixes is just another way of counting hard words?

In his article, "Predicting Readability," Mr. Lorge makes the following statement about measuring vocabulary load:

> It should he recognized that such elements as the number of abstract words, the number of uncommon words, the number of polysyllabic words, find the weighted index of difficulty of vocabulary are all inter-correlated. Any one of them could be used in place of any other, provided suitable adjustments were made in the empirical formula.[7]

If all counts of vocabulary load, whether abstract words, affixed morphemes, or number, of uncommon words, are interrelated, why use a less exact and more cumbersome method when a simpler one can be used?

From the evidence given, we believed that there was value in using a word list to measure vocabulary load. Mr. Flesch's main objection to the use of the Dale list of 769 words was that it did not differentiate between the higher levels of difficulty. What would happen if a larger word list were

[4] Flesch, op. cit. and *The Art of Plain Talk* (New York: Harper and Brothers, 1946),
[5] Flesch, *Marks of Readable Style*, p. 32.
[6] Ibid., p. 24.
[7] Lorge, *loc. cit.*, 406.

used?

Such a list would not be a discriminating instrument at the easy levels of writing since it would contain words not known to some of the readers. But by using a list which included most of the words well known to fourth-grade readers, a more discriminating instrument would be devised for the upper levels of reading ability.

The second shortcoming of the Flesch formula was the count of personal references. In our numerous analyses we found that the personal-reference count was not a reliable index of difficulty. For example, when we speak of *John* and *Mary* and *he* and *she*, referring to John and Mary, there is a justification for subtracting from difficulty. This is because in writing about John and Mary we usually say things that are not abstract or general. However, subtracting from difficulty for personal references such as *R. J. Thomas* of the automobile industry, or *Senator Austin*, when we are writing about atomic energy or the United Nations, does seem to us a bit inaccurate. If the reader does not know these persons, the difficulty of the written material is not decreased. In fact, these individuals are no longer personal, they are abstractions. Flooding printed materials with personal references to these "abstract" persons will add little to "human interest" and ease of comprehension.

A recent article in the *American Psychologist* by S. S. Stevens and Geraldine Stone reported that Koffka's *Principles of Gestalt Psychology* had predicted a Flesch score much lower than had been expected. In fact, it came out only a little higher than the elementary textbooks in psychology. It was startling news for them. They wrote:

The Harvard graduate students don't believe it, because they read Koffka and sweat.

Now how can Koffka, the students' choice for unreadability, score so low? Opinion around Harvard seems divided on this question, but this opinion is based on mere casual introspection, not on the result of careful analysis. A few things appear evident, however. For one thing, Koffka helps his score by peppering his passages with personal pronouns: 5.8 per hundred words. But his "I," "we," and "you" are rhetorical devices—he is actually very rarely talking about us or about himself. He is talking about abstractions and complicated relations and *he* and *we* get into it as mere guinea pigs in an experiment.[8]

Here is the sample they quote from Koffka:

[8] *American Psychologist,* II (July, 1947), p. 233.

In the first cases, real moving objects present in the field, the shift of the retinal pattern leads to the behavioral motion of objects, whether I fixate a non-moving object or follow a moving one with my regard; in the second case, when my eyes roam over stationary objects, such a shift will *not* have this result. Although the two facts belong closely together, the second one will be fully discussed in Chapter IX, after we have introduced the ego. Here we concentrate mainly on the first, even if we cannot entirely avoid referring to the second. Thus we turn now to the theory of perceived motion.[9]

This passage has 7 personal references per hundred words. According to Flesch's Quick Reference Chart,[10] a similar number of personal references characterizes materials that in difficulty are standard and are comparable to digest magazines.

IN VIEW of the shortcomings of the Flesch counts of affixes and personal references, we undertook to find a more efficient means of predicting readability. Our hypotheses were:

First, a larger word list would predict as well as, if not better than, the count of affixes. It would avoid the pitfalls of lack of discrimination at the upper levels of difficulty.

Second, a count of personal references does not add very much to the prediction of readability.

Third, a shorter, more efficient formula could be evolved with the use of a word factor and a factor of sentence structure.

For our sample passages, we used the McCall-Crabbs *Standard Test Lessons in Reading*,[11] the same passages used by Mr. Lorge and Mr. Flesch. These are a series of 376 passages of children's readings, already graded in difficulty on the basis of comprehensibility of questions at the end of each passage. This material, it should be noted, has serious deficiencies as a criterion, but it is the best we have at the present time. The writers, however, checked their findings against other passages as noted later. Following these authors, our criterion was the grade-level score equivalent for a group of readers who would get half of the test questions right on each passage. Mr. Lorge made his data-sheets available to us.[12] These data sheets also included the Flesch counts of affixed morphemes and personal references.

[9] Koffka, K., *Principles of Gestalt Psychology*. New York: Harcourt, Brace and Company, 1935. p. 280.

[10] Flesch, The Art of Plain Talk, p. 205.

[11] McCall, W. A., and Crabbs, Lelah. New York: Bureau of Publications, Teachers College, Columbia University, 1926.

[12] The authors wish to thank Mr. Lorge for making the data sheets available and for permission to publish the intercorrelations of his factors.

Our word count was based on the Dale list of approximately three thousand words. This list was constructed several years ago by testing fourth-graders on their knowledge in reading of a list of approximately ten thousand words. This larger list included the most common words in the Thorndike,[13] Buckingham and Dolch,[14] and other word lists. Words such as *milkman, carrot, candlestick, catbird,* and so on, which appeared in the high thousands, on the Thorndike list, were also tested with fourth-graders to see whether they knew them. An attempt was made to include all words that fourth-graders would possibly know. A word was considered as known when at least 80 per cent of the fourth-graders checked it as known.

This list differs from the Thorndike-word lists in that it is a measure of familiarity in reading rather than a measure of frequency of appearance in printed materials. Words such as *bracelet, watermelon,* and *cabbage*, appearing in the high thousands in the Thorndike lists, are included in the Dale three thousand list. In that respect it is less artificial than the Thorndike lists. No claim is made that all the words actually known in reading by at least 8o per cent of fourth-graders are on this list. Some may have been left out. The testing method used is crude. But it does present a fairly complete list of familiar and simple words.

WE WENT through the 376 passages in Books II to V of the McCall-Crabbs test lessons. In each passage, we counted the relative number of words not on the Dale list of 3,600 words.[15]

We punched this information on Hollerith cards, along with the information made available by Mr. Lorge. The intercorrelations appear in Table I.[16]

From Table I the reader can see that the highest correlation with the criterion is the relative number of words outside the Dale list of 3,000 words. The correlation is .6833. The two next highest factors are the Lorge hard-word count (based on the Dale list of 769 words) and the Flesch affixed-morphemes count. The intercorrelations among these three factors are high; between the Dale score and the Flesch morphemes, .7932; between the Dale score and the Lorge hard-word count,

[13] Thorndike, Edward L. *A Teacher's Word Book of Twenty Thousand Words*. New York: Teachers College, Columbia University, 1931.

[14] Buckingham, B. R., and Dolch, E. W. *A Combined Word List.* Boston: Ginn and Company,1936

[15] The specific instructions for counting will be included in the instructions which will appear in next month's issue.

[16] We wish to thank Mr. Flesch for permission to use his factors and to publish the intercorrelations of his factors, and Harold A. Edgerton for invaluable statistical help.

.7988. This table corroborates Mr. Lorge's findings that a measure of vocabulary load is the most important factor in reading difficulty, and that all the measures of vocabulary are highly intercorrelated.

TABLE I

Intercorrelations between Four Style elements and grade Score of a Pupil Who Answered One-Half of the Questions on McCall and Crabbs

	Dale Score (3,000 List)	Flesch Affixed Morphemes	Flesch Personal References	Lorge Hard Words (Dale 769)	Criterion C_{50}	Mean	Standard Deviation
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average sentence length	.5108	.4428	–.2201	.4913	.4681 *	16.8037	5.3813
Dale score (words outside 3,000 list)	.....	.7932	–.4033	.7988	.6833	8.1011	6.3056
Flesch affixed morphemes†	.....	.....	–.3254	.7441	.6017	25.2819	11.0668
Flesch personal references†	.....	.....	.....	–.3422	–.3675	7.8245	5.5439
Lorge hard words (outside Dale 769 list)	.....	.....	.....	.....	.6148	17.4165	7.1659
Criterion (C_{50})	.....	.....	.....	.....	.....	5.7492	1.6565

* The correlation coefficient reported here between the average sentence length and the criterion is much lower than the one reported by Mr. Lorge and later by Mr. Flesch. They reported a correlation coefficient of .6174. We checked this with Mr. Lorge. He went over his data and found that an error had been made in the computation. He is publishing the correlation in an article which will appear in *School and Society*, February 21, 1948.

† The intercorrelations of the two Flesch factors here reported are slightly different from t hose presented by Flesch in *Marks of Readable Style.* These differences are not significant and were probably caused by our using gross scores on Hollerith cards while Flesch used grouped data for his correlations.

The next highest measure of difficulty is average sentence length—which correlates .4681 with the criterion.

After making several combinations of factors, we found that the following two, plus a constant, gave the most efficient empirical formula:

$$X_{C_{50}} = .1579X_1 + .0496X_2 + 3.6365$$

When:

$X_{C_{50}}$ = reading-grade score of a pupil who could answer one-half of the test questions correctly

X_1 = Dale score (relative number of words outside Dale list of 3000 words)

X_2 = average sentence length

3.6365 = constant

The multiple-correlation coefficient of these two factors with the criterion is .70. Adding the factor of human interest (personal reference) of Mr. Flesch raises the multiple-correlation coefficient to .7025, an insignificant increase.

Because of the correction in the sentence-length factor, we recomputed the multiple-correlation coefficients on the Lorge and Flesch formulas. The corrected Lorge formula also has a multiple correlation of .66. We see that the one factor, words outside the Dale list of 3.000 words, alone, has a greater prediction than the three-factor Flesch and Lorge formulas.

DOES this new two-factor work in predicting the difficulty of reading materials other than the McCall-Crabbs reading passages? We conducted several experiments comparing the formula predictions with the judgments of experienced teachers, the judgment of readability "experts," and the actual comprehension scores of readers on passages.

On fifty-five passages of health-education materials, we found that our two-factor formula predictions correlated .92 with the judgments of readability experts, and .90 with the reading grades of children and adults who were able to answer at least three questions out of four on thirty of these passages. They ranged from the extremely easy to the very difficult.

On 78 passages on foreign affairs from current-events magazines, government pamphlets, and newspapers, the correlation between the predictions of the formula and judgments of difficulty by expert teachers in the social studies was .90.

As a result of these various experiments, we set up the following table of estimated corrected grade levels:

Formula Score	Corrected Grade Levels
4.9 and below	Grade 4 and below
5.0 to 5.9	Grades 5-6
6.0 to 6.9	Grades 7-8
7.0 to 7.9	Grades 9-10
8.0 to 8.9	Grades 11-12
9.0 to 9.9	Grades 13-15 (college)
10 and above	Grades 16 and above (college graduate)

The formula developed by the writers is a simple, two-factor formula that is easy to apply. With the use of a factor of vocabulary load (relative number of words outside the Dale list of 3,000 words) and a factor of sentence structure (average sentence length), we have a good prediction of readability. The additional validation on health and social-studies materials shows that it compares favorably with judgments of experts and with actual reader comprehension.

The corrected grade levels help interpret the scores obtained by the formula and give a more usable means of placing materials within the comprehension of the various grades. For example, a given piece of material having a formula score of 5.2 (corrected grade level of Grades V-VI) should be within the comprehension of children who have fifth-to sixth-grade reading abilities. By this we mean that these children will be able to answer approximately one-half to three-fourths of the questions asked on the material, concerning specific details, general import, appreciation, knowledge of vocabulary, and so on.

For adults, the corrected grade levels may be interpreted to mean the number of years of schooling required to read the material with ease and understanding. For example, if an article or book has a formula score of 6.3 (corrected grade level of Grades VII-VIII), it would be within the comprehension of the average adult who has had about eight and one-half years of schooling.

WE DO not claim that the formula developed here is definitive. The nature of the multiple-correlation coefficient makes this point rather obvious. We do believe, however, that it is a short cut in judging the difficulty of written materials.

The formula can also be used as an aid to text simplification. When a text has an undesirably high score according to the prediction of the formula, it may be simplified by substituting more concrete, familiar words for the unfamiliar and abstract words. Perhaps sentences can be shortened and made clearer. Writing should not be any harder to read and understand because the ideas are hard and complicated. It may be impossible to simplify this type of writing. On the other hand, a good deal of writing is hard because the words used are unnecessarily abstract and the sentence and paragraph structure needlessly complex. A later article will discuss these problems. But we must be cautious about “writing for a readability formula.” We must remember at all times that a formula is a statistical device. It means that, on the whole, longer sentences

make comprehension more difficult. This does not mean that all long sentences are hard to read and understand. There are some very short sentences that may be harder to comprehend than longer ones. The same holds true for the use of familiar words. On the whole, the more unfamiliar the words used, the harder the material will be to understand. But sometimes familiar words are used in a symbolic or metaphoric sense. “To be or not to be” is not an easy idea although the sentence is short and the separate words used would usually be called simple and familiar ones. Readability formulas are not sensitive to such subtle variations in meaning.

Furthermore, the nature of the difficulty of a given piece of writing depends to a great extent upon what we expect a reader to get out of the material. If we ask difficult questions on a passage, even if the passage is fairly simple, the reader may not be able to answer the questions asked and therefore will not understand it by our set criterion.

The reader’s purpose in reading and his interest and background in the subject-matter must also be considered by anyone using a readability formula. To say that a given article on chemistry is comfortable reading for average adults because it has a predicted grade level of VII-VIII, is giving an incomplete picture. For those readers who have no interest or no background in chemistry, the article will probably not be comfortable reading and they may get very little meaning from it. For others who are interested in chemistry and do considerable reading in the subject, the same article will probably be most comfortable reading. This difference in ease of reading and comprehension may exist even though both groups of readers have completed approximately eight and one-half years of schooling and have the same general reading ability on a standardized reading test.

Taking account of differences in background is especially important in writing and selecting materials for persons who have a specialized understanding of the field. Thus, in material written for farmers, the inclusion of such words as *barley, flax, hybrid, husk, fertilizer, mulch* will increase the predicted grade level of the material. But if these words are in the common vocabulary of the farmer, they may not offer any special difficulty in comprehension. This factor, therefore, must be taken into account in dealing with materials having a specialized vocabulary. Thus the direction, “Hand me that Stillson,” is perfectly clear to any mechanic but not very meaningful to the layman.

Keeping these cautions in mind, we have found that this formula can be a useful tool in selecting and preparing reading

materials that can be understood by specified audiences.

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A Formula for Predicting Readability: Instructions

By EDGAR DALE AND JEANNE S. CHALL[1]

AN ARTICLE in the January issue of the EDUCATIONAL RESEARCH BULLETIN discussed the way in which a formula for testing the grade-level difficulty of reading materials was developed.[2] The limitations of the formula, the circumstances under which it is properly applied, and specific examples for its use were given. This article, a continuation of the one just mentioned, gives specific information concerning the technique of using the formula.

The formula is based on two counts—average sentence length and percentage of unfamiliar words (words outside the Dale list of 3000 words). Rules for selecting samples of a text to be analyzed and for computing the average sentence length and percentage of unfamiliar words are presented in this article. As each count is made, it is recorded on a work sheet[3] where detailed steps are given for arriving at the grade-level of reading difficulty. To illustrate the mechanics of using the formula, we analyzed three samples from a pamphlet, Your Baby.[4] The various counts and computations are given in the work sheet. The directions to guide the various steps in filling out the work sheet follow.

I. Selecting Samples:

Take approximately 100 words about every tenth page for books.[5] For articles, select about four l00-word samples per 2,000 words. Space these samples evenly. For passages of about 200 to 300 words, analyze the entire passage. Never begin or end a sample in the middle of a sen-

[1] Originally published February 17, 1948 in *Educational Research Bulletin*, Vol. 17, No. 2, 37-54.—WHD

[2] Dale, Edgar, and Chall, Jeanne S. *"A Formula for Predicting Readability,"* Educational Research Bulletin, XXVII (January 21, 1948), pp. 11-20, 28.

[3] See page 43 of this issue. Mimeographed copies of the work sheet may be obtained from Edgar Dale, Bureau of Educational Research, Ohio State University.

[4] See pages 42 and 44.

[5] When a more exact grading of books is desired, aoo-word samples every tenth page will probably give a more reliable measure. See Leifeste, Bertha V., "An Investigation of the Reliability of the Sampling of Reading Material," Journal of Educational Research, XXXVII (February, 1944), pp. 441-50.

tence.

II. Labeling-Work Sheet:

Enter such information as title, author, publisher, date of publication, etc., regarding the sample to be appraised.

III. Counting the Number of Words:

A. Count the total number of words in the sample.

B. Count hyphenated words and contractions as one word.

C. Count numbers as words.

10 is one word.

1947 is one word.

D. Count compound names of persons and places as one word.

St. John, Van Buren, *del Rio, Le Brun*, and so on are each counted as one word.

E. Do not count initials which are part of a name as separate words.

J*ohn F.W. St. John* is counted as two words-—John and F.W. St. John.

F. Record the number of words under No. 1 of the work sheet.

IV. Counting; the Number of Sentences

A. Count the number of complete sentences in the sample.

B. Record this under No. 2 of the work sheet.

V. Counting the Number of Unfamiliar Words:

Words which do not appear on the Dale list[6] are considered unfamiliar. Underline all unfamiliar words, even if they appear more than once.

In making this count, special rules are necessary for common and proper nouns, verbs, and other parts of speech. These are given in the section which follows.

A. Common Nouns:

1. Consider familiar all regular plurals and possessives of words on the list.

boy's is familiar because boy is on the list (possessive).

[6] See the Dale list on pages 25-34

girls is familiar because girl is .on the list (plural by adding s). churches is familiar because church is on the list (plural by adding es).

armies is familiar because army is on the list (plural by changing y to ies).

2. Count irregular plurals as unfamiliar, even if the singular form appears on the list.

   oxen is unfamiliar, although *ox* is on the list.

   Several irregular plurals, however, are listed in the word list. When the plural appears as a separate word, or is indicated by the ending in parentheses next to the word, it is considered familiar.

   goose-and *geese* both appear on the list and are both considered familiar.

3. Count as unfamiliar a noun that is formed by adding *er* or r to a noun or verb appearing on the word list (unless this *er* or *r* form is indicated on the list).

   *burn*er is counted as unfamiliar, although burn is on the list.' owner is considered familiar because it appears on the list, as follows—own(er).

B. Proper Nouns:

1. Names of persons and places are considered familiar.

Japan, Smith, and so on, are familiar, even though they do not appear on the word list.

2. Names of organizations, laws, documents, titles of books, movies, and so on generally comprise several words.

   a. When determining the number of words in a sample, count all the words in the name of an organization, law, and the like. *Chicago Building Association* should be counted three words.

      Declaration of Independence should be counted three words.

   b. For the unfamiliar word count, consider unfamiliar only words which do not appear on the Dale list, except names of persons or places.

      SPECIAL RULE: When the title of an organization, law, and so on is used several times within a sample of 100 words, all the words in

the title are counted, no matter how many times they are repeated.

*Chicago Build*ing *Association* is counted one unfamiliar word — *Association. Building* and *Chicago* are familiar. *Declaration of Independence* is counted as two unfamiliar words — of is on the list.

SPECIAL RULE: When the name of an organization, law, document, and so on is used several times within a sample of 100 words, count it only twice when making the unfamiliar word count.

Security Council, if repeated more than twice within a 100-word sample, is counted as four unfamiliar words.

3. Abbreviations:

   a. In counting the words in a sample, an abbreviation is counted as one word. Y.M.C.A. is counted one word.

      Nov. is counted one word. *U.S.* is considered one word. *A.M.* and *P.M.* are each counted as one word.

   b. In making the unfamiliar word count, an abbreviation is counted as one unfamiliar word only. *Y.M.C.A.* is considered one unfamiliar word. *Nov.* is considered familiar because the names of the months are on the word list. *U.S.* is considered familiar. *A.M.* and *P.M.* are each considered familiar.

      SPECIAL RULE: An. abbreviation which is used several times within a 100-word sample is counted as two unfamiliar words only.

      C.I.O. repeated five times in a 100-word sample is counted two unfamiliar words.

C. Verbs:

1. Consider familiar the third-person, singular forms (*s* or *ies* from *y*), present-participle forms (*ing*), past-participle forms (*n*), and past-tense forms (*ed* or *ted* from *y*), when these are added to verbs appearing on the list. The same rule applies when a consonant is doubled before adding *ing* or *ed.*

   asks, asking, asked are considered familiar, although only the word ask appears on the word list.

dropped and *dropping* are familiar because drop is on the list.

D. Adjectives:

1. Comparatives and superlatives of adjectives appearing on the list are considered familiar. The same rule applies if the consonant is doubled before adding *er* or *est*.

   longer, *prettier*, and *bravest* are familiar because *long, pretty*, and *brave* are on the list. *red, redder, reddest* are all familiar.

2. Adjectives formed by adding n to a proper noun are familiar. For example, *American, Austrian.*

3. Count as unfamiliar an adjective that is formed by adding *y* to a word that appears on the list. But consider the word familiar if it appears in parentheses following the word.

woolly is unfamiliar although *wool* is on the list.

sandy is familiar because it appears on the list, as *sand (y),*

E. Adverbs:

1. Consider adverbs familiar which are formed by adding *ly* to a word on the list. In most cases *ly* will be indicated following the word.

   soundly is familiar because *sound* is on the list.

2. Count as unfamiliar words which add more than *ly*, like *easily*.

F. Hyphenated Words:

Count hyphenated words as unfamiliar if either word in the compound does not appear on the word list. When both appear on the list, the word is familiar.

G. Miscellaneous Special Cases:

1. Words formed by adding *en* to a word on the list (unless the en is listed. in parentheses o£ the word itself appears on the list) are considered unfamiliar.

   sharpen is considered unfamiliar although *sharp* is on the list.

   golden is considered familiar because it appears on the list, *gold* {*en*)•

2. Count a word unfamiliar if two or more endings

are added to a word on the list.

clippings is considered unfamiliar, although *clip* is on the list.

3. Words on the list to which *-tion, -ation, -ment,* and other suffixes not previously mentioned are added are considered unfamiliar, unless the word with the ending is included on the list.

   treatment is unfamiliar although *treat* is on the list. *protection* is unfamiliar although *protect* is on the list. *preparation* is unfamiliar although *prepare* is on the list.

4. Numbers:

   Numerals like *1947, 18,* and so on, are considered familiar.

H. Record the total number of unfamiliar words, under No. 3 of the work sheet.

The number of words in the sample (No. 1 on the work sheet) have now been recorded, as well as the number of sentences in the sample (No. 2) and the number of words not on the Dale list (No. 3). The next steps can be followed easily on the work sheet.

VI. Completing the Work Sheet:

1. The average sentence length (No. 4) is computed by dividing the number of words in the sample by the number of sentences in the sample.
2. The Dale score or percentage of words outside the Dale list is computed by dividing the number of words not on the Dale list by the number of words in the sample, and multiplying by 100.
3. Follow through Steps 6 and 7 on the work sheet.[7]
4. Add Nos. 6, 7, and 8 to get the formula raw score.
5. If you have more than one sample to analyze, get an average of the formula raw scores by adding all of these and dividing by the number of samples.
6. Convert the average formula raw score to a corrected grade-level according to the Correction Table given in Table I.

The corrected grade-level indicates the grade at which a book or article can be read with understanding. For example, a

[7] Copies of the table of multiplications may be obtained from Edgar Dale, Bureau of Educational Research, Ohio State University.

book with a corrected grade-level of 7-8 is one which should be within the reading ability of average children in Grades VII and VIII. For adults, the 7-8 grade-level can be compared to the last grade reached. If materials are being selected for persons who have had an average of eight grades of schooling, passages with a corrected grade-level of 7-8 should be within their ability. The corrected grade-levels corresponding to the raw scores obtained from the formula are given in Table I. These will serve to determine the grade-level of materials being appraised with the use of the Dale list.

The population reports of the Bureau of Census are a good source for determining the educational levels of large groups of adults. Statistics on the last grade reached are given in tables headed "Persons 25 Years Old by Years of School Completed," in the 1940 Population, Volume II, *Characteristics of the Population.* Part I contains the statistics for the states, cities, and counties. These are further broken down by sex, race, native and foreign born, urban and rural.

TABLE I

CORRECTION TABLE

Formula Raw Score	Corrected Grade-Levels
4.9 and below	4-th grade and below
5.0 to 5.9	5-6th grade
6.0 to 6.9	7-8th grade
7.0 to 7.9	9-10th grade
8.0 to 8.9	11-12th grade
9.0 to 9.9	13-15th grade (college)
10.0 and above	16-(college graduate)

AN illustration of the mechanics of using the formula is given in this part of this article. The following three samples were chosen from a 15-page pamphlet, *Your Baby,* published by the National Tuberculosis Association. The words printed in italics were not found in the Dale list and are by definition unfamiliar words.

Sample I:

> A happy, useful life—that's what you want for your baby, isn't it? And because a healthy mind and body are so *necessary* to happiness and long life, you must do all you can to get your baby off to a good start. There is much you can do while he is still a baby to lay the *foundation* for good health and good health habits.
>
> Many things *affect* your baby's health. One was the state of your own health during *pregnancy*, and the *special* care your doctor gave you before the baby was born. Other things important to your child's health are food, clothes, baths, sleep, and habit training. A baby needs a clean, happy place to live, and he must be kept from having any sickness that can be *prevented*.

Sample 2:

> *Diphtheria* used to kill many babies. Today no child need die of *diphtheria*. It is one of the *diseases* for which we have very good *treatment* and almost sure 'prevention. But your baby will not be safe from this *disease* unless he has been protected by *immunization*.
>
> The way to protect your baby is simple. *Physicians usually* give *injections* of three *doses* of *toxoid,* three to four weeks apart, generally beginning when a baby is about six months old. Your doctor will tell you that your baby should have this *protection* before his first birthday.
>
> Six months after the last *injection* of *toxoid,* the *physician* may test your baby to see if another *dose* of *toxoid* is *necessary.* Before the child enters school an extra shot of *toxoid* is often given.

Sample 3:

> The *germs* that cause *tuberculosis* can enter the baby's body through his mouth or be breathed in through his nose. These *germs* come to him on *spray* or *moisture* which the person with *active tuberculosis* breathes or coughs out. *Germ-filled spray* from the mouth or nose may light on the baby's food, his dishes, his toys. The baby's hands may carry *germs* from soiled *objects* to his mouth. Kissing is one way of spreading *TB* as well as other *germs.*
>
> *Tuberculosis* of the bones or *joints* or of certain organs of the body besides the *lungs* can come to the bottle-fed baby in milk which has not been •*pasteurized* or boiled.

The records for these three samples are given in the work sheet reproduced here as Table II. The average raw score for the three samples was 6.35. By referring to the grade equivalent given in Table I, the correction table, the grade-level of the readability of the pamphlet, 7-8, was determined.

TABLE 2

A Work Sheet Filled in for the Samples Taken from the Pamphlet "Your Baby"

Article: Your Baby	Page No. 2	Page No. 7	Page No. 12
Author:	From: "A happy...	From: "Diphtheria...	From: "The germs...
Publisher: Nat'l TB Assoc. Date: 1945	To: ...prevented."	To: ...often given."	To: ...or boiled."
1. Number of words in the sample	132	131	111
2. Number of sentences in the sample	7	9	6
3. Number of words not on the Dale list	6	20	17
4. Average sentence length (divide 1 by 2)	19	15	19
5. Dale scored (divide 3 by 1, multiply by 100)	7	9	6
6. Multiply average sentence length by .0496	.9424	.7440	.9424
7. Multiply Dale score (5) by .1579	.7895	2.3685	2.3685
8. Constant	3.6365	3.6365	3.6365
9. Formula raw score (add 6, 7, and 8)	5.3684	6.7490	6.9474

Average raw score of 3 samples ..... 6.35 Analyzed by J.S.C Date 1/28/48

Average corrected grade level..... 7-8 Checked by C.D.C Date 1/28/48

THE Dale list of approximately three thousand familiar words represents words that are known in reading by at least 80 per cent of the children in Grade IV. It is presented primarily as a list which gives a significant correlation with reading difficulty. It is not intended as a list of the most important words for children or adults. It includes words that are relatively unimportant and excludes some important ones. To use the list for more than an over-all statistical device which gives a good prediction of readability would be out of harmony with the purpose for which it was constructed.

The technique used for constructing the list was crude. When 80 per cent of the fourth-graders questioned indicated that they knew a word, that word was included in the list. This arbitrary cutting off at the 8o-per cent point and the lack of any measure of the importance of these words make exceedingly dubious the wisdom of using individual words in appraising the ease or difficulty of material. For purposes of computing a level of difficulty, however, the percentage of words outside this list is a very good index of the difficulty of reading materials. The terms *familiar* and *unfamiliar* describing words are therefore used here in a statistical sense.

There is, however, a real place for a list of important familiar words, graded in about four levels, for use in the preparation of materials for adults of limited reading ability. At the present time we are experimenting with such a list. It will include such words as *nation* and so on, which tested slightly below the 8o-per cent criterion on children, but are important, and for all practical purposes are probably familiar to adults.

The three thousand words which comprise the Dale list are given in the pages which follow.

Dale List of 3,000 Words

a	ah	an	armful	awhile	barrel
able	ahead	and	army	ax	base
aboard	aid	angel	arose	baa	baseball
about	aim	anger	around	babe	basement
above	air	angry	arrange	baby (ies).	basket
absent	airfield	animal	arrive (d)	back	bat
accept	airport	another	arrow	background	batch
accident	airplane	answer	art	backward (s)	bath
account	airship	ant	artist	bacon	bathe
ache (ing)	airy	any	as	bad (ly)	bathing
acorn	alarm	anybody	ash (es)	badge	bathroom
acre	alike	anyhow	aside	bag	bathtub
across	alive	anyone	ask	bake (r)	battle
act	all	anything	asleep	baking	battleship
add	alley	anyway	at	bakery	bay
address	alligator	anywhere	ate	ball	be (ing)
admire	allow	apart	attack	balloon '	beach
adventure	almost	apartment	attend	banana	bead
afar	alone	ape	attention	band	beam
afraid	along	apiece	August	bandage	bean
after	aloud	appear	aunt	bang	bear
afternoon	already	apple	author	banjo	beard
afterward (s)	also	April	auto	bank (er)	beast
again	always	apron	automobile	bar	beaming
against	am	are	autumn	barber	beautiful
age	America	aren't	avenue	bare (ly)	beautify
aged	American	arise	awake (n)	barefoot	beauty
ago	among	arithmetic	away	bark	became
agree	amount	arm	awful (ly)	barn	because

become	bird	bookkeeper	bubble	calendar	cattle
becoming	birth	boom	bucket	calf	caught
bed	birthday	boot	buckle	call (er) (ing)	cause
bedbug	biscuit	born	bud	came	cave
bedroom	bit	borrow	buffalo	camel	ceiling
bedspread	bite	boss	bug	camp	cell
bedtime	biting	both	buggy	campfire	cellar
bee	bitter	bother	build	can	cent
beech	black	bottle	building	canal	center
beef	blackberry	bottom	built	canary	cereal
beefsteak	blackbird	bought	bulb	candle	certain (ly)
beehive	blackboard	bounce	bull	candlestick	chain
been	blackness	bow	bullet	candy	chair
beer	blacksmith	bowl	bum	cane	chalk
beet	blame	bow-wow	bumblebee	cannon	champion
before	blank	box (es)	bump	cannot	chance
beg	blanket	boxcar	bun	canoe	change
began	blast	boxer	bunch	can't	chap
beggar	blaze	boy	bundle	canyon	charge
begged	bleed	boyhood	bunny	cap	charm
begin	bless	bracelet	burn	cape	chart
begun	blew	brake	bury	captain	chatter
behave	blind (s)	bran	bus	car	cheap
behind	blindfold	branch	bush	card	cheat
believe	block	brass	bushel	cardboard	check
bell	blood	brave	business	care	checkers
belong	bloom	bread	busy	careful	cheek
below	blossom	break	but	careless	cheer
belt	blot	breakfast	butcher	carelessness	cheese
beneath	blow	breast	butt	carload	cherry
bench	blue	breath	butter	carpenter	chest
bend	blueberry	breathe	buttercup	carpet	chew
bent	bluebird	breeze	butterfly	carriage	chick
berry (ies)	blue jay	brick	buttermilk	carrot	chicken
besides (s)	blush	bride	butterscotch	carry	chief
best	board	bridge	button	cart	child
bet	boast	bright	buttonhole	carve	childhood
better	boat	brightness	buy	case	children
between	bob	bring	buzz	cash	chill (y)
bib	bobwhite	broad	by	cashier	chimney
bible	body (ies)	broadcast	bye	castle	chin
bicycle	boil (er)	broke(n)	cab	cat	china
bid	bold	brook	cabbage	catbird	chip
big (ger)	bone	broom	cabin	catch	chipmunk
bill	bonnet	brother	cabinet	catcher	chocolate
billboard	boo	brought	cackle	caterpillar	choice
bin	book	brown	cage	catfish	choose
bind	bookcase	brush	cake	catsup	chop

chorus	codfish	cow	dad	destroy	downstairs
chose	coffee.	coward (ly)	daddy	devil	downtown
christen	coffeepot	cowboy	daily	dew	dozen
Christmas	coin	cozy	dairy	diamond	drag
church	cold	crab	daisy	did	drain
churn	collar	crack	dam	didn't	drank
cigarette	college	cracker	damage	die (d) (s)	draw (er)
circle	color (ed)	cradle	dame	difference	draw (ing)
circus	colt	cramps	damp	different -	dream
citizen	column	cranberry	dance (r)	dig	-dress
city	comb	crank (y)	dancing	dim	dresser
clang	come	crash	dandy	dime	dressmaker
clap	comfort	crawl	danger (ous)	dine	drew
class	comic	crazy	dare	ding-dong	dried
classmate	coming	cream (y)	dark (ness)	dinner	drift
classroom	company	creek	darling	dip	drill
claw	compare	creep	darn	direct	drink
clay	conductor	crept	dart	direction	drip
clean(er)	cone	-cried	dash	dirt (y)	drive (n)
clear	connect	croak	date	discover	driver
clerk	coo	crook(ed)	daughter	dish	drop
clever	cook (ed)	crop	dawn	dislike	drove
click	cook (ing)	cross (ing)	day	dismiss	drown
cliff	cooky (ie) (s)	cross-eyed	daybreak	ditch	drowsy
climb	cool (er)	crow	daytime	dive	drug
clip	coop	crowd(ed)	dead	diver	drum
cloak	copper	crown	deaf	divide	drunk
clock	copy	cruel	deal	do	dry
close	cord	crumb	dear	dock	duck
closet	cork	crumble	death	doctor	due
cloth	corn	crush	December	does	dug
clothes	corner	crust.	decide	doesn't	dull
clothing	correct	cry (ies)	deck	dog	dumb
cloud (y)	cost	cub	deed	doll	dump
clover	cot	cuff	deep	dollar	during
clown	cottage	cup	deer	dolly	dust(y)
club	cotton	cupboard	defeat	done	duty
cluck	couch	cupful	defend	donkey	dwarf
clump	cough	cure	defense	don't	dwell
coach	could	curl(y)	delight	door	dwelt
coal	couldn't	curtain	den	doorbell	dying
coast	count	curve	dentist	doorknob	each
coat	counter	cushion	depend	doorstep	eager
cob	country	custard	deposit	dope	eagle
cobbler	county	customer	describe	dot	ear
cocoa	course	cut	desert	double	early
coconut	court	cute	deserve	dough	earn
cocoon	cousin	cutting	desire	dove	earth
cod	cover	dab	desk	down	eastern

easy
eat (en)
edge
egg
eh
eight
eighteen
eighth
eighty
either
elbow
elder
eldest
electric
electricity
elephant
eleven
elf
elm
else
elsewhere
empty
end (ing)
enemy
engine
engineer
English
enjoy
enough
enter
envelope
equal
erase (r)
errand
escape
eve
even
evening
ever
every
everybody
everyday
everyone
everything
everywhere
evil
exact
except
exchange
excited
exciting
excuse
exit
expect
explain
extra
eye
eyebrow
fable
face
facing
fact
factory
fail
faint
fair
fairy
faith
fake
fall
false
family
fan
fancy
far
faraway
fare
farmer
farm (ing)
far-off
farther
fashion
fast
fasten
fat
father
fault
favor
favorite
fear
feast
feather
February
fed
feed
feel
feet
fell
fellow
felt
fence
fever
few
fib
fiddle
field
fife
fifteen
fifth
fifty
fig
fight
figure
file
fill
film
finally
find
fine
finger
finish
fire
firearm
firecracker
fireplace
fireworks
firing
first
fish
fisherman
fist
fit (s)
five"
fix
flag
flake
flame
flap
flash
flashlight
flat
flea
flesh
flew
flies
flight
flip
flip-flop
float
flock
flood
floor
flop
flour
flow
flower (y)
flutter
fly
foam
fog
foggy
fold
folks
follow (ing)
fond
food
fool
foolish
foot
football
footprint
for
forehead
forest
forget
forgive
forgot (ten)
fork
form
fort
forth
fortune
forty
forward
fought
found
fountain
four
fourteen
fourth
fox
frame
free
freedom
freeze
freight
French
fresh
fret
Friday
fried
friend (ly)
friendship
frighten
frog
from
front
frost
frown
froze
fruit
fry
fudge
fuel
full (y)
fun
funny
fur
furniture
further
fuzzy
gain
gallon
gallop
game
gang
garage
garbage
garden
gas
gasoline
gate
gather
gave
gay
gear
geese
general
gentle
gentleman
gentlemen
geography
get
getting
giant
gift
gingerbread
girl
give (n);
giving
glad (ly)
glance
glass (es)
glean
glide
glory
glove
glow
glue
go (ing)
goes
goal
goat
gobble
God (g)
godmother
gold (en)
goldfish
golf
gone
good (s)
good-by (bye)
good-looking
goodness
goody
goose
gooseberry
got
govern
government
gown
grab
gracious
grade
grain
grand
grandchild
grandchildren
granddaughter
grandfather
grandma
grandmother
grandpa
grandson

grandstand	handle	held	homely	hush	January
grape (s)	handwriting	hell	homesick	hut	jar
grapefruit	hang	he'll	honest	hymn	jaw
grass	happen	hello	honey	I	jay
grasshopper	happily	helmet	honeybee	ice	jelly
grateful	happiness	help (er)	honeymoon	icy	jellyfish
grave	happy	helpful	honk	I'd	jerk
gravel	harbor	hem	honor	idea	jig
graveyard	hard	hen	hood	ideal	job
gravy	hardly	henhouse	hoof	if	jockey
gray	hardship	her (s)	hook	ill	join
graze	hardware	herd	hoop	I'll	joke
grease	hare	here	hop	I'm	joking
great	hark	here's	hope (ful)	important	jolly
green	harm	hero'	hopeless	impossible	journey
greet	harness	herself	horn	improve	joy (ful)
grew	harp	he's	horse	in	joyous
grind	harvest	hey	horseback	inch (es)	judge
groan	has	hickory	horseshoe	income	jug
grocery	hasn't	hid	hose	indeed	juice
ground	haste (n)	hidden	hospital	Indian	juicy
group	hasty	hide	host	indoors	July
grove	hat	high	hot	ink	jump
grow	hatch	highway	hotel	inn	June
guard	hatchet	hill	hound	insect	junior
guess	hate	hillside	hour	inside	junk
guest	haul	hilltop	house	instant	just
guide	have	hilly	housetop	instead	keen
gulf	haven't	him	housewife	insult	keep
gum	having	himself	housework	intend	kept
gun	hawk	hind	how	interested	kettle
gunpowder	hay	hint	however	interesting	key
guy	hayfield	hip	howl	into	kick
ha	haystack	hire	hug	invite	kid
habit	he	his	huge	iron	killed (ed}
had	head	hiss	hum	is	kind (ly)
hadn't	headache	history	humble	island	kindness
hail	heal	hit	hump	isn't	king
hair	health (y)	hitch	hundred	it	kingdom
haircut	heap	hive	hung	its	kiss
hairpin	hear (ing)	ho	hunger	it's	kitchen
half	heard	hoe	hungry	itself	kite
hall	heart	hog	hunk	I've	kitten
halt	heat (er)	hold (er)	hunt (er)	ivory	kitty
ham	heaven	hole	hurrah	ivy	knee
hammer	heavy	holiday	hurried	jacket	kneel
hand	he'd	hollow	hurry	jacks	knew
handful	heel	holy	hurt	jail	knife
handkerchief	height	home	husband	jam	knit

knives	lend	lonesome	market	minute	name
knob	length	long	marriage	mirror	nap
knock	less	look	married	mischief	napkin
knot	lesson	lookout	marry	miss (M)	narrow
know	let	loop	mask	misspell	nasty
known	let's	loose	mast	mistake	naughty
lace	letter	lord	master	misty	navy
lad	letting	lose (r)	mat	mitt	near
ladder	lettuce	loss	match	mitten	nearby
ladies	level	lost	matter	mix	nearly
lady	liberty	lot	mattress	moment	neat
laid	library	loud	may (M)	Monday	neck
lake	lice	love	maybe	money	necktie
lamb	lick	lovely	mayor	monkey	need
lame	lid	lover	maypole	month	needle
lamp	lie	low	me	moo	needn't
land	life	luck (y)	meadow	moon	Negro
lane	lift	lumber	meal	moonlight	neighbor
language	light (ness)	lump	mean (s)	moose	neighborhood
lantern	lightning	lunch	meant	mop	neither
lap	like	lying	measure	more	nerve
lard	likely	ma	meat	morning	nest
large	liking	machine	medicine	morrow	net
lash	lily	machinery	meet (ing)	moss	never
lass	limb	mad	melt	most (ly)	nevermore
last	lime	made	member	mother'	new
late	limp	magazine	men	motor	news
laugh	line	magic	mend	mount	newspaper
laundry	linen	maid	meow	mountain	next
law	lion	mail	merry	mouse	nibble
lawn	lip	mailbox	mess	mouth	nice
lawyer	list	mailman	message	move	nickel
lay	listen	major	met	movie	night
lazy	lit	make	metal	movies	nightgown
lead	little	making	mew	moving	nine
leader	live (s)	male	mice	mow	nineteen
leaf	lively	mama	middle	Mr., Mrs.	ninety
leak	liver	mamma	midnight	much	no
lean	living-	man	might (y)	mud	nobody
leap	lizard	manager	mile	muddy	nod
learn (ed)	load	mane	milk	mug	noise
least	loaf	manger	milkman	mule	noisy
leather	loan	many	mill	multiply	none
leave (ing)	loaves	map	miller	murder	noon
led	lock	maple	million	music	nor
left	locomotive	marble	mind	must	north (ern)
leg	log	march (M)	mine	my	nose
lemon	lone	mare	miner	myself	not
lemonade	lonely	mark	mint	nail	note

nothing
notice
November
now
nowhere
number
nurse
nut
oak
oar
oatmeal
oats
obey
ocean
o'clock
October
odd
of
off
offer
office
officer
often
oh
oil
old
old-fashioned
on
once
one
onion
only
onward
open
or
orange
orchard
order
ore
organ
other
otherwise
ouch
ought
our (s)
ourselves
out
outdoors
outfit
outlaw
outline
outside
outward
oven
over
overalls
overcoat
overeat
overhead
overhear
overnight
overturn
owe
owing
owl
own (er)
ox
pa
pace
pack
package
pad
page
paid
pail
pain (ful)
paint (er)
painting
pair
pal
palace
pale
pan
pancake
pane
pansy
pants
papa
paper
parade
pardon
parent
park
part (ly)
partner
party
pass
passenger
past
paste
pasture
pat
patch
path
patter
pave
pavement
paw
pay
payment
pea (s)
peace (ful)
peach (es)
peak
peanut
pear
pearl
peck
peek
peel
peep
peg
pen
pencil
penny
people
pepper
peppermint
perfume
perhaps
person
pet
phone
piano
pick
pickle
picnic
picture
pie
piece
pig
pigeon
piggy
pile
pill
pillow
pin
pine
pineapple
pink
pint
pipe
pistol
pit
pitch
pitcher
pity
place
plain
plan
plane
plant
plate
platform
platter
play (er)
playground
playhouse
playmate
plaything
pleasant
please
pleasure
plenty
plow
plug
plum
pocket
pocketbook
poem
point
poison
poke
pole
police
policeman
polish
polite
pond
ponies
pony
pool
poor
pop
popcorn
popped
porch
pork
possible
post
postage
postman
pot
potato (es)
pound
pour
powder
power (ful)
praise
pray
prayer
prepare
present
pretty
price
prick
prince
princess
print
prison
prize
promise
proper
protect
proud
prove
prune
public
puddle
puff
pull
pump
pumpkin
punch
punish
pup
pupil
puppy
pure
purple
purse
push
puss
pussy
pussycat
put
putting
puzzle
quack
quart
quarter
queen
queer
question
quick (ly)
quiet
quilt
quit
quite
rabbit
race
rack
radio
radish
rag
rail
railroad
railway
rain (y)
rainbow
raise
raisin
rake
ram
ran
ranch
rang
rap
rapidly
rat
rate
rather
rattle
raw
ray
reach
read
reader
reading
ready
real
really
reap

rear	rock (y)	sand (y)	self	shirt	sixteen
reason	rocket	sandwich	selfish	shock	sixth
rebuild	rode	sang	sell	shoe	sixty
receive	roll	sank	send	shoemaker	size
recess	roller	sap	sense	shone	skate
record	roof	sash	sent	shook	skater
red	room	sat	sentence	shoot	ski
redbird	rooster	satin	separate	shop	skin
redbreast	root	satisfactory	September	shopping	skip
refuse	rope	Saturday	servant	shore	skirt
reindeer	rose	sausage	serve	short	sky
rejoice	rosebud	savage	service	shot	slam
remain	rot	save	set	should	slap
remember	rotten	savings	setting	shoulder	slate
remind	rough	saw	settle	shouldn't	slave
remove	round	say	settlement	shout	sled
rent	route	scab	seven	shovel	sleep (y)
repair	row	scales	seventeen	show	sleeve
repay	rowboat	scare	seventh	shower	sleigh
repeat	royal	scarf	seventy	shut	slept
report	rub	school	several	shy	slice
rest	rubbed	schoolboy	sew	sick (ness)	slid
return	rubber	schoolhouse	shade	side	slide
review	rubbish	schoolmaster	shadow	sidewalk	sling
reward	rug	schoolroom	shady	sideways	slip
rib	rule (r)	scorch	shake (r)	sigh	slipped
ribbon	rumble	score	shaking	sight	slipper
rice	run	scrap	shall	sign	slippery
rich	rung	scrape	shame	silence	slit
rid	runner	scratch	shan't	silent	slow (ly)
riddle	running	scream	shape	silk	sly
ride (r)	rush	screen	share	sill	smack
riding	rust (y)	screw	sharp	silly	small
right	rye	scrub	shave	silver	smart
rim	sack	sea	she	simple	smell
ring	sad	seal	she'd	sin	smile
rip	saddle	seam	she'll	since	smoke
ripe	sadness	search	she's	sing	smooth
rise	safe	season	shear (s)	singer	snail
rising	safety	seat	shed	single	snake
river	said	second	sheep	sink	snap
road	sail	secret	sheet	sip	snapping
roadside	sailboat	see (ing)	shelf	sir	sneeze
roar	sailor	seed	shell	sis	snow (y)
roast	saint	seek	shepherd	sissy	snowball
rob	salad	seem	shine	sister	snowflake
robber	sale	seen	shining	sit '	snuff
robe	salt	seesaw	shiny	sitting	snug
robin	same	select	ship	six	so

soak
soap
sob
socks
sod
soda
sofa
soft-
soil
sold
soldier
sole
some
somebody
somehow
someone
something
sometime (s)
somewhere
son
song
soon
sore
sorrow
sorry
sort
soul
sound
soup
sour
south (ern)
space
spade
spank
sparrow
speak (er)
spear
speech
speed
spell (ing)
spend
spent
spider
spike
spill
spin
spinach
spirit
spit
splash
spoil
spoke
spook
spoon
sport.
spot
spread
spring
springtime
sprinkle
square
squash
squeak
squeeze
squirrel
stable
stack
stage
stair
stall
stamp
stand
star
stare
start
starve
state
station
stay
steak
steal
steam
steamboat
steamer
steel
steep
steeple
steer
stem
step
stepping
stick (y)
stiff
still (ness)
sting
stir
stitch
stock
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stole
stone
stood
stool
stoop
stop
stopped
stopping
store
stork
stories
storm (y)
story
stove
straight
strange (r)
strap
straw
strawberry
stream
street
stretch
string
strip
stripes
strong
stuck
study
stuff
stump
stung
subject
such
suck
sudden
suffer
sugar
suit
sum
summer
sun
Sunday
sunflower
sung
sunk
sunlight
sunny
sunrise
sunset
sunshine
supper
suppose
sure (ly)
surface
surprise
swallow
swam
swamp
swan
swat
swear
sweat
sweater
sweep
sweet (ness)
sweetheart
swell
swept
swift
swim
swimming
swing
switch
sword
swore
table
tablecloth
tablespoon
tablet
tack
tag
tail
tailor
take (n)
taking
tale
talk (er)
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tan
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tap
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tardy
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taste
taught
tax
tea
teach (er)
team
tear
tease
teaspoon
teeth
telephone
tell
temper.
ten
tennis
tent
term
terrible
test
than
thank (s)
thankful
Thanks giving
that
that's
the
theater
thee
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them
then
there
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thought
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three
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through
throw (n)
thumb
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Thursday
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ticket
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tie
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tight
till
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tip
tiptoe
tire
tired
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to
toad
toadstool
toast
tobacco
today
toe
together
toilet
told
tomato
tomorrow
ton
tone
tongue

tonight
too
took
tool
toot
tooth
toothbrush
toothpick
top
tore
torn
toss
touch
tow
toward (s)
towel
tower
town
toy
trace
track
trade
tram
tramp
trap
tray
treasure
treat
tree
trick
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tried
trim
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trolley
trouble
truck
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tub
Tuesday
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tumble
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tunnel
turkey
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uncle
under
understand
underwear
undress
unfair
unfinished
unfold
unfriendly
unhappy
unhurt
uniform
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States
unkind
unknown
unless
unpleasant
until
unwilling
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upon
upper
upset
upside
upstairs
uptown
upward
us
use (d)
useful
valentine
valley
valuable
value
vase
vegetable
velvet
very
vessel
victory
view
village
vine
violet
visit
visitor
voice
vote
wag
wagon
waist
wait
wake (n)
walk
wall
walnut
want
war
warm
warn
was
wash (er)
washtub
wasn't
waste
watch
watchman
water
watermelon
waterproof
wave
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wayside
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weak (ness)
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wealth
weapon
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weary
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weave
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welcome
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whisper
whistle
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wiggle
wild
wildcat
will
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willow
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wind (y)
windmill
window
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winner
winter
wipe
wire
wise
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woke
wolf
woman
women
won
wonder
wonderful
won't
wood (en)
woodpecker
woods
wool
woolen
word
wore
work (er)-
workman
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yesterday
yet
yolk
yonder
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you'd
you'll
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youngster
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you're
yourself
yourselves
youth
you've

1948—The Flesch Formulas

Introduction

The one perhaps most responsible for publicizing the need for readability was Rudolf Flesch, a colleague of Lorge at Columbia University. Besides working as a readability consultant, lecturer, and teacher of writing, he published a number of studies and nearly 20 popular books on English usage and readability. His best-selling books included *The Art of Plain Talk* (1946), *The Art of Readable Writing* (1949), *The Art of Clear Thinking* (1951), *Why Johnny Can't Read —And What You Can Do About It* (1955), *The ABC of Style: A Guide to Plain English* (1964), *How to Write in Plain English: A Book for Lawyers and Consumers* (1979).

Flesch was born in Austria and got a degree in law from the University of Vienna in 1933. He practiced law until 1938, when he came to the U.S. as a refugee from the Nazis.

Rudolf Flesch. The first edition of The Art of Plain Talk in 1946 was a best seller. The readability formulas it featured started a revolution in journalism and business communication.

Since his law degree was not recognized, he worked several other jobs, one of them in the shipping department of a New York book manufacturer.

In 1939, he received a refugee's scholarship at Columbia University. In 1940, he received a bachelor's degree with honors in library science. That same year, he became an assistant to Lyman Bryson in the Teachers' College Readability Lab.

In 1942, Flesch received a master's degree in adult education. The next year, he received a Ph.D. in educational research for his dissertation, "Marks of a Readable Style" (1943). This paper set a course for his career and that of readability.

In his dissertation, Flesch published his first readability formula for measuring adult reading material. One of the variables it used was affixes and another was "personal references" such as personal pronouns and names. Publishers quickly discovered that Flesch's formula could increase readership by 40 to 60 percent. Investigators in many fields of communication began using it in their studies.

In a 1948 article printed here, "A New Readability Yardstick," Flesch published a second formula with two parts. The first part, the Reading Ease formula, dropped the use of affixes and used only two variables, the number of syllables and the number of sentences for each 100-word sample. It predicts reading ease on a scale from 1 to 100, with 30 being "very difficult" and 70 being "easy." Flesch (p. 225) wrote that a score of 100 indicates reading matter understood by readers who have completed the fourth grade and are, in the language of the U.S. Census barely "functionally literate."

The second part of Flesch's formula predicts human interest by counting the number of personal words (such as pronouns and names) and personal sentences (such as quotes, exclamations, and incomplete sentences).

The formula for the updated Flesch Reading Ease score is:

Score = 206.835 – (1.015 x ASL) – (84.6 x ASW)

Where:

Score = position on a scale of 0 (difficult) to 100 (easy), with 30 = very difficult and 70 = suitable for adult audiences.

ASL = average sentence length (the number of words divided by the number of sentences).

ASW = average number of syllables per word (the number of syllables divided by the number of words).

This formula correlated .70 with the 1925 McCall-Crabbs reading tests and .64 with the 1950 version of the same tests.

In *The Art of Readable Writing,* Flesch, described his Reading Ease scale in this way:

Reading Ease Score	Style Description	Estimated Reading Grade	Estimated Percent of U.S. Adults (1949)
0 to 30:	Very Difficult	College graduate	4.5
30 to 40:	Difficult	13th to 16th grade	33
50 to 60:	Fairly Difficult	10th to 12th grade	54
60 to 70:	Standard	8th and 9th grade	83
70 to 80:	Fairly Easy	7th grade	88
80 to 90:	Easy	6th grade	91
90 to 100:	Very Easy	5th grade	93

Flesch's Reading Ease formula became the most widely used formula and one of the most tested and reliable (Chall 1958, Klare 1963).

In an attempt to further simplify the Flesch Reading Ease formula, Farr, Jenkins, and Paterson (1951) substituted the average number of one-syllable words per hundred words for Flesh's syllable count. The modified formula is:

New Reading Ease score = 1.599 nosw – 1.015 sl – 31.517

Where: nosw = number of one-syllable words per 100 words;

sl = average sentence length in words

This formula correlates better than .90 with the original Flesch Reading Ease formula and .70 with 75% comprehension of 100-word samplings of the McCall-Crabbs reading lessons. In 1976, a study commissioned by the U.S. Navy modified the Reading Ease formula to produce a grade-level score, This popular formula is known as the Flesch-Kincaid formula, the Flesch Grade-Scale formula or the Kincaid formula.

In 1949, Flesch published the results of a 10-year study of the edito-

rial content of several magazines. He found that:

- About 45% of the population can read The Saturday Evening Post.
- Nearly 50% of the population can read McCall's, Ladies Home Journal, and Woman's Home Companion.
- Slightly over 50% can read American Magazine.
- 80% of the population can read Modern Screen, Photoplay, and three confession magazines.

Flesch, in *The Art of Plain Talk* (1949)compared the reading scores of popular magazines with other variables:

Style	Flesch Reading Ease Score	Average Sentence Length in Words	Average No. of Syll. Per 100 Words	Type of Magazine	Estimated School Grade Completed	Estimated Percent of U.S. Adults
Very Easy	90 to 100	8 or less	123 or less	Comics	4th grade	93
Easy	80 to 90	11	131	Pulp fiction	5th grade	91
Fairly Easy	70 to 80	14	139	Slick fiction	6th grade	88
Standard	60 to 70	17	147	Digests	7th or 8th grades	83
Fairly Difficult	50 to 60	21	155	Quality	Some high school	54
Difficult	30 to 50	25	167	Academic	High school or some college	33
Very Difficult	0 to 30	29 or more	192 or more	Scientific	College	4.5

Table 1. Flesch's1949 analysis of the readability of adult reading materials.

Flesch's work had an enormous impact on journalism. Like Robert Gunning, who worked with the United Press, Flesch was a consultant with the Associated Press. Together, they helped to bring down the reading grade level of front-page stories from the 16th to the 11th grade, where they remain today.

—WHD

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A New Readability Yardstick*

Rudolf Flesch

***Dobbs** Ferry, N, Y.*

IN 1943 the writer developed a statistical formula for the objective measurement of readability (comprehension difficulty) (5, 6). The formula was based on a count of three language elements: average sentence length in words, number of affixes, and number of references to people. Since its publication, the formula has been put to use in a wide variety of fields. For example, it has been applied to newspaper reports (9, 20), advertising copy (1), government publications (19), bulletins and leaflets for farmers (3), materials for adult education (4), and children's books (12). Its validity has been reaffirmed by five independent studies; the formula ratings of psychology textbooks substantially agreed with ratings by students and teachers (17); the formula scores rated specially edited radio news, newsmagazine, and Sunday news-summary copy "more readable" than comparable newspaper reports (18); advertisements, rated "more readable" by the formula, showed higher readership figures (7); and articles that were simplified with the aid of the formula brought increased readership in two successive split-run tests (13, 14). Since 1943, a number of academic institutions have incorporated the formula in the curriculum of courses in composition, creative writing, journalism, and advertising; it has also been used as the basis of several graduate research projects.

Because of this wide application, it seemed worthwhile to re-examine the formula and to analyze its shortcomings. One of these is to be traced to the basic structure of the formula; others are the results of difficulties in its application.

The structural shortcoming of the formula is the fact that it does not always show the high readability of direct, conversational writing. For example, in the study of psychology texts mentioned above (17), the score for Koffka's *Principles of gestalt psychology* ("the students' choice for un-i readability") was 5.4 ("difficult"); yet William James' *Principles of Psychology,* a classic example of readability, rated 6.0

* Samples from the main body of this paper, when tested for readability by the method here proposed, had an average "reading ease" score of 30 and a "human interest" score of 0. Presumably, the paper is easier to read than most other articles appearing in scientific journals. The section, "The Formulas Restated/," which contains directions for users of the formulas, has a "reading ease" score of 79 and a "human interest" score of 42—which puts that portion of the article in the class of a good cookbook.

(bordering on "very difficult"). Similarly, the formula consistently rates the popular *Reader's Digest* more readable than the sophisticated *New Yorker* magazine, although many educated readers consider the *Reader's Digest* dull and the sprightly *New Yorker* ten times as readable.

Aside from that, the practical application of the formula led to several minor misinterpretations. Sentence length, for instance, is the element with the heaviest weight; it is also the easiest to measure. As a result, this feature of the formula is of ten-overemphasized, sometimes to the exclusion of the others—as in the directives that have been issued to staff writers of the Associated Press and the *New York Times,* recommending the use of shorter sentences in "leads." On the other hand, the second element—number of affixes—seems often difficult to apply; users of the formula found this count particularly tedious and admitted to uncertainty in spotting affixes. The third element—references to people— raised no such questions; but it was sometimes felt to be arbitrary and the underlying principle was often misunderstood.

In addition, many people found it hard to get used to the scoring system, which generally ranges from 0 ("very easy") to 7 ("very difficult"). Also, the average time needed to test a 100-word sample is six minutes (4). This makes the application of the formula considerably faster than that of earlier formulas, which required reference to word lists (e.g. Gray-Leary (8) or Lorge (10)), but it is still too long for practical use.

The revision of the formula presented in this paper is an attempt to overcome these shortcomings and make the formula a more useful instrument.

Procedure

The criterion used in the original formula was McCall-Crabbs' *Standard test lessons in reading* (11). The formula was so constructed that it predicted the average grade level of a child who could answer correctly three-quarters of the test questions asked about a given passage. Its multiple correlation coefficient was $R = .74$. It was partly based on statistical findings established in an earlier study by Lorge (10).

For many obvious reasons, the grade level of children answering test questions is not the best criterion for general readability. Data about the ease and interests with which adults will read selected passages would be far better. But such data were not available at the time the first formula was developed, and they are still unavailable today. So McCall-Crabbs' *Standard test lessons* are still the best and most extensive criterion that can be found; therefore they were used again for the revision. In reanalyzing the test passages, the following elements were used:

(1) *Average Sentence Length in Words.* The same element was used in the previous formula, but the correlation coefficient used was taken from Lorge's earlier findings. In the present study this coefficient was recomputed.

(2) *Average word length in syllables,* expressed as the number of syllables per 100 words. The hypothesis was that this measure would furnish results similar to the affix count in the earlier formula. Syllables are obviously easier to count than affixes since this work can be reduced to a mechanical routine.

(3) *Average Percentage of "Personal Words."* The same element was used in the earlier formula. However, the opportunity was used to test a clarified definition, which made no significant difference in correlation. The new definition was stated as follows: All nouns with natural gender; all pronouns except neuter pronouns; and the words *people* (used with the plural verb) and *folks.*

(4) *Average Percentage of "Personal Sentences."* This new element was designed to correct the structural shortcoming of the earlier formula, mentioned above. By hypothesis, it tests the conversational quality and the story interest of the passage analyzed. It was defined as the percentage of the following sentences: Spoken sentences, marked by quotation marks or otherwise; questions, commands, requests, and other sentences directly addressed to the reader; exclamations; and grammatically incomplete sentences whose meaning has to be inferred from the context.

To make the prediction more accurate, 13 of the 376 McCall-Crabbs' passages that contained poetry or problems in arithmetic were omitted in the count of the first two elements, which are designed to test solely prose comprehension. However, these 13 passages were retained in the count of the last two elements, which are designed to test human interest.

Following the procedure in the earlier study, intercorrelations were then computed. However, multiple correlation of the four elements with the criterion showed no significant gain in prediction value over the earlier formula in spite of the significant prediction value of the additional fourth element by itself ($r = -.27$). Therefore, *two* multiple-correlation regression formulas were computed: one using the first two elements and one using the last two. This procedure had the advantage of giving independent predictions of the reading ease and the human interest of a given passage.

Finally, the resulting twin formulas were expressed in such a way that maximum readability (in both formulas) had a value of 100, and minimum readability a value of 0. This was done to make the scores more readily understandable for the practical user.

Table 1
Correlations, Means, Standard Deviations, and Regression Weights of Word and Sentence Length

	sl	C_{50}	$\bar{X}$	s	β
wl	.4644	.6648	134.2208	13.6845	.5422
sl	—	.5157*	16.5213	5.5509	.2639

* After the preparation of this paper two articles appeared that pointed out a computational error affecting the writer's original formula (Dale, E. and Chall, Jeanne S. A formula for predicting readability. *Educ. Res. Bull.,* Ohio St. Univ., 1948, 27, 11-20, 28; Lorge, I. The Lorge and Flesch readability formulae: a correction. *Sch. & Soc.,* 1948, 67, 141-142). The error concerned the correlation coefficient between sentence length and the criterion, which had originally been reported by Lorge as .6174; the writer, acknowledging his debt to Lorge, used that figure without recomputation. The corrected correlation coefficient is now reported as .4681 by Dale and Chall, and as .467 by Lorge; this corresponds closely to the figure of .5157 reported in Table 1, considering the fact that the writer now used a slightly better criterion of 363 passages for sentence length. In other words, the formula presented in this paper incidentally and independently also corrects the error found by Dale and Chall and by Lorge.

Table 2

Correlations, Means, Standard Deviations, and Regression Weights of Personal Words and Sentences

	ps	C_{50}	$\bar{X}$	s	β
pw	.2268	.– .3881	7.34578	5.5175	–.3446
ps	—	–.2699	29.5745	35.58.22	–.1917

Findings

The intercorrelations, means, standard deviations, and regression weights found are shown in Tables 1, 2, and 3. The following symbols were used: *wl* for word length (syllables per 100 words), *sl* for sentence length in words, *pw* for percentage of "personal words," *ps* for percentage of "personal sentences/[7] cm for the average grade of children who could answer one-half of the test questions correctly, and C75 for the average grade of children who could answer three-quarters of the test questions correctly.

Table 3

Means and Standard Deviations of Two Criteria

	$\bar{X}$	s
C_{50}	5.4973	1.3877
C_{75}	7.3484	2.1345

The two regression formulas based on these correlations are:

Formula A (for predicting "reading ease"): $RE = 206.835 - .846\ wl - 1.015\ sl$.

The scores computed by this formula have a range from 0 to 100 for almost all samples taken from ordinary prose. A score of 100 corresponds to the prediction that a child who has completed fourth grade will be able to answer correctly three-quarters of the test questions to be asked about the passage that is being rated; in other words, a score of 100 indicates reading matter that is understandable for persons who have completed fourth grade and are, in the language of the U. S. Census, barely "functionally literate. The range of 100 points was arrived at by multiplying the grade level prediction by 10, so that a point on the formula scale corresponds to one-tenth of a grade. However, this relationship holds true only up to about seventh grade; beyond that, the formula under-rates grade level to an increasing degree. Finally, the formula—which predicted grade level and, therefore, difficulty—was "turned around" by reversing the signs to predict "reading ease." (Before this transformation, the formula read: $C_{75} = .0846\ wl + .1015\ sl - 5.6835$.) The multiple correlation coefficient of this formula is $R = .7047$.

Formula B (for predicting "human interest"): $HI = 3.635\ pw + .314\ ps$.

Scores computed by this formula, too, have a range from 0 to 100. A score of 100 has the same meaning as in Formula A. It indicates reading matter with enough human interest to suit the reading skills and habits of a barely "functionally literate" person. A score of 0, however, means here simply that the passage contains neither “personal words” nor “personal sentences”; in contrast to Formula A, the two elements counted here may be totally absent. Since the zero point could be fixed in this way, the scoring was arrived at by dividing the range between 0 (absence of both elements) and 100 (prediction of completed fourth grade) by 100. The formula therefore contains no statistical constant. The signs were reversed in the same fashion as in Formula A. (Before transformation, this formula read: $C_{75} = -.1333\ pw - .0115\ ps + 8.6673$.) The multiple correlation coefficient of this formula is $R = .4306$.

Since the correlations of three of the four elements with the criterion

C_{75}, were higher than with the criterion C_{50}, the multiple correlation with the criterion C_{50} was computed first. As a second step, the values so found were used to predict criterion C_{75}, since it seemed obviously more desirable to predict 75% comprehension than 50% comprehension.

The correlation between the word length factor (syllable count) and the corresponding affix count in the earlier formula was found to be $r = .87$. For practical purposes the two measures may therefore be considered equivalent.

The number of affixes per 100 words (a) can be predicted from the syllable count *(wl)* by the formula: $a = .6832\ wl - 66.6017$. Conversely, the number of syllables per 100 words *(wl)* can be predicted from the number of affixes *(a)* by the formula: $wl = 1.49\ a + 94.56$.

Comment

It is hoped that the two new formulas will prove more useful than the earlier formula. Formula A alone, with a correlation coefficient of .70, has almost as high a prediction value as the combined earlier formula whose correlation coefficient was .74. Formula B has a much lower correlation coefficient of .43 and, accordingly, does not seem to contribute much to the measurement of readability. It should be remembered, however, that because of the criterion used, Formula B predicts only the effect of the two "human interest" elements on *comprehension;* in other words, the correlation coefficient shows only to what extent human interest in a given text will make the reader understand it better. The real value of this formula, however, lies in the fact that human interest will also increase the reader's attention and his motivation for continued reading.

In addition, the two new formulas will be more useful for the teaching of writing, since the added factor and the division into two parts will show specific faults in writing more clearly.

The significance of Formula A will be more easily understood when it is realized that the measurement of word length is indirectly a measurement of word complexity (as mentioned above, the correlation is $r = .87$) and that word complexity in turn is indirectly a measurement of abstraction: the correlation between the number of affixes and that of abstract words was found to be .78 (5). Similarly, the measurement of sentence length is indirectly a measurement of sentence complexity. In two independent studies the correlation between these two factors was found to be .775 (8) and .72 (15). Sentence complexity, in turn, may again be considered as a measure of abstraction. Formula A, therefore, is essentially a test of the level of abstraction.

It seems hardly necessary to prove the importance of human interest in reading, as tested by Formula B. That people are most interested in other people is an old truism. And the readability value of written dia-

logue, as tested by the added element, is well described in the following, oddly parallel quotations from a printer and a novelist: "Have you ever watched people at a library selecting books for home reading? Other things being equal, if they see enough pages that . . . promise interesting dialogue, they are much more apt to put the book under their arm and walk away with it, than if they see too many solid pages . . . which always suggest hard work" (16). "'What is the use of a book without pictures or conversations?' thought Alice just before the White Rabbit ran by, in condemnation of the book her sister was reading, and this childish comment is supported by novel-readers of all degrees of intelligence. Long close paragraphs of print are in themselves apt to dismay the less serious readers and their instinct here is a sound one, for an excess of summary and an insufficiency of scene in a novel make the story seem remote, without bite, second-hand. . . . A great part of the vigor, the vivacity and the readability of Dickens derives from his innumerable interweavings of scene and summary; his general method is to keep summary to the barest essential minimum, a mere sentence or two here and there between the incredibly fertile burgeoning of his scenes" (2).

Table 4

Comparative Analysis of *The New Yorker* (October 26, 1946) and the *Reader's Digest* (November, 1946)

	New Yorker	*Reader's Digest*
Old Formula:		
Average sentence length in words	20	16
Affixes per 100 words	36	34
Personal words per 100 words	10	8
Readability score	3.59	3.05
New Formula A:		
Average sentence length in words	20	16
Syllables per 100 words	148	145
"Reading ease" score	61	68
New Formula B:		
Personal words per 100 words	10	8
Personal sentences per 100 sentences	39	15
"Human interest" score	49	34

In preliminary tests of the formulas, the following results were found: When the newly isolated fourth element ("personal sentences") was applied to the psychology texts by Koffka and James mentioned above (17), it was found that the percentage of "personal sentences" in Koffka was negligible (4%), whereas in James's first volume it was 16% and in his second volume 10%. A striking example of this difference in style is the following of James's "personal sentences": "Ask

half the common drunkards you know why it is that they fall so often prey to temptation, and they will say that most of the time they cannot tell." This sentence shows well the aspect of readability that eluded the earlier formula.

When the old and the new formulas were applied to two random copies of the *New Yorker* (October 26, 1946) and the *Reader's Digest* (November 1946), the results were as shown in Table 4.

As can be seen, the old formula rated the *Reader's Digest* significantly more readable than the *New Yorker;* the new formula A also shows that the *Reader's Digest* is significantly easier to read. But the new formula B clearly shows a large difference in human interest in favor of the *New Yorker.*

The Formulas Restated

For practical application, the formulas may be restated this way: To measure the readability ("reading ease" and "human interest") of a piece of writing, go through the following steps:

Step 1. Unless you want to test a whole piece of writing, take samples. Take enough samples to make a fair test (say, three to five of an article and 25 to 30 of a book). Don't try to pick "good" or "typical" samples. Go by a strictly numerical scheme. For instance, take every third paragraph or every other page. Each sample should start at the beginning of a paragraph.

Step 2. Count the words in your piece of writing or, if you are using samples, take each sample and count each word in it up to 100. Count contractions and hyphenated words as one word. Count as words numbers or letters separated by space.

Step 3. Count the syllables in your 100-word samples or, if you are testing a whole piece of writing, compute the number of syllables per 100 words. If in doubt about syllabication rules, use any good dictionary. Count the number of syllables in symbols and figures according to the way they are normally read aloud, e.g. two for $ ("dollars") and four for 1918 ("nineteen-eighteen"). If a passage contains several or lengthy figures, your estimate will be more accurate if you don't include these figures in your syllable count. In a 100-word sample, be sure to add instead a corresponding number of words in your syllable count. To save time, count all syllables except the first in all words of more than one syllable and add the total to the number of words tested. It is also helpful to "read silently aloud" while counting.

Step 4. Figure the average sentence length in words for your piece of writing or, if you are using samples, for all your samples combined. In a 100-word sample, find the sentence that ends nearest to the 100-word mark—that might be at the 94th word or the 109th word. Count the sentences up to that point and divide the number of words in those sentences by the number of sentences. In counting sentences, follow

the units of thought rather than the punctuation: usually sentences are marked off by periods; but sometimes they are marked off by colons or semicolons—like these. But don't break up sentences that are joined by conjunctions like *and* or *but.*

Step 5. Figure the number of "personal words" per 100 words in your piece of writing or, if you are using samples, in all your samples combined. "Personal words" are: (a) All first-, second-, and third-person pronouns except the neuter pronouns *it, its, itself,* and *they, them, their, theirs, themselves* if referring to things rather than people, (b) All words that have masculine or feminine natural gender, e.g. *Jones, Mary, father, sister, iceman, actress.* Do not count common-gender words like *teacher, doctor, employee, assistant, spouse.* Count singular and plural forms, (c) The group words *people* (with the plural verb) and *folks.*

Step 6. Figure the number of "personal sentences" per 100 sentences in your piece of writing or, if you use samples, in all your samples combined. "Personal sentences" are: (a) Spoken sentences, marked by quotation marks or otherwise, often including so-called speech tags like "he said" (e.g. "I doubt it."—We told him: "You can take it or leave it."— "That's all very well," he replied, showing clearly that he didn't believe a word of what we said). (b) Questions, commands, requests, and other sentences directly addressed to the reader. (c) Exclamations. (d) Grammatically incomplete sentences whose full meaning has to be inferred from the context (e.g. Doesn't know a word of English.—Handsome, though.—Well, he wasn't.—The minute you walked out). If a sentence fits two or more of these definitions, count it only once. Divide the number of these "personal sentences" by the total number of sentences you found in Step 4.

Step 7. Find your "reading ease" score by inserting the number of syllables per 100 words (word length, *wl)* and the average sentence length *(sl)* in the following formula:

R.E. ("reading ease") - 206.835 – .846 *wl* – 1.015 *sl.*

The "reading ease" score will put your piece of writing on a scale between 0 (practically unreadable) and 100 (easy for any literate person).

Step 8. Find your "human interest" score by inserting the percentage of "personal words" *(pw)* and the percentage of "personal sentences" (*ps*) in the following formula:

H.L ("human interest") = 3.635 *pw* + 314 *ps.*

The "human interest" score will put your piece of writing on a scale between 0 (no human interest) and 100 (full of human interest). In applying the formulas, remember that Formula A measures *length* (the longer the words and sentences, the harder to read) and Formula B measures *percentages* (the more personal words and sentences, the

more human interest).

Roughly, "reading ease" scores will tend to follow the pattern shown in Table 5.

"Human interest" scores will follow the general pattern shown in Table 6.

Table 5

Pattern of “Reading Ease” Scores

“Reading Ease” Score	Description of Style	Typical Magazine	Syllables per 100 words	Average Sentence Length in Words
0 to 20	Very Difficult	Scientific	192 or more	29 or more
30 to 50	Difficult	Academic	167	25
50 to 60	Fairly difficult	Quality	155	21
60 to 70	Standard	Digests	147	17
70 to 80	Fairly easy	Slick-fiction	139	14
80 to 90	Easy	Pulp-fiction	131	11
90 to 100	Very easy	Comics	123 or less	8 or less

Table 6

Pattern of “Reading Ease” Scores

“Human Interest” Score	Description of Style	Typical Magazine	Percentage of Personal Words	Percentage of Personal Sentences
0 to 10	Dull	Scientific	2 or less	0
10 to 20	Mildly Interesting	Trade	4	5
20 to 40	Interesting	Digests	7	15
40 to 60	Highly Interesting	*New Yorker*	11	22
60 to 100	Dramatic	Fiction	17 or more	58 or more

Sample Application

As an example of the application of the new formulas, two recent descriptions of the "nerve-block" method of anesthesia will be used.

By an odd coincidence, these two variations upon a theme appeared within the same week in *Life* (October 27, 1947) and *The New Yorker* (October 25, 1947). The *Life* story served as text accompanying a series of pictures; it is straight reporting, not particularly simple, and lacks human interest (which was supplied by the pictures). The *New Yorker* passage is part of a personality profile, vivid, dramatic, using all the tricks of the trade to get the reader interested and keep him in suspense.

From *Life:*

Except in the field of surgery, control of pain is still very much in the primitive stages. Countless thousands of patients suffer the tortures of cancer, angina pectoris and other distressing diseases while their physicians are helpless to relieve

them. A big step toward help for these sufferers is now being made with a treatment known as nerve-blocking. This treatment, which consists of putting a "block" between the source of pain and the brain, is not a new therapy. But its potentialities are just now being realized., Using better drugs and a wider knowledge of the mechanics of pain gained during and since the war, Doctors E. A. Rovenstine and E. M. Papper of the New York University College of Medicine have been able to help two-thirds of the patients accepted for treatment in their "pain clinic" at Bellevue Hospital.

The nerve-block treatment is comparatively simple and does not have serious aftereffects. It merely involves the injection of an anesthetic drug along the path of the nerve carrying pain impulses from the diseased or injured tissue to the brain. Although its action is similar to that of spinal anesthesia used in surgery, nerve block generally lasts much longer and is only occasionally used for operations. The N. Y. U. doctors have found it effective in a wide range of diseases, including angina pectoris, sciatica, shingles, neuralgia and some forms of cancer. Relief is not always permanent, but usually the injection can be repeated. Some angina pectoris patients have had relief for periods ranging from six months to two years. While recognizing that nerve block is no panacea, the doctors feel that results obtained in cases like that of Mike Ostroich *(next page}* will mean a much wider application in the near future.

From *The New Yorker*:

: . . Recently, [Rovenstine] devoted a few minutes to relieving a free patient in Bellevue of a pain in an arm that had been cut off several years before. The victim of this phantom pain said that the tendons ached and that his fingers were clenched so hard he could feel his nails digging into his palm. Dr. Rovenstine's assistant, Dr. E. M. Papper, reminded Rovenstine that a hundred and fifty years ago the cure would have been to dig up the man's arm, if its burial place was known, and straighten out the hand. Rovenstine smiled. "I tell you," he said. *"We'll* use a two-percent solution of procaine, and if it works, in a couple of weeks we'll go on with an alcohol solution. Procaine, you know, lasts a couple of weeks, alcohol six months or longer. In most cases of this sort,! use the nerve block originated by Labat around 1910 and improved on in New Orleans about ten years back, plus one or two improvisations of my own." (Nerve blocking is a method of anesthetizing a nerve that is transmitting pain.) . . .

The man with the pain in the nonexistent hand was an indigent, and Rovenstine was working before a large gallery of student anesthetists and visitors when he exorcised the ghosts that were paining him. Some of the spectators, though they felt awed, also felt inclined to giggle. Even trained anesthetists sometimes get into this state during nerve-block demonstrations because of the tenseness such feats of magic induce in them. The patient, thin, stark-naked, and an obvious product of poverty and cheap gin mills, was nervous and rather apologetic when he was brought into the operating theatre. He lay face down on the operating table. Rovenstine has an easy manner with patients, and as his thick, stubby hands roamed over the man's back, he gently asked, "How you doing?" "My hand, it is all closed together, Doc," the man answered, startled and evidently a little proud of the attention he was getting. "You'll be O.K. soon," Rovenstine said, and turned to the audience. "One of my greatest contributions to medical science has been the use of the eyebrow pencil," he said. He took one from the pocket of his white smock and made a series of marks on the patient's back, near the shoulder of the amputated arm, so that the spectators could see exactly where he was going to work. With a syringe and needle, he raised four small weals on the man's back and then shoved long needles into the weals. The man shuddered but said he felt no pain. Rovenstine then attached a syringe to the first needle, injected

the procaine solution, unfastened the syringe, attached it to the next needle, injected more of the solution, and so on. The patient's face began to relax a little. "Lord, Doc," he said. "My hand is loosening up a bit already." "You'll be all right by tonight, I think," Rovenstine said. He was.

A comparative analysis of these two passages is shown in Table 7. The two passages furnish a good illustration of the stylistic features measured and emphasized by the two new formulas.

Table 7

Comparative Analysis of Treatment of the Same Theme in *Life* and *The New Yorker*

	Life (290 words)	*New Yorker* (495 words)
Old Formula:		
Average sentence length in words	23	18
Affixes per 100 words	48	35
Personal words per 100 words	2	11
Readability score	5.16	3.20
New Formula A:		
Average sentence length in words	22	18
Syllables per 100 words	165	145
“Reading ease” score	46	66
New Formula B:		
Personal words per 100 words	2	11
Personal sentences per 100 sentences	0	41
“Human interest” score	7	53

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