Reading Levels for Children Books
(and many other applications)

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inspired by presentation given by Adina C. in Core 109 (fall 2016)

is this book appropriate for a 6 year old or is it more suitable for an 11 year old?

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- why do we care about readability score of books?
    - children use books to learn:
        - books that are too hard may discourage students from reading more
        - books that are too easy do not challenge the students and may be boring
    - second language learners use books to learn the language

readability scores

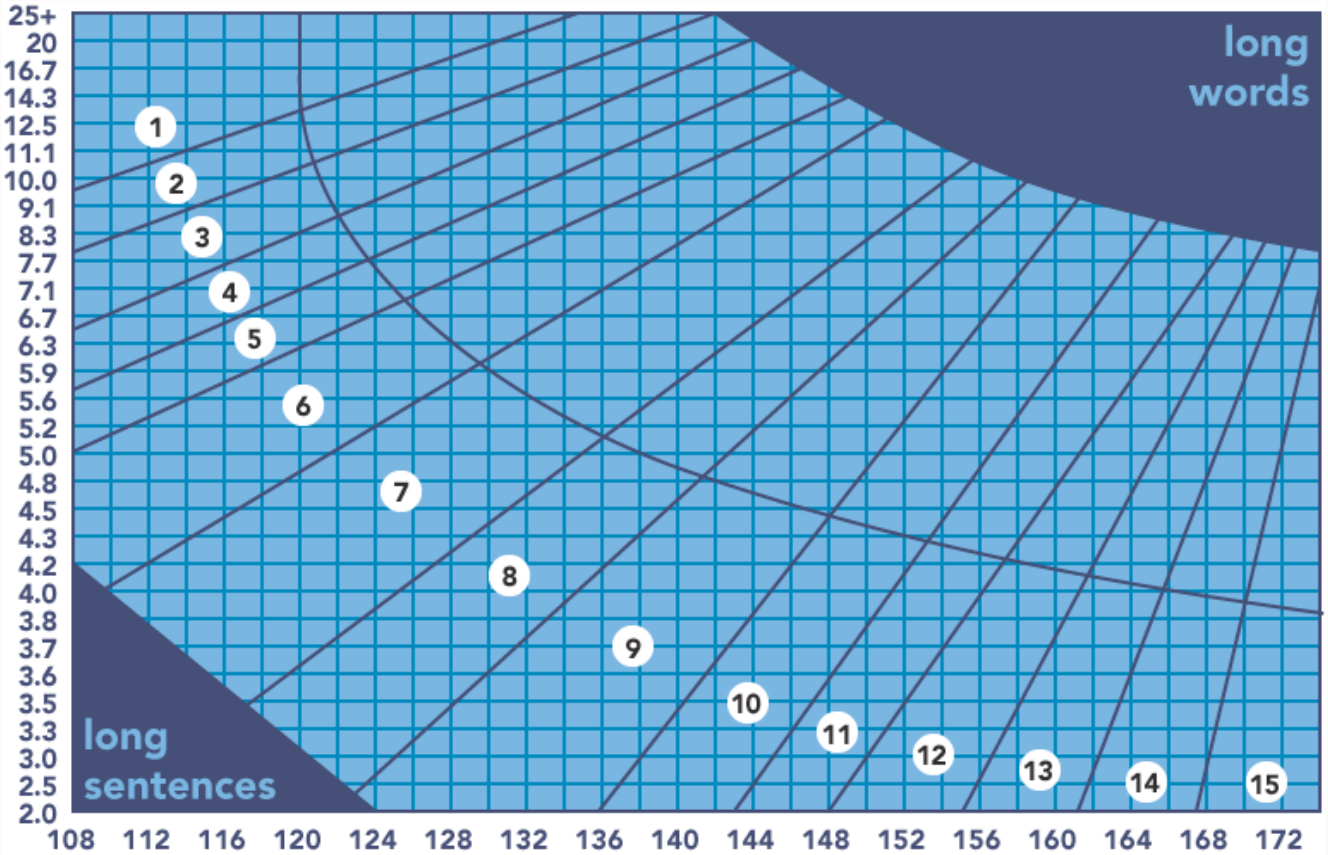
Fry Readability Formula

- developed by Edward Fry
- for English texts (why do you think this matters?)
- how is it calculated:
  - determine the average number of sentences per hundred words (vertical axis)
  - determine the average number of syllables per hundred words (horizontal axis)
  - find the point of intersection of those two values in the Fry Graph (next slide)

Source: https://en.wikipedia.org/wiki/Fry_readability_formula

Online test: http://www.readabilityformulas.com/free-fry-graph-test.php

Fry Readability Formula



A rendition of the Fry graph.

Source: https://en.wikipedia.org/wiki/Fry_readability_formula

Flesch-Kincaid Index

- developed by Rudolf Flesch and J. Peter Kincaid
- developed for the United States Navy
  - first used in 1978 for assessing difficulty of technical manuals
- Pennsylvania was the first US state to require that automobile insurance policies are written with no higher level than the ninth grade on the Flesch-Kincaid index
  - this is now a standard across the country
- the forumla used for calculation:

$$0.39 \left(\frac{\text{total words}}{\text{total sentences}} \right) + 11.8 \left(\frac{\text{total syllables}}{\text{total words}} \right) - 15.59$$

- the result is a number that corresponds with a U.S. grade level
- Note: The lowest grade level score in theory is −3.40, but there are few real passages in which every sentence consists of a single one-syllable word. Green Eggs and Ham by Dr. Seuss comes close, averaging 5.7 words per sentence and 1.02 syllables per word, with a grade level of −1.3. (Most of the 50 used words are monosyllabic; "anywhere", which occurs eight times, is the only exception.)

Source: https://en.wikipedia.org/wiki/Flesch%E2%80%93Kincaid_readability_tests

Dale-Chall Readability Test

- developed by Edgar Dale and Jeanne Chall
- attempts to determine comprehension difficulty of the text
- originally (1948) used 763 words that were considered simple (80% of fourth-grade students were familiar with those words),
  in 1995 extended to 3,000 words
- list of 3,000 familiar words:
  - https://wordcounttools.com/list-of-3000-familiar-words.html
  - http://www.readabilityformulas.com/articles/dale-chall-readability-word-list.php

Dale-Chall Readability Test

the forumla used for calculation:

$$0.1579\left(\frac{\text{difficult words}}{\text{words}} \times 100\right) + 0.0496\left(\frac{\text{words}}{\text{sentences}}\right)$$

- adjustment: if the percentage of difficult words is above 5%, then add 3.6365 to the raw score to get the adjusted score, otherwise the adjusted score is equal to the raw score
- score interpretation

Score	Notes
4.9 or lower	easily understood by an average 4th-grade student or lower
5.0–5.9	easily understood by an average 5th or 6th-grade student
6.0–6.9	easily understood by an average 7th or 8th-grade student
7.0–7.9	easily understood by an average 9th or 10th-grade student
8.0–8.9	easily understood by an average 11th or 12th-grade student
9.0–9.9	easily understood by an average 13th to 15th-grade (college) student

Source: https://en.wikipedia.org/wiki/Dale%E2%80%93Chall_readability_formula

SMOG Readability Formula

- SMOG is an acronym for Simple Measure of Gobbledygook
- developed by G. Harry McLaughlin in 1969
- A 2010 study published in the Journal of the Royal College of Physicians of Edinburgh stated that “SMOG should be the preferred measure of readability when evaluating consumer-oriented healthcare material.” The study found that “The Flesch-Kincaid formula significantly underestimated reading difficulty compared with the gold standard SMOG formula.”
- approximate algorithm for calculating SMOG:
    - count the words of three or more syllables in three 10-sentence samples (beginning, middle, and end are often used),
    - calculate/estimate the count's square root (from the nearest perfect square),
    - add 3

Source: https://en.wikipedia.org/wiki/SMOG

SMOG Readability Formula

Complete algorithm:

- Count a number of sentences (at least 30)
- In those sentences, count the polysyllables (words of 3 or more syllables).
- Calculate

$$\text{grade} = 1.0430\sqrt{\text{number of polysyllables} \times \frac{30}{\text{number of sentences}}} + 3.1291$$

(this formula is valid for number of sentences >= 30)

SMOG Readability Formula

SMOG Conversion Table (based on approximate formula)

Total Polysyllabic Word Count	Approximate Grade Level
1 - 6	5
7 - 12	6
13 - 20	7
21 - 30	8
31 - 42	9
43 - 56	10
57 - 72	11
73 - 90	12
91 - 110	13
111 - 132	14
133 - 156	15
157 - 182	16
183 - 210	17
211 - 240	18

evaluating texts

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- how can we calculate these values given a HUGE string that contains the text?

Reading List

- This Surprising Reading Level Analysis Will Change the Way You Write by Shane Snow
- Who is reading your writing?, The Ohio State University Medical Center