THE READABILITY OF GERMAN TEXTBOOKS: SAN SALVADOR (STORY)

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Annotation: In this article, we will examine the importance of readability, research of German readability formulas as the Hohenheim Formula, the Flesch Reading Ease formula, the Wiener Sachtextformel. We will delve deeper into Wiener Shachtextformel pivotal formula in German linguistics to conduct a comprehensive analysis of texts

KEY WORDS: Readability formulas, German readability, Hohenheim Formula, Flesch Reading Ease formula, Wiener Sachtextformel, Text comprehension, Sentence length, Word complexity, Index of Complex Words (IW**), Mean Sentence Length (MS), Mean Syllables per Word (SL),** Proportion of Exotic or Special Words (ES), Text difficulty, Text analysis, **Educational materials**

The concept of *readability* in textbooks pertains to the extent to which a written text can be easily comprehended by the reader. This notion exists both in natural languages and programming languages; however, the characteristics and parameters that define readability in each domain diverge significantly. Despite these differences, the overarching objective in both contexts remains the same: to effectively convey information in a manner that is both cognitively accessible and efficiently digestible. In the context of natural languages, textual readability is influenced by a multitude of factors, foremost among which are **semantic and structural elements**. These include the lexical richness of the text, the complexity or simplicity of the language employed, syntactic constructions, and grammatical variations. Texts replete with complex sentence structures and dense academic terminology often impose a higher cognitive load on the reader, thereby reducing readability. In contrast, straightforward syntax and familiar vocabulary facilitate a smoother reading experience. Additionally**, typographical considerations**—such as font size, line length, spacing between characters, and the overall layout of the text on the page—play a crucial role in influencing how effortlessly a text can be read. Even seemingly minor elements, such

as the selection of a legible and reader-friendly typeface, can significantly enhance reading speed and comprehension.

Readability is equally paramount in the domain of programming, where it serves not merely an aesthetic function but a practical one. Code must be interpretable not only by the originating programmer but also by other developers and by machines with varying architectures. Readable code is characterized by clarity, consistency, logical structure, and adherence to established conventions. In essence, it ensures the longevity, maintainability, and collaborative potential of software projects.

Historically, the concern with readability has persisted over centuries, challenging linguists, philosophers, and scholars alike. Emphasis has long been placed on the **organizational coherence, structural consistency, and rhetorical clarity** of texts. One of the early voices in this discourse was the English professor L. A. Sherman, who, as early as 1880, expressed concern over a noticeable decline in average sentence length in English prose. During the Elizabethan era, the typical sentence comprised approximately 50 words. By the late 19th century, in Sherman's own time, this figure had decreased to an average of just 23 words—a shift he found alarming.

Initially, no formal formula existed for evaluating readability. Instead, the readability of texts and books was estimated subjectively or through rough approximation—a method commonly referred to as grade-level estimation. This approach relied heavily on personal judgment and was thus inherently subjective. However, such estimations often failed to adequately account for the purpose, visual design, illustrative components, and structural organization of the text.

Grade-level estimation proved more applicable in contexts where reading difficulties were easily identifiable, such as in literature intended for early school-aged children. However, this method proved inadequate for analyzing more complex texts, such as those found in novels or literary fiction, where individual reading difficulties are more nuanced and harder to quantify.

In response to these limitations, by the 1920s, educational researchers began developing scientifically grounded assessments aimed at evaluating students' reading achievements. The ultimate goal of these efforts was to enhance readability across educational materials. These investigations were primarily conducted by university psychologists and were later adopted by textbook publishers.

In 1921, a scholar named Harry D. Kitson published a book entitled *The Mind of the Buyer*. In this work, he analyzed two journals and two newspapers, concluding that shorter sentences and more concise word choices were among the most critical factors contributing to a text's readability. His findings laid the groundwork for future, more objective readability assessment tools.

By 1923, Bertha A. Lively and Sidney L. Pressey developed a formula known as the *"reading ease"* formula. This formula significantly simplified the process of evaluating readability compared to earlier methods.

Readability formulas designed to assess the comprehensibility level of texts have since been developed for many languages by linguists and subject matter experts. These formulas are used to classify textbooks and instructional materials according to students' age and grade level, making them more appropriate for the target audience.

Naturally, such formulas have also been created for the German language. Some of them were developed specifically for German, while others were originally designed for different languages and later adapted for German use. Notable examples include the Flesch Reading Ease, the Hohenheim Formula, and the Wiener Sachtextformel, all of which are commonly used to evaluate the readability of German texts.

The Flesch Reading Ease formula was originally developed by Rudolf Flesch in 1948 for evaluating the readability of English texts. Although it was initially designed for the English language, the formula was later adapted to suit the phonetic and grammatical characteristics of the German language.

FRE = 206.835 - 1.015 * (W / S) - 84.6 * (Sy / W)

The Hohenheim Formula

The Hohenheim formula is employed to provide a quicker and more accessible assessment of the readability of German-language texts. It places particular emphasis on two key factors: **sentence** length and the complexity of words used within a text. The formula emerged in the late 20th century and early 21st century, as part of efforts to refine readability measures tailored specifically to the linguistic characteristics of the German language.

Its structure is as follows:

HIX = 180 - aSL - (aSC per word × 58.5)

Although inspired by earlier models—most notably Rudolf Flesch's Reading Ease formula—the Hohenheim formula was designed to address the specific syntactic and morphological complexity inherent in German. Given that German grammar and word formation tend to be more intricate compared to many other languages, language-specific models were deemed necessary to achieve more accurate assessments.

As a result, multiple readability formulas have been developed and refined to suit various types of German texts, ranging from scientific and formal writing to everyday communication. These formulas now function as adaptable models capable of evaluating readability across diverse textual contexts.

The Wiener Sachtextformel was developed by Richard Bauberger in 1970 as a novel and more precise formula designed to measure the complexity of scientific and technical information. This formula evaluates characteristics such as sentence length, word length, and word structure—particularly focusing on long and complex words.

It is regarded as one of the most prominent readability formulas used specifically for the German language. The Wiener Sachtextformel is especially suited for assessing scientific texts, textbooks, and technical documents.

The formula provides a quantitative rating of the text's difficulty level, which helps determine whether a given textbook is appropriate for school students, university students, or specialists.

The name of the formula is derived from the city of Vienna (Wien), reflecting its place of origin, hence the designation "Wiener."

According to this formula:

1. The complexity of reading escalates proportionally with the increase in average sentence length, as longer sentences impose greater cognitive load on the reader.
2. An increase in the length of words—particularly those comprising multiple syllables or extended phonetic structures—further exacerbates the difficulty of text comprehension.
3. The prevalence of complex lexical items, such as technical jargon or specialized scientific terminology, significantly intensifies the overall reading complexity and reduces readability.

This formula is stratified into four distinct mathematical variants, each designed to accommodate varying levels of analytical precision and application contexts.

WSTF1 Formula:

$0.1935 \times MS + 0.1672 \times SL + 0.1297 \times IW - 0.0327 \times ES - 0.875$

MS — Mean Sentence Length

SL — Mean Syllables per Word

IW — Index of Complex Words

ES — Proportion of Exotic or Special Words

This version is the most comprehensive, as it takes into account four different measures. Consequently, the results it produces are the most accurate and detailed. It is well-suited for extensive scientific research and in-depth analysis.

WSTF2 Formula

Formula:

$0.2007 \times MS + 0.1682 \times SL + 0.1373 \times IW - 2.779$

MS (Measurement Scale — the scope or extent of measurement)

SL (Scale Level — the degree or stage of measurement)

IW (Importance Weight — the significance or weighting of the measurement)

Description: This version represents a simplified iteration of the WSTF1 formula. The ES (Environmental Score — an indicator of environmental factors) has been omitted, meaning that environmental considerations are excluded from the calculation. Consequently, the computational process is somewhat streamlined, yet the

resulting output maintains a reasonable degree of accuracy. This formula incorporates the MS, SL, and IW measurements.

WSTF3 Formula

Formula:

0.2963 × MS + 0.1905 × SL – 1.1144

Key Measurements:

- **MS** (Measurement Scale — the scope or extent of measurement)
- **SL** (Scale Level — the degree or stage of measurement)

Description:

This formula considers only two primary measurements — MS and SL. The IW and ES indicators have been excluded. As a result, the calculation process is simplified and faster to perform. However, since some data points are omitted, the level of accuracy may decrease. This formula is suitable for rapid and simplifiedWSTF4 Formula

Formula:

0.2744 × MS + 0.2656 × SL – 1.693

Key Measurements:

- **MS** (Measurement Scale — the scope or extent of measurement)
- **SL** (Scale Level — the degree or stage of measurement)

Description:

This is the most simplified version. The formula includes only the MS and SL measurements, without any additional indicators. Therefore, the calculation is very quick and easy to perform. This formula is used in practice when time is limited or a rapid result is needed. However, the accuracy may decrease somewhat.

This formula determines the ease or difficulty of a text based on its indicators."

Score (Result)	Readability Level	Description
< 0	Very difficult	Suitable only for experts
0 – 1	Difficult	At the level of academic or scientific texts
1 – 2	Moderately difficult	Appropriate for upper-grade students or adults
2 – 3	Fairly easy	Suitable for the general public or typical readers
> 3	Very easy	Intended for children or elementary-level readers

"Let's analyze the following German story based on the following formula.

Peter Bichsel: San Salvador Er hatte sich eine Füllfeder gekauft. Nachdem er mehrmals seine Unterschrift, dann seine Initialen, seine Adresse, einige Wellenlinien, dann die Adresse seiner Eltern auf ein Blatt gezeichnet hatte, nahm er einen neuen Bogen, faltete ihn sorgfältig und schrieb: „Mir ist es hier zu kalt“, dann, „ich gehe nach Südamerika“, dann hielt er inne, schraubte die Kappe auf die Feder, betrachtete den Bogen und sah, wie die Tinte eintrocknete und dunkel wurde (in der Papeterie garantierte man, dass sie schwarz werde), dann nahm er seine Feder erneut zur Hand und setzte noch großzügig seinen Namen Paul darunter. Dann saß er da. Später räumte er die Zeitungen vom Tisch, überflog dabei die Kinoinserate, dachte an irgend etwas, schob den Aschenbecher beiseite, zerriss den Zettel mit den Wellenlinien, entleerte seine Feder und füllte sie wieder. Für die Kinovorstellung war es jetzt zu spät. Die Probe des Kirchenchores dauert bis neun Uhr, um halb zehn würde Hildegard zurück sein. Er wartete auf Hildegard. Zu all dem Musik aus dem Radio. Jetzt drehte er das Radio ab. Auf dem Tisch, mitten auf dem Tisch, lag nun der gefaltete Bogen, darauf stand in blauschwarzer Schrift sein Name Paul. „Mir ist es hier zu kalt“, stand auch darauf. Nun würde also Hildegard heimkommen, um halb zehn. Es war jetzt neun Uhr. Sie läse seine Mitteilung, erschräke dabei, glaubte wohl das mit Südamerika nicht, würde dennoch die Hemden im Kasten zählen, etwas müsste ja geschehen sein. Sie würde in den „Löwen“ telefonieren. Der „Löwen“ ist mittwochs geschlossen. Sie würde lächeln und verzweifeln und sich damit abfinden, vielleicht. Sie würde sich mehrmals die Haare aus dem Gesicht streichen, mit dem Ringfinger der linken Hand beidseitig der Schläfe entlangfahren, dann langsam den Mantel aufknöpfen. Dann saß er da, überlegte, wem er einen Brief schreiben könnte, las die Gebrauchsanweisung für den Füller noch einmal - leicht nach rechts drehen - las auch den französischen Text, verglich den englischen mit dem deutschen, sah wieder seinen Zettel, dachte an Palmen, dachte an Hildegard. Saß da. Und um halb zehn kam Hildegard und fragte: „Schlafen die Kinder?“ Sie strich sich die Haare aus dem Gesicht.

$$0.1935 \times MS + 0.1672 \times SL + 0.1297 \times IW - 0.0327 \times ES - 0.875$$

We will analyze the following German short story using the WSTF1 formula

1. Average Sentence Length (MS):

The text contains 16 sentences.

2. Average Syllables per Word (SL):

The text comprises 222 words.

The average syllables per word is approximately 1.5.

3. Index of Complex Words (IW):

There are 15 complex words identified in the text.

The index of complex words is 0.07.

4. Proportion of Exotic or Special Words (ES):

- The text includes 5 exotic or special words.

- The proportion is 0.02.

  Using the formula:

  $WSTF1 = (0.1935 \times MS) + (0.1672 \times SL) + (0.1297 \times IW) - (0.0327 \times ES) - 0.875$

  Substituting the values:

  $WSTF1 = (0.1935 \times 16) + (0.1672 \times 1.5) + (0.1297 \times 0.07) - (0.0327 \times 0.02) - 0.875$

  $WSTF1 = 3.096 + 0.2508 + 0.0091 - 0.000654 - 0.875$

  $WSTF1 \approx 2.480$ =

2 – 3	Fairly easy	Suitable for the general public or typical readers

This study examined the readability of German-language textbooks and the main formulas used to assess it — Flesch Reading Ease, Hohenheim Formula, and Wiener Sachtextformel (WSTF). The research revealed that the readability of a text largely depends on such factors as sentence length, word complexity, number of syllables per word, and the proportion of special or technical words. Historically, the assessment of readability relied on subjective judgment, but since the early 20th century, objective mathematical formulas have been developed to provide more accurate evaluations. Among these, the Wiener Sachtextformel stands out as one of the most precise and effective tools for analyzing the complexity of scientific and technical texts in German. The analysis of Peter Bichsel's short story "San Salvador" using the WSTF1 formula yielded a readability score of 2.48, which corresponds to the "fairly easy" level. This indicates that the text is generally accessible and understandable for the wider public.

In conclusion, scientifically assessing the readability of German textbooks not only facilitates students' comprehension and learning efficiency but also contributes to improving the overall quality of educational materials. Therefore, the application of readability formulas plays a vital practical role in modern education and textbook development.

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