AI-simplification of Mark Twain's The Adventures of Tom Sawyer:
Assessment and Considerations

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Contents

1. Readability
2. Simplification & LLMs & ChatGPT
3. Methodology

Chindris & Chitez / WUT / Romania

What is readability?

- Written texts have properties that make them understandable.
- Readability metrics measure sentence and word lengths.
- Common metrics: Flesch-Kincaid and Coleman-Liau scales.
- These scales indicate age suitability, not text coherence (Siddharthan 2004).

A. Flesch-Kincaid Grade Level

- Created in 1975.
- Calculates text difficulty using sentence length and syllables per word.
- Helps adapt texts to target audiences.

(Kincaid et al., 1975)

Source: https://readable.com/

B. Coleman-Liau Index

- Uses characters instead of syllables.
- Easier integration into automatic programs.
- More flexible and applicable to different languages.

(Coleman & Liau, 1975)

The Coleman-Liau Index

$$= (0.0588 \times L) - (0.296 \times S) - 15.8$$
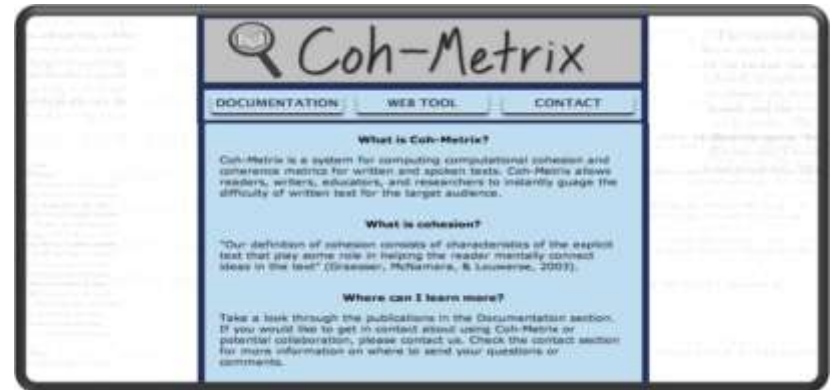
L = average number of letters per 100 words
S = average number of sentences per 100 words

Source: https://readable.com/

C. Coh-Metrix

- Developed at the University of Memphis.
- Analyzes text on a cognitive level.
- Evaluates lexical diversity, narrative coherence, and syntactic complexity.
- Goes beyond superficial text analysis.

(Graesser et al., 2003)

Source:
Dowell, Nia & Graesser, Arthur & Cai, Zhiqiang. (2015). Language and Discourse Analysis with Coh-Metrix: Applications from Educational Material to Learning Environments at Scale. *Journal of Learning Analytics*. 3. 10.18608/jla.2016.33.5.

Why is readability important for education?

- Educators adapt texts for their audience's comprehension.
- Text simplification aims to make texts more accessible.
- Simplification preserves the meaning while reducing complexity.
- Examples: dis-embedding clauses, active voice, easier synonyms.

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Benefits of text simplification

- Simplification helps various groups: schoolchildren, low-literacy communities and individuals with certain cognitive impairments.
- Makes classic literature more accessible.
- Supports ESL learners and those with special needs.
- Enhances engagement and understanding.

Relevance of LLMs for this study

- LLMs (Large Language Models) have evolved significantly
- Shift from rule-based systems to AI models
- Examples: ChatGPT, Perplexity, BERT
- These models create human-like language

Focus on ChatGPT

- ChatGPT simplifies text by replacing difficult words with simpler synonyms.
- Breaks down complex sentences into simpler ones.
- Enhances coherence and clarity.
- ChatGPT-4 recognizes complicated structures and provides contextual synonyms (Liu et al., 2023).

ChatGPT in practice

- Used in education to aid understanding of complex topics.
- Benefits in healthcare, cultural events, and customer service.
- Helps in everyday contexts by simplifying texts.
- Improves accessibility for specialized and general audiences.

Source: https://arxiv.org/pdf/2304.02017

What is missing?

- Studies highlight ChatGPT's ability to simplify texts
- Lack of research on classic literature simplification
- Focus on 'The Adventures of Tom Sawyer'

Aim of our research:
➢ **investigate ChatGPT's simplification effectiveness on school literature.**

Stages

1. **Selection of excerpts** from 'The Adventures of Tom Sawyer'
2. **Analysis** using readability formulas
3. **Simplification** using ChatGPT-4
4. **Evaluation** of readability and simplification impact

Which readability scores?

- Importance of readability scores in simplification
- We used Flesch-Kincaid, Coleman-Liau and Coh-Metrix
- We evaluated text complexity before and after simplification
- We established baseline readability for comparison

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Selection & analysis of fragments

- Excerpts from 'The Adventures of Tom Sawyer'
- Analyzed using readability formulas
- Simplified using ChatGPT-4
- Focus on lexical and syntactic simplifications

Simplification & evaluation process

- Simplification using ChatGPT-4
- Focus on lexical changes and syntactic simplification
- Simplified through two modalities: (1) dialogue and (2) imagery
- Evaluation of readability scores post-simplification

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Examples of analysis

- Original vs. simplified fragments
- Comparison of readability scores
- Impact on understanding and engagement
- Two examples for thorough analysis

Original fragment (1)

"Tom gave up the brush with reluctance in his face but alacrity in his heart..."

(Twain 2007, p. 21)

- Advanced vocabulary and complex structures.
- Challenging for younger readers.
- Suitable for older readers with advanced skills.

Simplified fragment (1)

"Tom gave the brush to Ben slowly, but he was happy inside..."

(OpenAI)

- Simpler words and shorter sentences.
- Improved accessibility for younger readers.
- Retains original meaning while enhancing clarity.

Readability comparison (fragment 1)

- Original: Flesch-Kincaid 7.02, Coleman-Liau 6.38
- Simplified: Flesch-Kincaid 3.81, Coleman-Liau 4.70
- Coh-Metrix: Higher narrativity and syntactic simplicity in simplified versions

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Original fragment (2)

"**A few minutes later Tom was in the shoal water of the bar, wading toward the Illinois shore...**"

(Twain 2007, p. 95)

- Complex descriptions and advanced vocabulary.
- Suitable for older, advanced readers.
- Highlights Tom's struggle with the current.

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Simplified fragment (2)

"A few minutes later, Tom was in the low water, walking to the Illinois shore..."

(ChatGPT)

- Simpler descriptions and vocabulary
- Improved readability for younger audience
- Maintains key events and narrative flow

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Creation of visual aid

- Used DALL-E to generate visual aids
- Collage of images to illustrate scenes
- Helps children visualize and understand the text
- Complemented textual simplification

Readability comparison (fragment 2)

- **Original**: Flesch-Kincaid 9.51, Coleman-Liau 10.66
- **Simplified**: Flesch-Kincaid 5.76, Coleman-Liau 7.29
- **Coh-Metrix**: Increased narrativity and syntactic simplicity in simplified version
- **Visual aids** enhance comprehension

Questionnaire design

- Google Forms questionnaire
- 21 primary and middle-school students from *Learning Together* Multidisciplinary Center (Arad, Romania)
- Questions on word understanding and engagement
- Two sections: lexical/syntactic and dialogue/imagery simplifications

Questionnaire results (fragment 1)

- 40.9% found words "Very easy" to understand.
- Dialogue-based simplification: 42.9% "A lot", 52.4% "Somewhat"
- Variability in children's language levels

Questionnaire results (fragment 2)

- Visual aids: 90.5% found them helpful
- Simplified text and visual aids improve comprehension
- Visual materials make texts more engaging
- Suitable for primary-school children

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Discussion & conclusions

- AI-driven simplifications enhance readability
- descriptions
- Visual aids complement text simplification
- Positive feedback from students on readability and engagement
- Simplifications are beneficial for educational contexts
- Trade-offs: reduced narrative depth and detailed
- Future studies: broader text types and larger sample sizes

Thank you!

Please visit our webpage to find out details about our studies, projects and tools:

https://codhus.projects.uvt.ro/

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