Tools and services for text adaptation

Arne Jönsson
Natural Language Processing Laboratory
Division of Human-centered design
Department of Computer and Information Science

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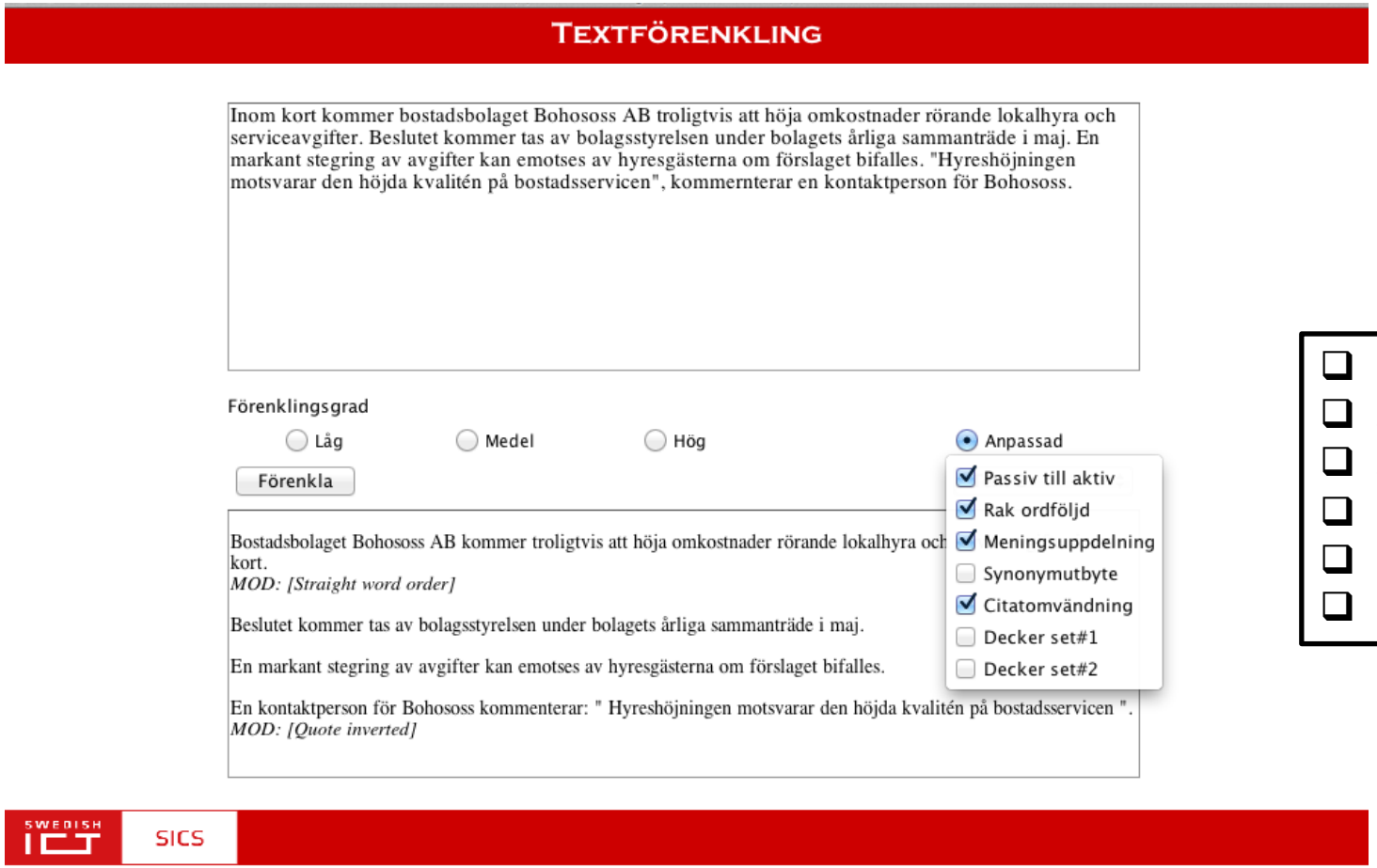
Extractive summarization

Slider to change summarization

Syntactic simplification



- ❑ Passive to active
- ❑ Straight word order
- ❑ Sentence split
- ❑ Quotation inversion
- ❑ .
- ❑ .

Challenges

- How to express text adaptation needs
  - Lexical
  - Syntactic
  - Text complexity
- Different users
  - Text producers
  - Teachers
  - End users

End user demands

Reader audience	Examples of experienced difficulties
Dyslexia	Long and unfrequent words, homophones, ortographically similar words, new words
Aphasia	High information density, long sentences, long sequences of adjectives, passive tense, compound words
Second language learners	Limited vocabulary, cultural phenomena, text structure
Hearing impairment	Complex grammatical constuctions, text structure
Intellectual disabilities	Difficulties related to working memory, motivation for reading

Text adaptation as design of intelligent agents

Outline

- Interaction design and User experience
- Text adaptation examples
- Visualisation of text complexity
- Evaluations

Interaction design and UX

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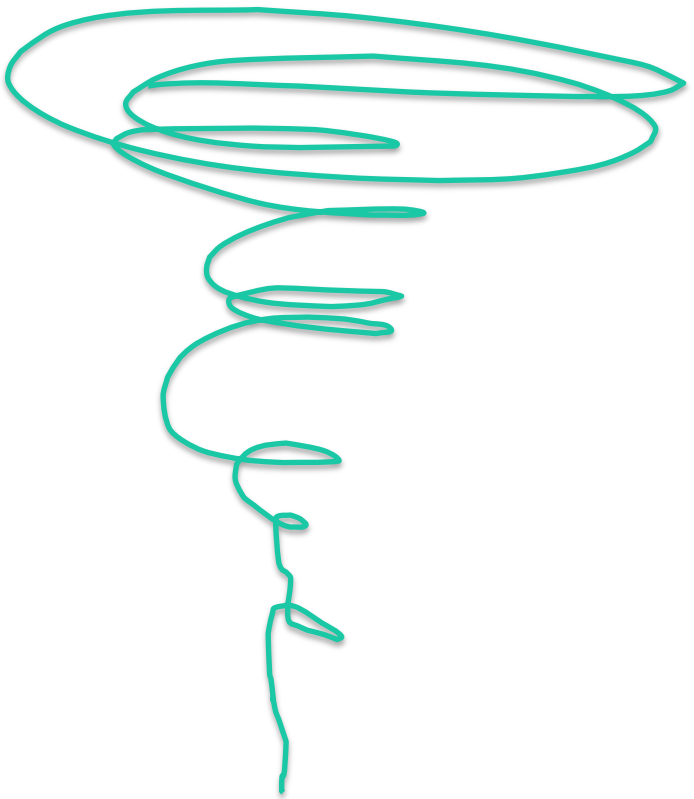
Definitions
(ISO 9241-210:2010)

- Human-centred design
  - approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques
- User Experience, UX
  - person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service

Three phases

- Concept phase
  - Ideas
- Adaption phase
  - Protoypes
- Details phase
  - Product



Concept phase

- Interviews
- Workshops
- Observations
- Literature reviews and previous studies
- Personas

Mapping users´ experiences of an intelligent agent

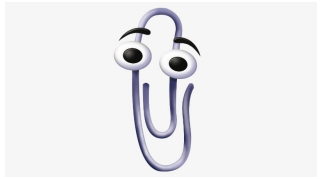
	Before use	During use	After use
What the user knows • Knowledge • Imaginations • Goals	Reading difficulties Goal: understand a text	New words Text properties	Text content
What the user does • Step by step • Tools and means	Start up	Adapt lexically, syntacticly, contextually View text properties	Save results and profiles Get feedback
What the user feels • Experiences • Feelings • Driving forces	Avoidance	Text gets easier to decode and comprehend	Satisfaction

Arvola, *Interaktionsdesign och UX,* Studentlitteratur, 2020.

Posture and embodiment

How the system presents itself to users

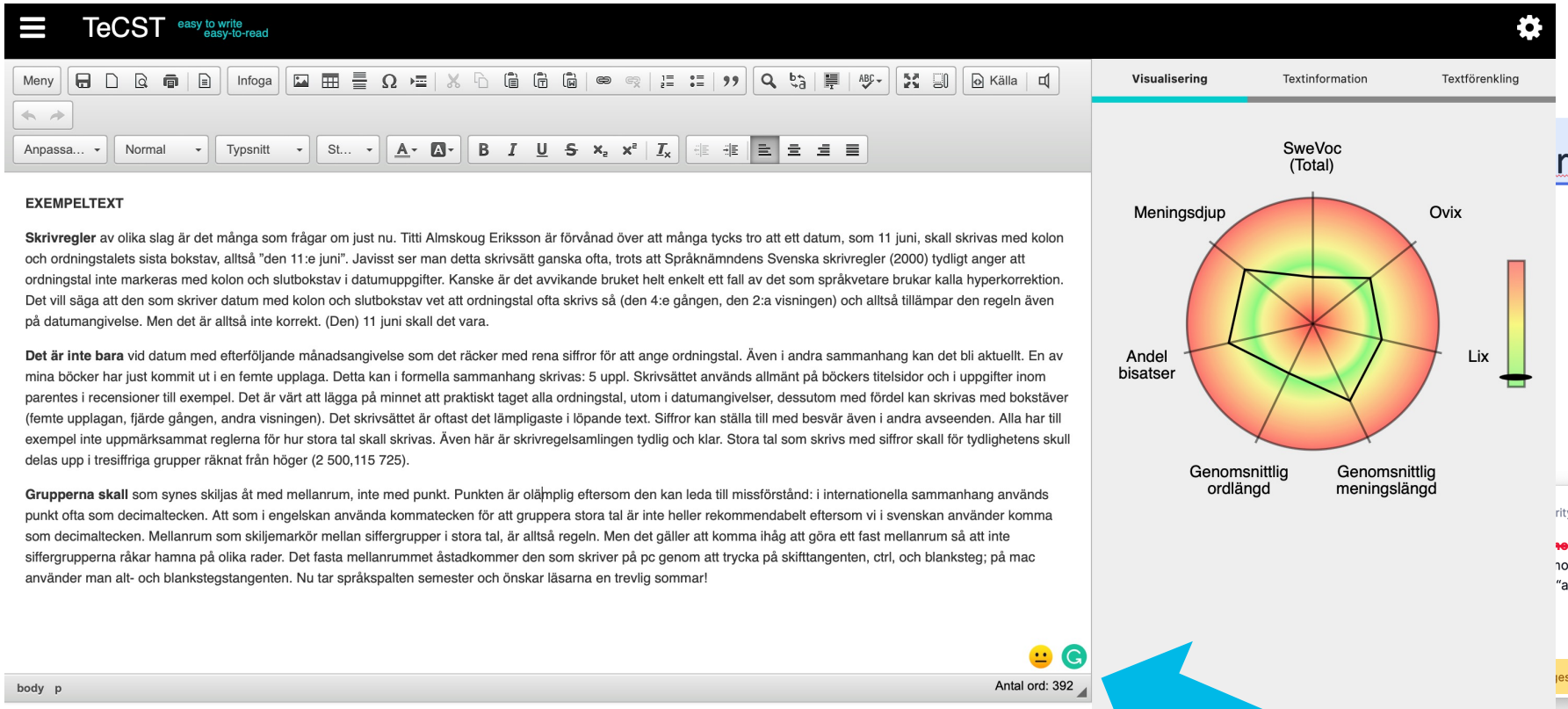
	Robot	Virtual agent	Embedded system
Sovereign			*Mail client*
Transient	Furhat	Clippy	SIMPLIFICA, AMesure
Daemonic			*Background processes*
Parasitic, Assisting		Alexa	Grammarly



Cooper, *et.al.,. About face 3: The essentials of interaction design (3. ed.)*. Hoboken: Wiley, 2007.

Grammarly

”Grammarly analyzes your text for not only misspellings but also commonly-confused words used in the wrong context, like “affect” and “effect.” You can improve your writing.”



Adaptation phase: Prototypes

- A simulation of the final product, not the final product.
- Interactive mock-up with varying degrees of fidelity. Not necessarily looking like the final product.
  - Paper prototyping (using paper, pencil, sticky notes, and index cards)
  - Computer prototypes (Power point, Adobe animate, Figma etc)
  - Wizard of Oz
- Gives insights into the users' interaction, the use flow.
- Test the feasibility and usability. Lead to unexpected discoveries and innovations.

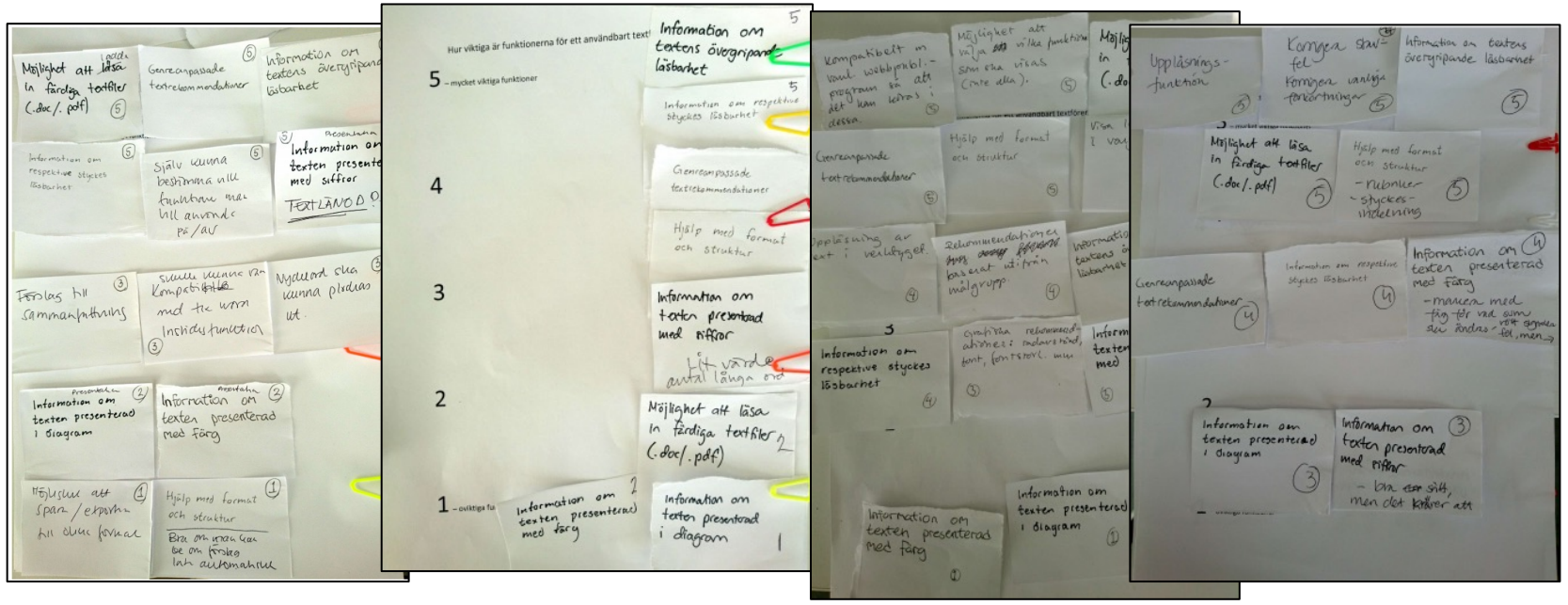
Text adaptation examples

Workshops

- A tool to write less complex
- Text producers
    - Web editors
- 2 workshops
  - Needs and functionality. Concept phase
  - Interaction and visualisation. Adaption phase

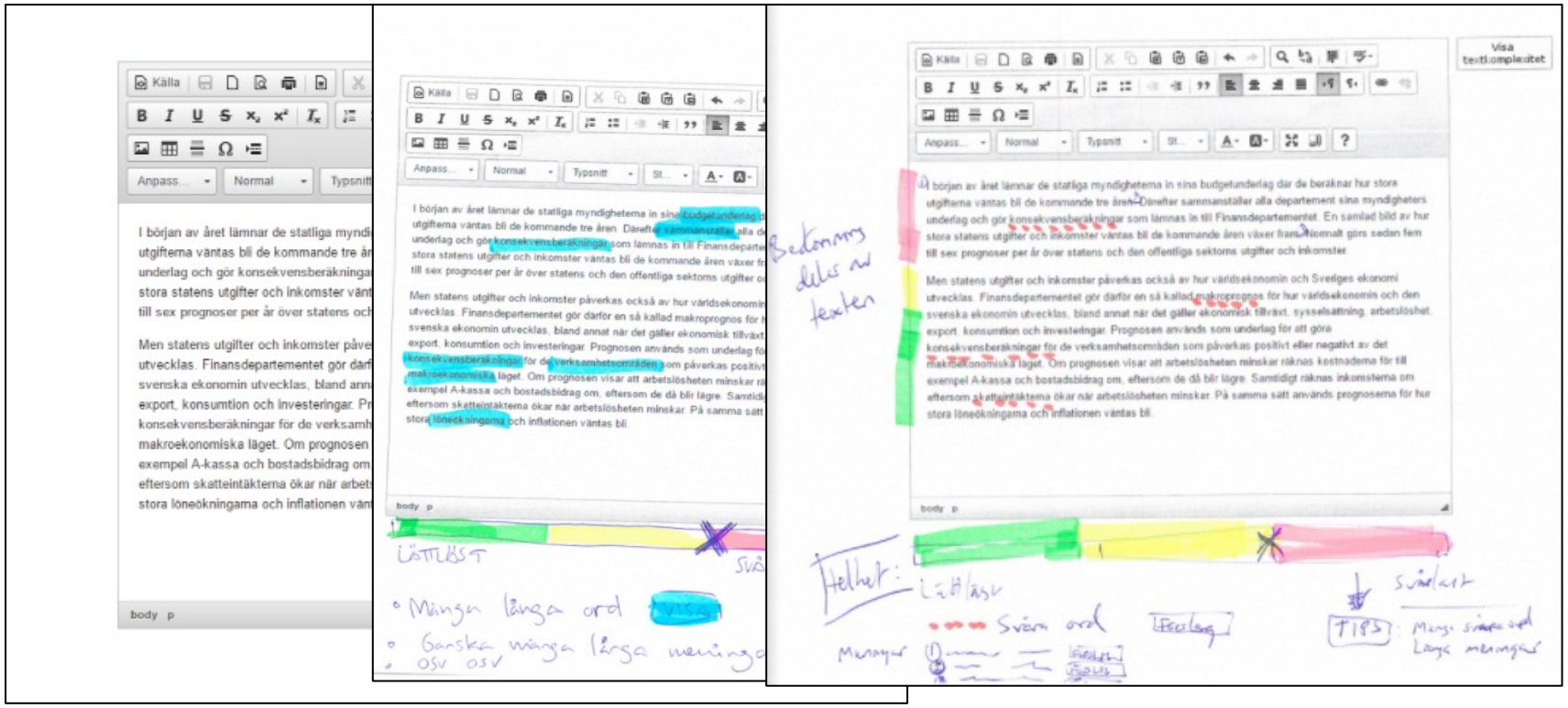
Workshop A

- Needs and functionality
- Storyboards and brainstorming
- Four web editors



Workshop B

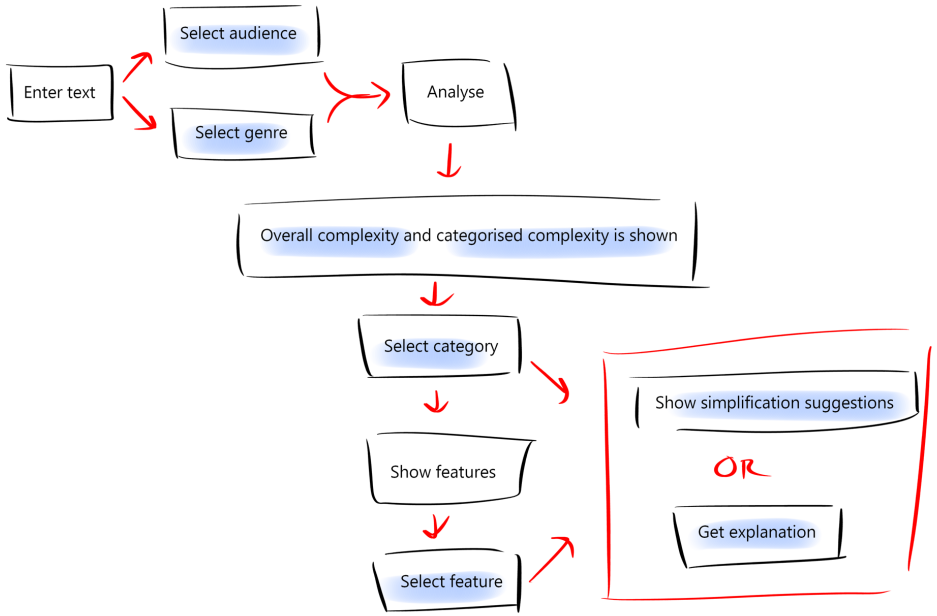
- Interaction and visualisation
- Prototype evaluations
- Seven web editors



Results

Easy to use

- Supportive, no extra work
  - Clear connection between analysis and suggestions
- Adaptable and simple
  - Explanations
- Want readability measures
  - Understandable measures
  - Connected to passages in the text



Scenario based design

- Short storys about users and their activities.
- Typical use cases with a focus on goals.
- No interface details.
- Objects and actions.

Personas and scenarios

- Realistic, but fictive, user
  - Representing multiple users
- Example: Birgitta, one of our personas
  - Based on semistructured interviews
  - 17 students with varying reading problems and needs
  - Each interview lasted 1-1.5h
  - Recorded and transcribed
  - Identify behaviour variables
    - Grouping determines how many personas, Birgitta one of four

Persona

Birgitta has been visually impaired all her 53-year-old life. She lives with her family in Lambohov and works at the Swedish Association of the Visually Impaired in Linköping. There she works with adult education for the visually impaired and other disabled people. Her duties include finding out what applies to the disabled with the employment service and the social insurance office and other legal aspects of academic studies. She also helps to bring various aids and extra resources to those who need them. This work requires that Birgitta is constantly updated on laws and regulations, which leads to a lot of searching and searching on the internet.

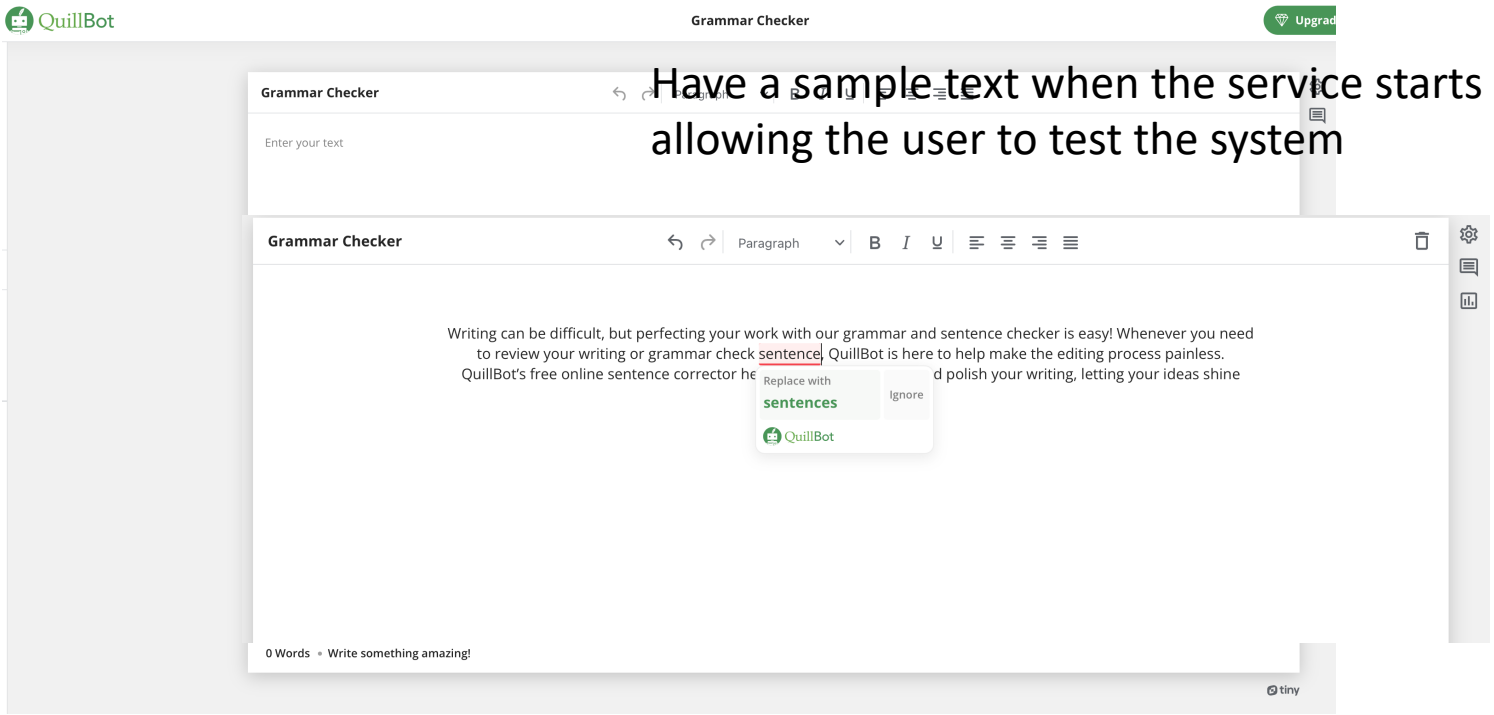
When she reads on the computer, she uses hers magnification program and if she has to read a lot of text, she uses her speech synthesis to help, as it takes a lot of time and energy to read even when she uses her magnification program. Speech synthesis is not that fun to listen to and that's why she only uses it when she absolutely has to. Birgitta thinks that she reads a lot unnecessarily just to find what she needs. She finds this difficult and sometimes wishes it had been easier to sift through the information she reads.

Birgitta has difficulty seeing the mouse on the screen and therefore usually uses arrow keys and keyboard shortcuts to navigate the screen. This works differently on different websites. Birgitta thinks that the authorities' websites usually work well, as they are often structured, without unnecessary information and sketchy pictures. Such websites are easy to navigate even when the screen magnifier is on. Structure is a must for Birgitta, if the website is unstructured, it will be almost impossible to find what she is looking for. If the website is sketchy with a lot of information and pictures, it is easy for the speech synthesis to get stuck and this can also happen with the screen magnification program, which Birgitta thinks is incredibly difficult. It takes both time and energy to shut down the computer and start over from the beginning after the computer has hung up.

Birgitta thinks that it will be easier for her to see the text if the colors are inverted, as she experiences that the contrast becomes clearer, which makes her see the text better. She also uses yellow glasses to increase the contrast in the real environment.

Design of AI services

- Guideline 10: Provide an environment for the user to familiarize themselves with the AI functionality in a test environment (sandbox).



Wärnestål, *Design av AI-drivna tjänster,* Studentlitteratur, 2021

First impression guidelines

- Guideline 17: Communicate what the service does. Help the user to understand what capabilities the service contributes and what data functionality is based on.
  - Training data for abstractive text summarisers affect the summary
  - Extractive summarisation can be incoherent
  - Rule based and model based text simplification
- Guideline 18: Communicate what the service does not do. Help the user to understand the limitations of the service.
  - Text analyis or text editor
  - Are texts changed or only suggestions

Continuous use guidelines

- Guideline 23: Let the service communicate uncertainties in the model of what the user's goal is, so that the user can make the final decision on what action to take.

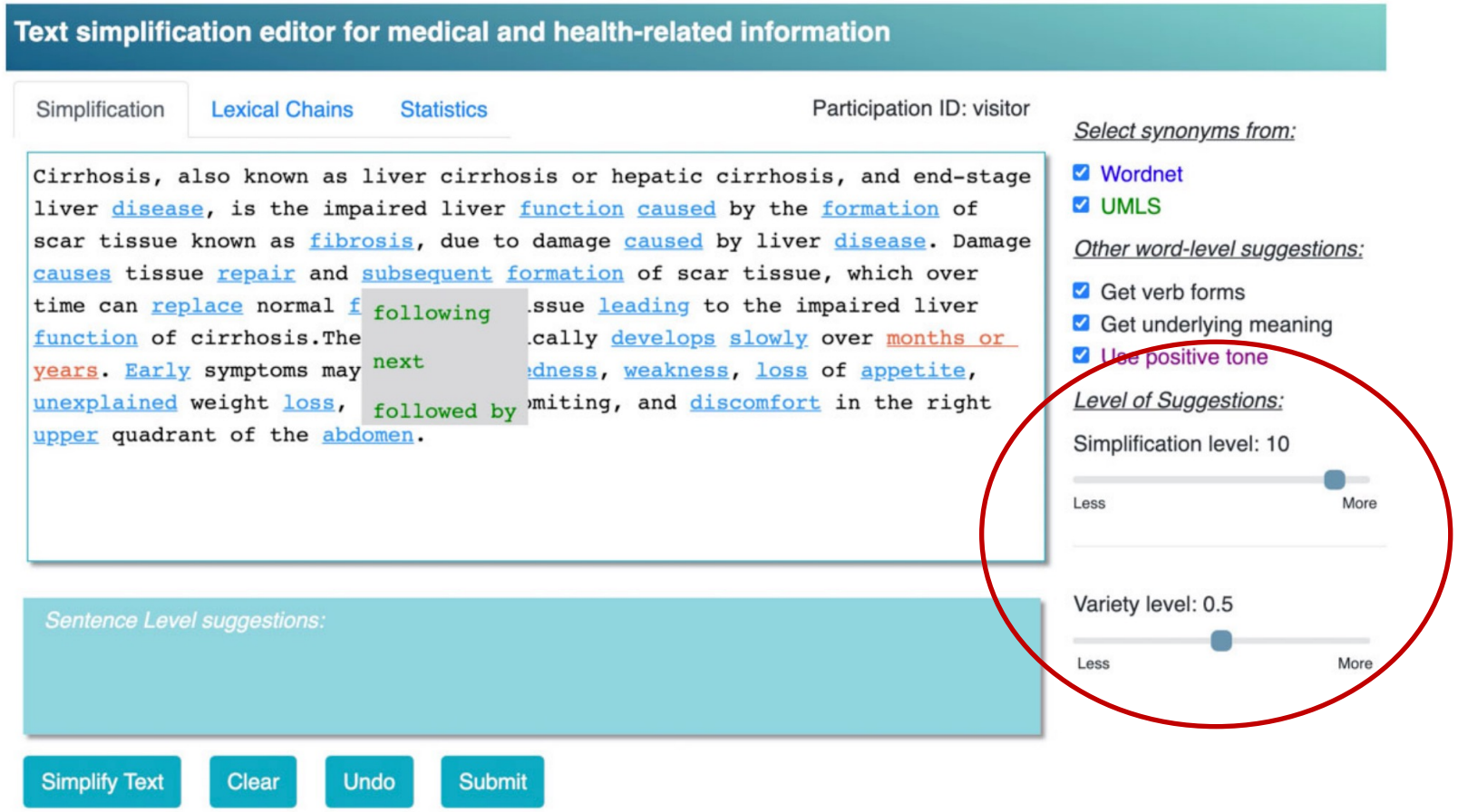
- Muliple synonyms displayed

Leroy *et.al.*, Evaluation of an online text simplification editor using manual and automated metrics for perceived and actual text difficulty, *JAIMA Open,* 2014

Continuous use guidelines, 2

- Guideline 19: Explain how well the service works. Help the user to establish the right level of expectation.

- Simplification level = number of words identified as difficult
- Variety level = number of alternatives

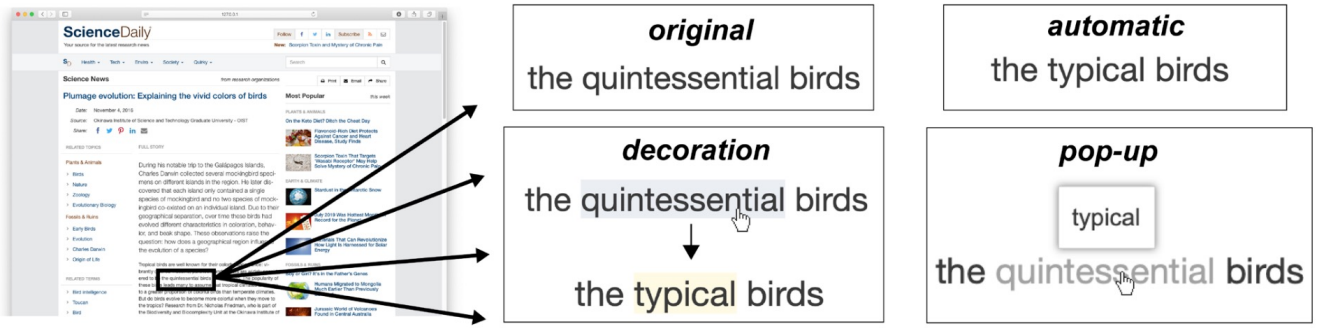


Continuous use guidelines, 3

- Guideline 24: Design the service so that it communicates predictions and leaves decision-making to the user.
  - Found in our workshops with web editors

Guideline 24: Lexical simplification

- Study with deaf and hard of hearing
- Three different conditions, and a baseline



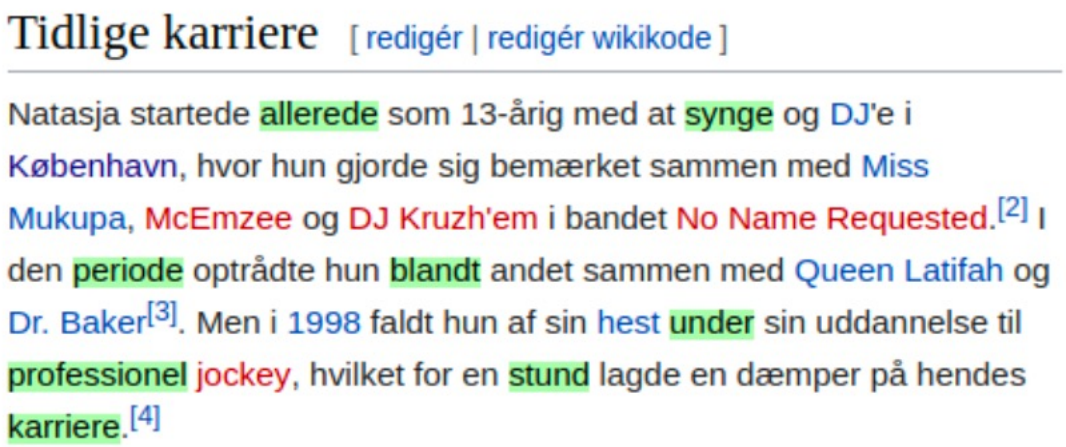
Decoration changes
Pop-up only displays

- No difference in comprehension
- Users prefer autonomy
  - Pop-up and decoration significantly higher scores on ”likely to use”

Alonzo *et.al.*, Automatic Text Simplification Tools for Deaf and Hard of Hearing Adults: Benefits of Lexical Simplification and Providing Users with Autonomy, *Proceedings of CHI 2020,* Honolulu, USA

Lexi

- When the user clicks on a green word it is replaced with a simpler alternative



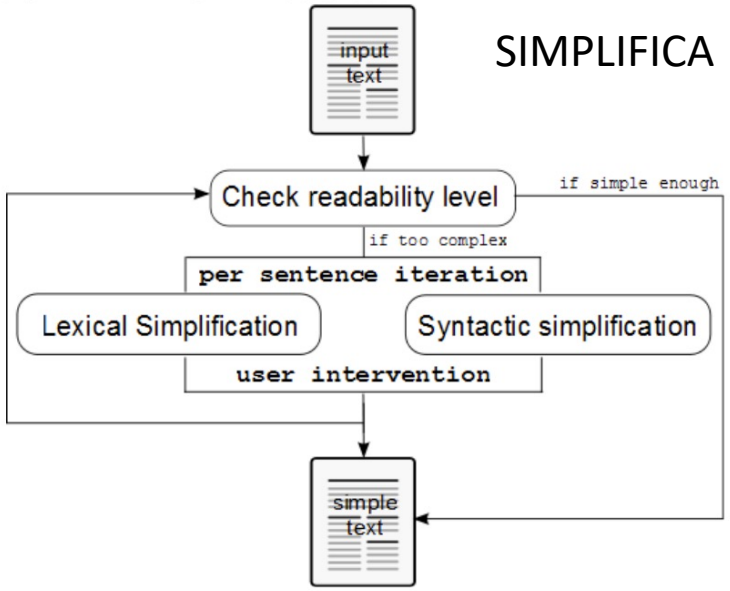
Tidlige karriere [redigér | redigér wikikode]

Natasja startede allerede som 13-årig med at synge og DJ'e i København, hvor hun gjorde sig bemærket sammen med Miss Mukupa, McEmzee og DJ Kruzh'em i bandet No Name Requested.[2] I den periode optrådte hun blandt andet sammen med Queen Latifah og Dr. Baker[3]. Men i 1998 faldt hun af sin hest under sin uddannelse til professionel jockey, hvilket for en stund lagde en dæmper på hendes karriere.[4]

Bingel *et. al*., Lexi: A tool for adaptive, personalized text simplification, *COLING 2018 - 27th International Conference on Computational Linguistics,* Santa Fe, USA

Continuous use guidelines, 4

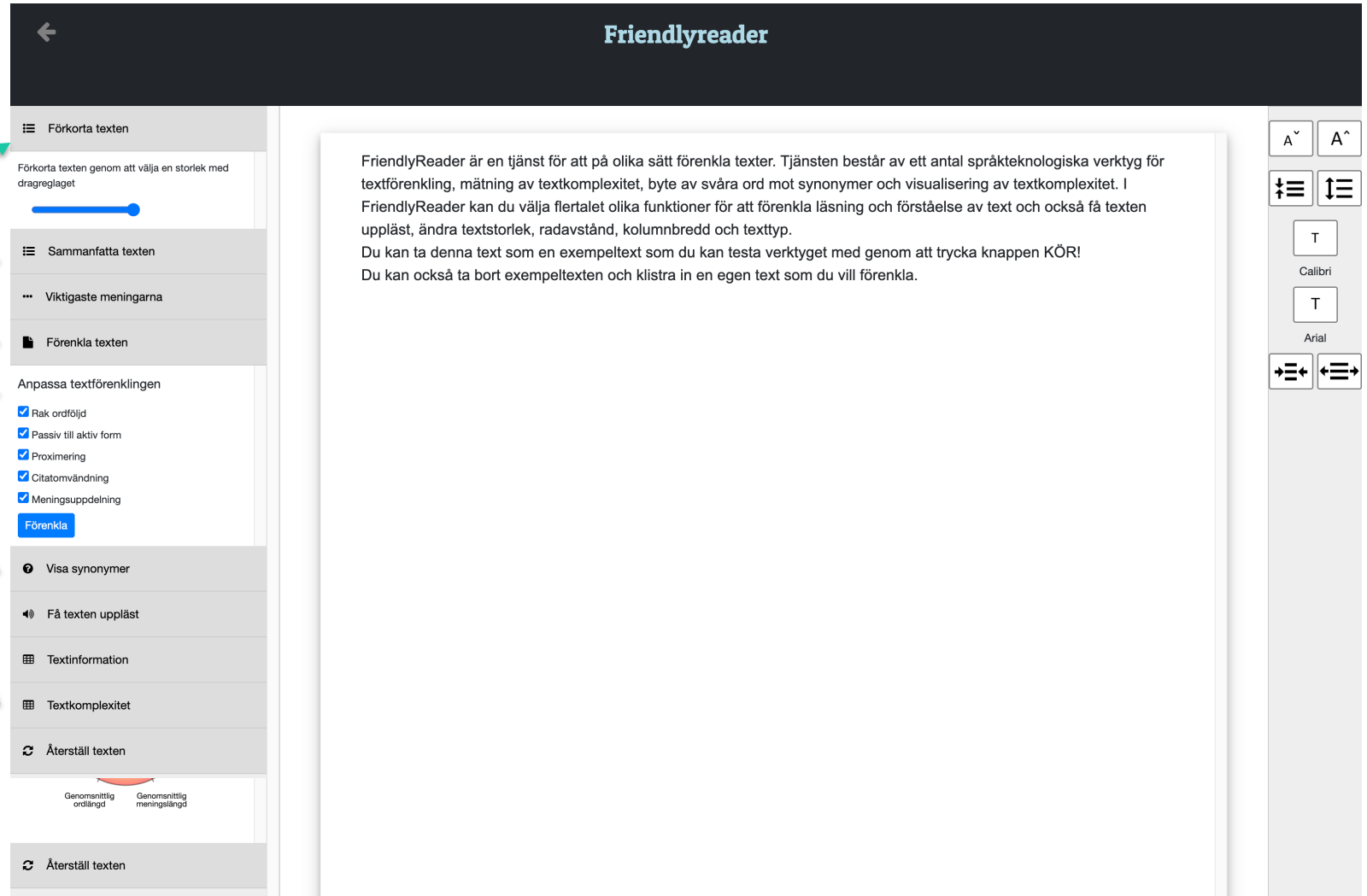
- Guideline 26: Remember, and use, the user's interaction history.



FriendlyReader

- Seamless simplify text – summarise – further simplification – less summarisation – measure complexity –
- Very hard to implement.

Extractive summarizer
Abstractive summarizer
Syntactic simplification
Synonyms
Text complexity



Continuous use guidelines, 5

- Guideline 28: Minimize the cost of bad guesses and allow the user to use partially performed work whenever possible
  - Abstractive summarisation often takes time and it is hard to change the length

Visualisation of text complexity

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Text complexity - Readability

Sentence length and long words

- Flesch-Kincaid
- Gunning Fox
- Coleman-Liau
- SMOG
- LIX (Swedish)

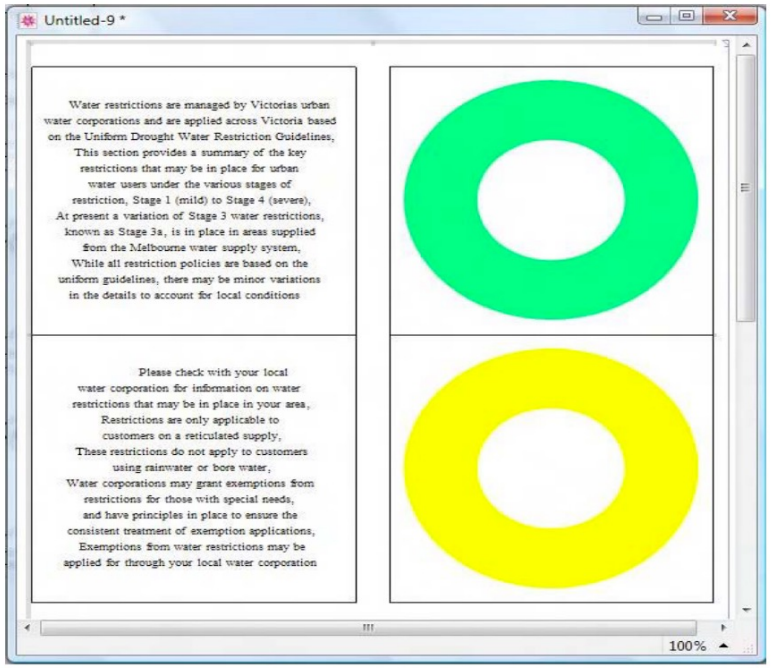
LIX = 42

Text difficulty	LIX
Very Easy	< 30
Easy	30-40
Medium	40-50
Difficult	50-60
Very Difficult	> 60

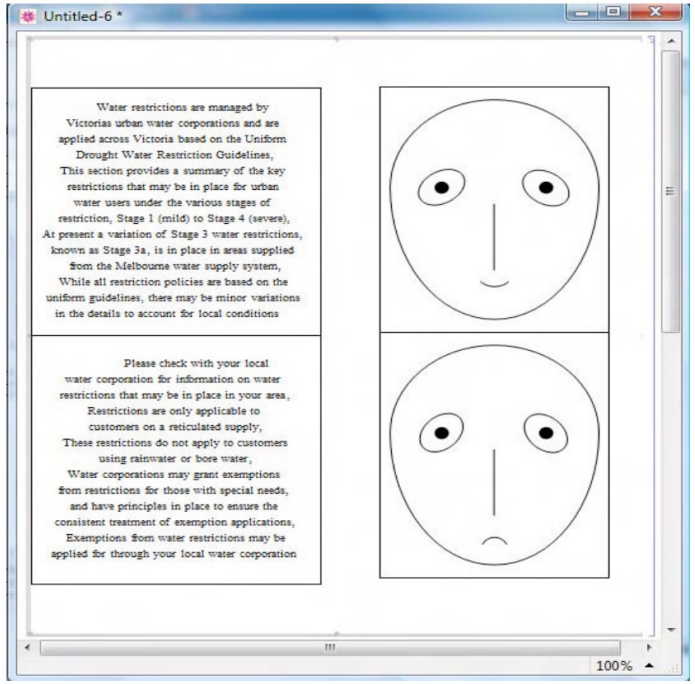
Medium, normal news paper text

Visualizing multiple text readability indexes

Five sentence length readability indexes (Flesch-Kincaid, Gunning Fox, Coleman-Liau, SMOG, Automatic readability index)



... weighted and colour coded

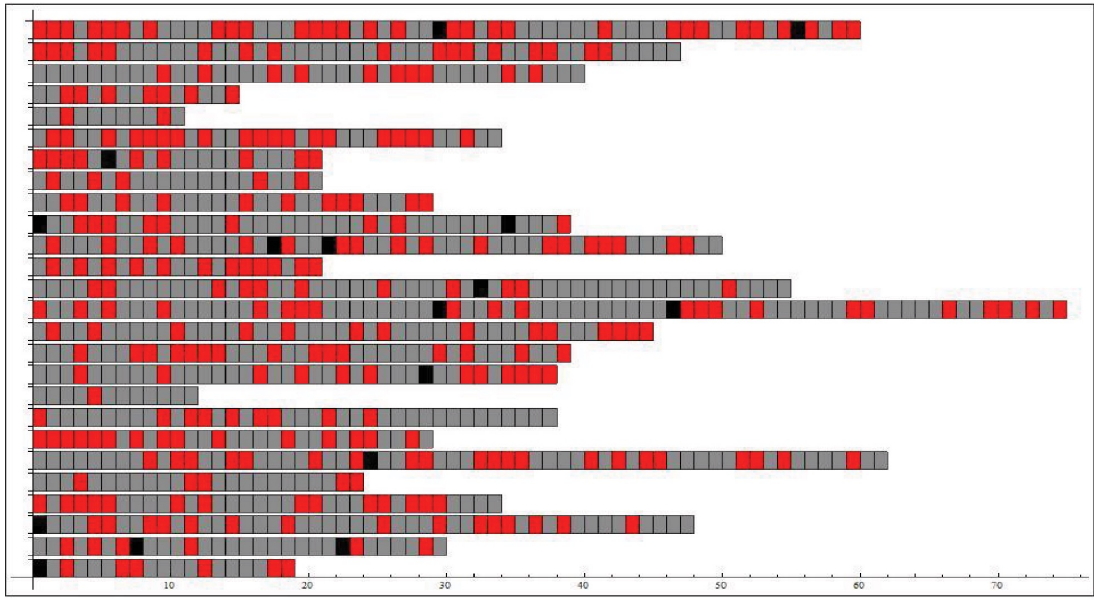


… mapped to facial characters

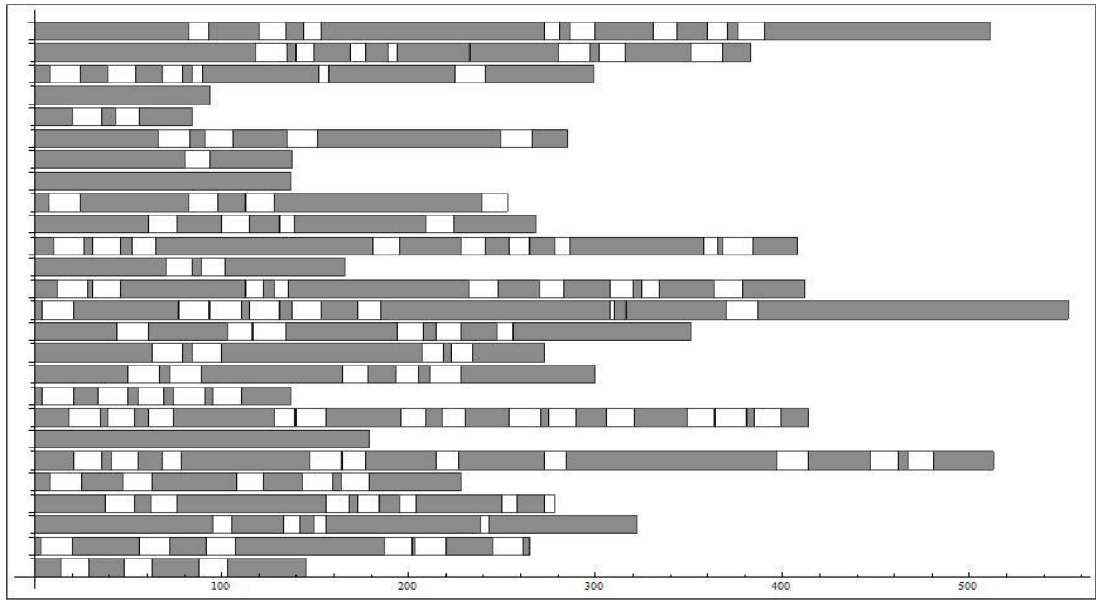
Karmakar, S. and Zhu, Y. Visualizing multiple text readability indexes, *2010 International Conference on Education and Management Technology,* 2010, pp. 133-137, doi: 10.1109/ICEMT.2010.5657684.

Visualizing text complexity, Karmakar & Zhu

Each bar represents a sentence. Each section represents a word (left) or sub-clause (right).



Lexical complexity (Dale-Chall in grey), red means not on that list and black are non words

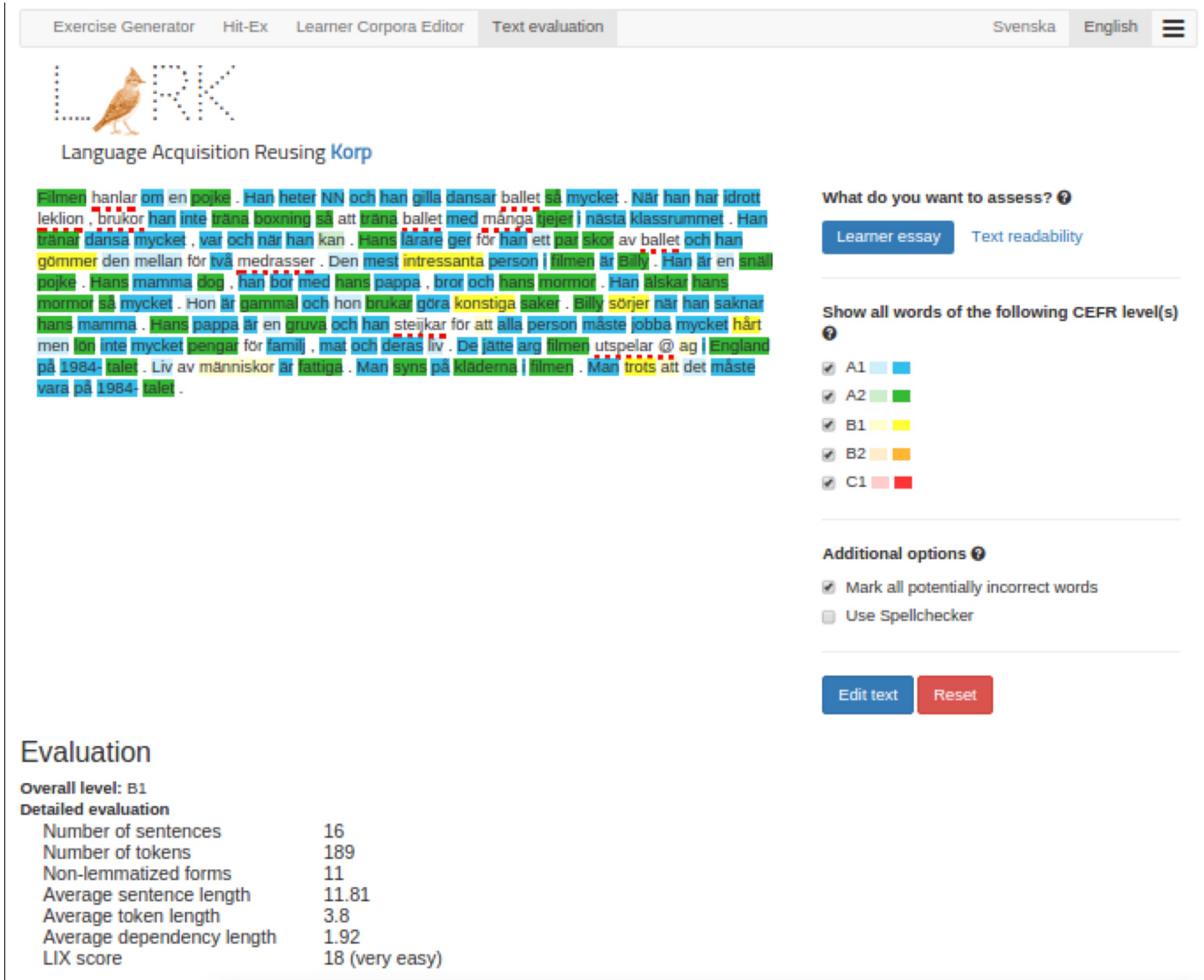


Syntactic complexity, sub-clauses in grey.
The white gaps are indicators of the level of depth.

Karmakar, S., & Zhu, Y. (2010). Visualizing text readability. In *6th International Conference on Advanced Information Management and Service (IMS),* IEEE.

Lärka

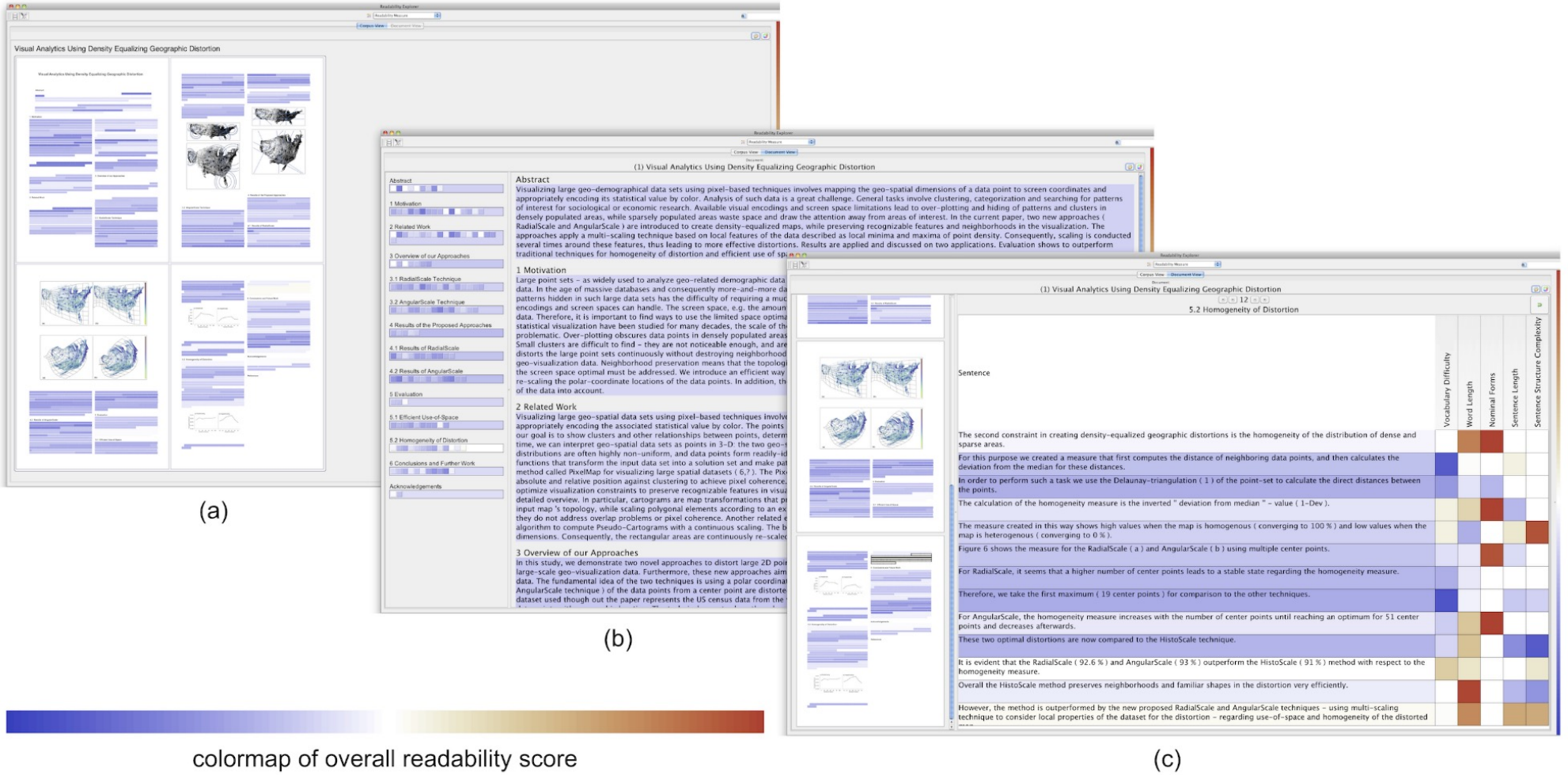
Colour codes representing different reading proficiency levels



Pilán, *et.al.*, Coursebook Texts as a Helping Hand for Classifying Linguistic Complexity in Language Learners' Writings, *Proceedings of the Workshop on Computational Linguistics for Linguistic Complexity,* Japan, 2016

VisRA

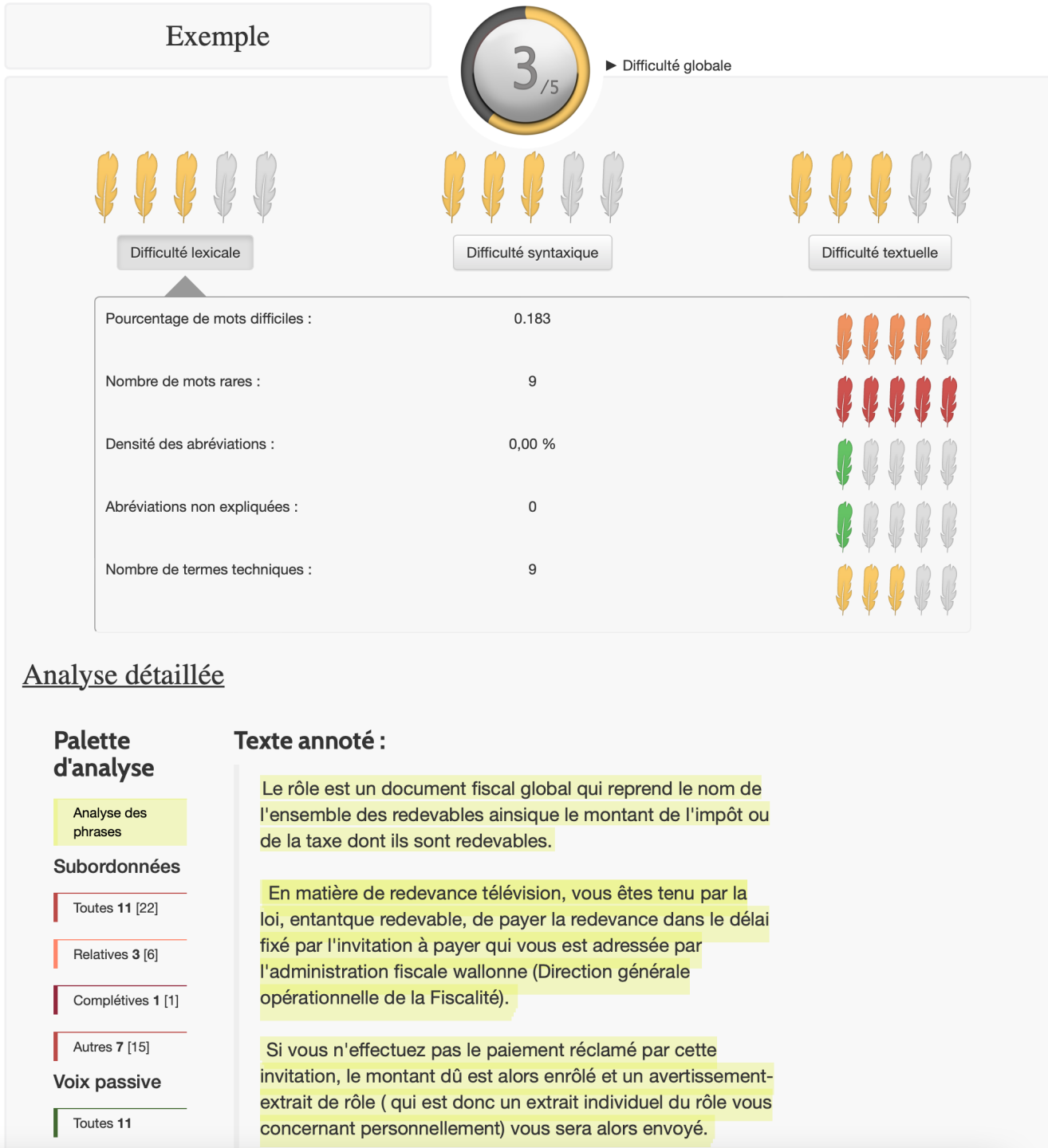
- Filtered feature set, displayed in various ways



Oelke *et al.,* Visual readability analysis: How to make your writings easier to read, *VAST 10 - IEEE Conference on Visual Analytics Science and Technology 2010*, Utah, USA

AMesure

- Writing tool
- Performance evaluated



François *et.al.*, AMesure: A Web Platform to Assist the Clear Writing of Administrative Texts, *Proceedings of the 1st Conference of the Asia-Pacific Chapter of the Association for Computational Linguistics and the 10th International Joint Conference on Natural Language Processing: System Demonstrations*, Suzhou, China, 2020

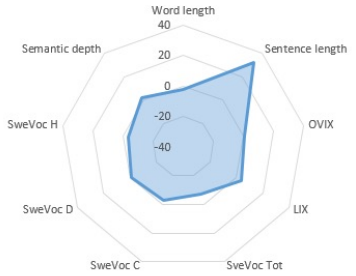
LX CEFR

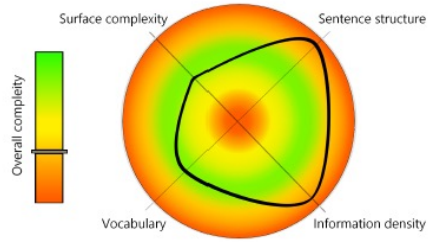
- Flesch Reading Ease Index
- Lexical category density in proportion of nouns
- Average word length in number of syllables per word
- Average sentence length in number of words per sentence

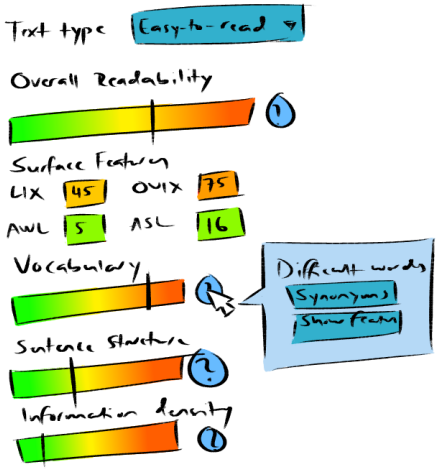
Branco *et.al.*, Rolling out text categorization for language learning assessment supported by language technology, *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics),* 2014

A user study on visualisations

- Web form
  - 11 web editors
  - Various visualisations presented
  - Different visualisation interpretation tasks
  - Questionnaire
- Results
  - Preferred Bar, easier to understand, fewer parameters
  - Radar diagram more informative, more nuanced, compact
  - Combined

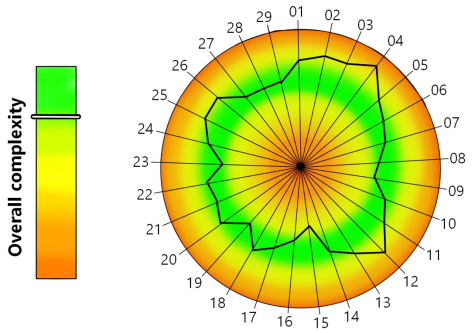






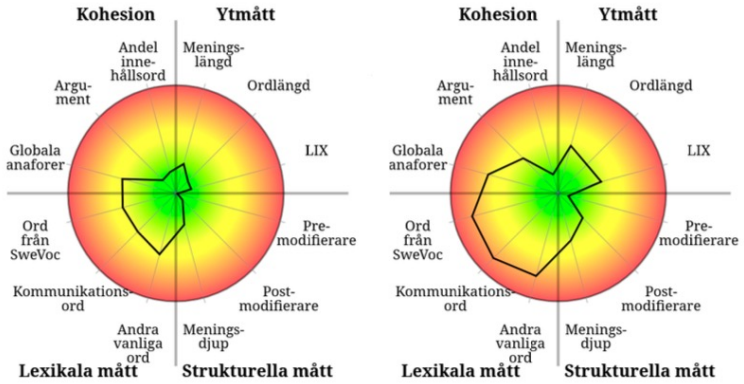
Which measures

- Workshop with 12 experts
  - No consensus
  - Group parameters
  - Parameters correlate
- Factor analysis (PCA)
  - 29 components



Evaluation of the text complexity visualisation

- Three semi-structured focus groups with two special teachers
- Open questions on text complexity and two radar diagrams
- Text complexity
  - Do not always know exactly what their students are struggling with
  - Intuition regarding a text's complexity,
  - Challenging to explain what aspects make a text complex.
    - Text length, word length, unusual words, too much to read between the lines, sentence length and the visual impression of the text
- Visualisation
  - Sentence length, word length and number of long words pretty straightforward
  - Arguments, sentence depth, SweVoc, pre-/post-modifiers and anaphors more difficult to understand
  - Difficult for most participants to connect the colours to the measurements and what it indicates about the texts



Kohesion=Cohesion,
Ytmått=Surface,
Strukturella mått=Structural,
Lexikala mått=Lexical

Evaluations

Evaluation of adapted texts

- Intrinsic
  - Data driven
  - Various metrics
    - Readability metrics
      - Lexical Complexity
      - Sentence Complexity
    - BLEU
    - SARI
    - SAMSA
    - BERTScore
  - Few corpora on various user groups
  - ”Cheaper”

- Extrinsic
  - Human evaluations
  - More user group specific
  - Fewer data points
  - Crowdsourcing

Alva-Manchego, *et.al.,* The (Un)Suitability of Automatic Evaluation Metrics for Text Simplification, Computational Linguistics, 2021

Extrinsic evaluations of simplifications

- Lexical and syntactic evaluations
  - Fluency, adequacy, and simplicity
  - Eye tracking
- Summarisations
  - Content, fluency
- Text complexity
  - Classifiers
  - Recall, precision, and F1-score for various phenomena

Evaluation of tools and services

- Formative
  - During the development
  - Allow for adjustments
  - Target user groups
    - Personas guide
  - Low-fi prototypes
  - Users perform tasks
- Summative
  - Test of complete system
  - Intrinsic
    - Chat bots evaluated on corpora
  - Extrinsic
    - Standard evaluations, e.g. SUS
    - Intended user groups

Summary

- Tools for adaptation must be usable
- Users have different needs
  - Writers, readers, teachers
- Not straightfoward to express how to adapt
- Various techniques to understand users' needs
  - Interviews
  - Workshops
  - Personas
- Design principles guide interface development