Implementation of the Online Text Accessibility Heuristics

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1. Introduction

The digitisation of everyday life has led to an increase in users needing accessible content on websites, mobile applications and digital services. Despite the increasing amount of audiovisual content, a considerable proportion of online content is still in textual form (Kalender et al. 2018) and texts and linguistic elements have a great responsibility in order to convey meaning (Isohella & Nuopponen 2016). Furthermore, the use of assistive technology, such as screen readers, makes interaction with text content a listening activity (Babu et al. 2010). Therefore, the text should be produced in such a form that it supports not only reading but also listening activities. Writing and text production are also essential in the digital age and online interactions in contemporary organisations rely on writing (Fayard & Metiu 2012). Fayard and Metiu (ibid.) conceptualise writing not only as a technology but primarily as a fundamental mode of communication: we are writing and reading more than ever. Hilbert (2014: 138) found in his large empirical inventory that 'the proportional share of alphanumeric text is larger in the digital 'multimedia age' than it has been at the end of the analog age'.

From the perspective of content production, the online text accessibility heuristics by Mäkipää and Isohella (2022) provide hands-on guidance for accessible text production. They are meant for people who especially create text content for the web to achieve or allow text accessibility. The heuristics may also be used as a self-assessment tool for the same purpose. The creation of the heuristics addressed problems relating to the technicality

and understandability encountered by content creators, especially people who are not webmasters or web developers but who need to edit and produce web content (Henka & Zimmermann 2014). Even though the heuristics are meant for text content creation, they do not consider the writing process itself. The writing process consists of several phases and elements (Flower & Hayes 1981) and the use of external guidelines during the writing process can increase the writer's cognitive load, which makes guidelines difficult to implement. We need to remember that people who create text content, that is, writers, are also humans, which means that heuristics themselves should be accessible (Iivari et al. 2020).

In this chapter, therefore, we address the problem of how heuristics should be implemented to support the writing process in content creation. To improve the accessible use of heuristics, we align the online text accessibility heuristics by Mäkipää and Isohella (2022) to the cognitive process theory of writing by Flower and Hayes (1981). We propose an implementation model to make the use of heuristics more natural and efficient during the writing process.

2. Background of Text Accessibility in Web Context

The well-known ISO standard (ISO 9241–11:2018), to which the European Union (EU) legislation (Directive 2016/2102, 2016) also refers, defines accessibility as the 'extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use' (ISO 2018). Overall, digital products on the web, for example, websites and mobile applications, are composed of content, presentational style, functionality and interactional style (Hassenzahl 2004). The content on the web generally refers to the information presented on a web page or web application, including texts, images, sounds and code or markup that defines the structure, presentation, etc. (WAI 2016).

In this chapter, we focus on how texts should be presented to provide improved access to the information that the writer wants to convey. Therefore, with respect to human rights, the content presented in texts should accommodate a population with the widest range of needs and disabilities (WHO 2002). The United Nations Convention on the Rights of Persons with Disabilities (CRPD) defines people with disabilities as 'those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others' (UN 2006).

However, accessible texts should be applicable to everyone, not only people with disabilities (Yesilada et al. 2015). Although the scope of accessibility and its interconnection with usability have been hard to define (Link et al. 2006; Leuthold et al. 2008; Ruiz et al. 2011; Martins et al. 2017; Giraud et al. 2018; Vollenwyder et al. 2019), usability to all could also be enhanced by improving accessibility (WAI 2016). For example, adjustments to accessibility that reduce cognitive load improve usability, such as effectiveness, efficiency and satisfaction (Giraud et al. 2018). Thus, the purpose of making text content accessible is to primarily benefit users with disabilities to access the information while improving understandability, memorability, efficiency and overall satisfaction.

In the context of text accessibility, assistive technologies (AT) play a significant role, as they provide an alternative method to perceive the information. The most widely adopted AT for reading digital texts for individuals who are blind or visually impaired is text-to-speech AT, often called screen readers or read aloud readers (Ferres et al. 2013). Screen readers are also used by people with physical, cognitive or literacy disabilities to independently read an online text (Newman et al. 2017).

The use of screen readers makes reading a listening activity (Babu et al. 2010; Dim et al. 2018). Screen readers read a web page aloud from the top left to the bottom right (Babu et al. 2010) which makes the navigation behaviour of blind users completely different from that of sighted users, often extremely difficult (Harper & Bechhofer 2007; Leuthold et al. 2008). This means that blind users must form their mental model of the structure based on linearly presented audible information about navigation items and other audible cues from the visual context (Leuthold et al. 2008). For

sighted people, visualisation of text, such as text size, colours and other visual formatting, may convey meaning and provide cues about web page structure and intended navigation space. However, when listening to a text, these meanings and cues cannot be perceived, which poses challenges in providing the same meaning in the content of the text. Moreover, the information presented in non-textual elements, such as images and graphs, should also be presented alternatively in text so that the AT can interpret the information in audio format (W3C 2018). However, for people with cognitive disabilities, the factors that cause difficulties in cognition, such as cognitive load, remembering task-related steps or understanding terminology, are more relevant than difficulties in reading from the screen or perceiving other visual information, such as icons (Sayago & Blat 2010).

As a response to the inclusion of people with different needs, the online text accessibility heuristics by Mäkipää and Isohella (2022), to which we will refer as the heuristics, aim to improve text accessibility for a wider scope of users' needs. The heuristics are meant for people who create text content for the web to achieve or allow text accessibility for users with disabilities. The heuristics may also be used as a self-assessment tool for the same purpose. Many prior studies have provided guidelines for improving the readability or accessibility of online text reporting guidelines that consider the needs of people with dyslexia (Rello et al. 2012; Miniukovich et al. 2017; Li et al. 2019). Therefore, beyond the needs of people with dyslexia, these heuristics also cover the needs of people with difficulties in understanding content or cues, people with limited memory or those with difficulties in perceiving visual information.

The heuristics are a combination of three categories: text formatting, text structure and text content. The aim of the categorisation is to help the person using them perceive and understand the structure of the heuristics and to focus on areas in which help is needed. The heuristics are formulated and tested empirically with content creators in public organisations. According to the study by Mäkipää and Isohella (2022), the heuristics are clear, easy to understand and useful. However, it should be noted that the heuristics do not meet all legal obligations regarding accessibility, as only the accessibility of textual online content is addressed. Moreover, heuristics can be defined as a set of principles that guide our actions towards

a procedure, new ideas and results (The Helsinki Term Bank for the Arts and Sciences 2021). This means that heuristic principles should not be taken as rigorous prescriptions, they rather 'give useful recommendations and hints but never require exactly one special solution' (Gadanne 2006).

The heuristics contain seven items (H1–H7) related to text formatting, three items (H8–H10) related to text structure and five items (H11–H15) related to formulating content. However, the heuristics do not address the writing process, which may influence the implementor's cognitive load. Inspired by the cognitive process theory of writing by Flower and Hayes (1981), we next discuss the order in which the heuristics should be implemented to support the writing process.

3. Implementing the Text Accessibility Heuristics

According to Flower and Hayes (1981), writing as an act contains three major elements: (1) the task environment, (2) the writer's long-term memory and (3) the writing process. The task environment includes, for example, rhetorical decisions and plans for reaching the audience, which affects the process of organising ideas at all levels. The writer also reviews the text that s/he has produced so far for the task (Figure 6.1).

The writer's long-term memory contains knowledge about the audience, as well as the topic and writing plans. Knowledge about the audience and plans for reaching the audience are guided by goal setting in the planning process as a part of the writing process (ibid.). The writing process contains three basic processes: (1) planning, (2) translating, and (3) reviewing

The planning process includes organising and ordering the text and it refers to the writer's internal formulation of represented knowledge or information that s/he is about to write. This process consists of idea generation, when the writer reflects on his or her knowledge (long-term memory) about the topic, audience, and prior writing plans to generate ideas. This may also include the use of outside resources, such as books. Translating refers to the process by which the writer puts his or her ideas into visible

language. In the reviewing process, the writer reads and evaluates what s/he has written so far and revises the text. The reviewing process has a cycle back to the planning and translating processes, which means that if the writer is not satisfied with the written text, s/he restarts or reconsiders the planning and translating process again (ibid.).

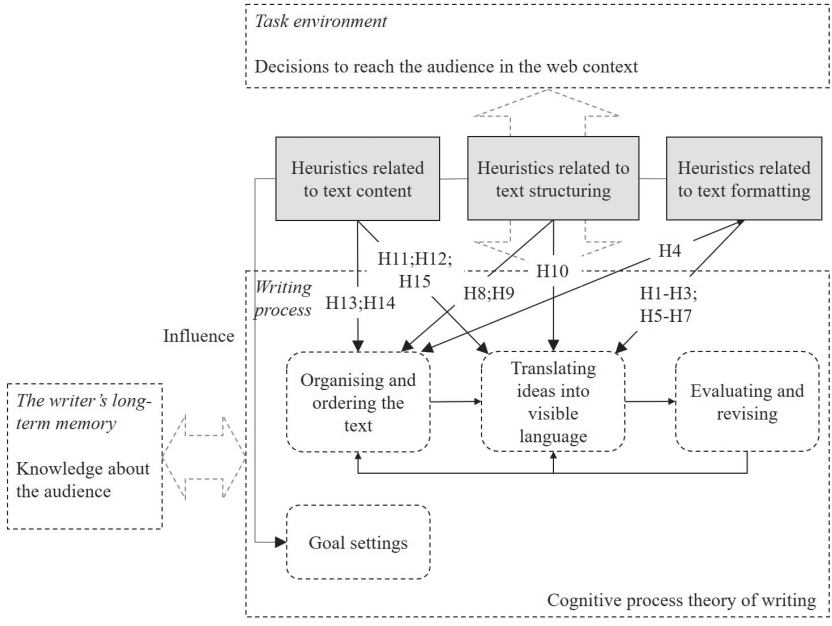

Figure 6.1 Online text accessibility heuristics implementation model.

To integrate the online text accessibility heuristics (Mäkipää & Isohella 2022) into the writing process and support the writer's plans to reach the audience, we compared and aligned the heuristics to the elements of writing in the cognitive process theory of writing by Flower and Hayes (1981) (Figure 6.1).

We posited the implementation of the heuristics between the *writing process* and the *task environment*. This means that the writer considers the heuristics when making decisions to reach the audience in the web context. Therefore, the heuristics related to text formatting, text structure and text

content can be implemented during the planning process, including the knowledge organisation, or during the translating process. Moreover, the use of the heuristics influences the writer's knowledge about the overall needs for accessibility of the audience; hence, the use of the heuristics also influences the writer's goal settings.

Instead of following the original sequential order, we propose that the writer should first implement the heuristics related to the content, followed by the heuristics related to structuring, and lastly, the heuristics related to formatting. To fit this order to the writing process, we propose implementing the heuristics when the writer is about to organise and order the text and then translate the ideas into visible language.

In what follows, we explain the heuristics one by one and discuss why this order makes their use more natural and efficient in the writing process and how it affects the writer's cognitive load, thus the accessibility of the heuristics. The letter H refers to the word heuristics, and the number attached to it refers to the heuristic number in the original version. We suggest implementing the heuristics in the following order:

1. Organising and ordering the text (H13, H14, H8, H9, H4)
2. Translating ideas into visible language (H11, H12, H15, H10, H1, H2, H3, H5, H6, H7)

During the organisation and ordering of the text, we suggest first implementing heuristics H13 and H14 for the formulation of the content of the text, because in this phase, the writer goes through the process of identifying important ideas, ordering the text and identifying presentational style (Flower & Hayes 1981).

H13: 'Provide the most relevant information first. For long texts, provide a short summary of the content at the beginning – the content is easier to perceive when the most important information is placed on the top of the page'. Providing a summary at the beginning of the text gives readers an idea of what the following text contains. It helps them get an idea of the upcoming topic, which reduces cognitive load (EU 2012). Similarly, this helps the writer to clarify the generated idea of an upcoming text.

H14: 'Prefer short sentences and avoid complicated sentence constructions – short sentences help readers understand the content better. Express one idea in one sentence'. Writing short sentences and expressing one important thing per sentence keeps the text simple, thus helping readers to better understand the content (Plainlanguage.gov 2011). This heuristic tells the writer what the kind of sentence should be. Therefore, at this point of the process, H14 should be implemented when the writer is identifying an appropriate presentational style for the audience to avoid rewriting in a later phase.

Next, H8 and H9 should be implemented for structuring the text because these heuristics provide instructional information on how the factors that influence accessibility should be addressed in the structure of the text.

H8: 'Use headings (H1, H2, etc.) consistently. Avoid sub-sub-headings (e.g. 1.1.1.1) – Do not use headings to just increase font size, as headings are meant to divide content into meaningful sections. Headings are important for screen reader users to navigate a page according to its headings'. Sequentially and logically used headings benefit people with cognitive disabilities, limited short-term memory, visual disabilities and severe mobility impairment, as well as people who use audio for navigation (W3C 2018). When organising the text, the titles of the text (heading levels) should be used sequentially and logically to facilitate navigation.

H9: 'When you add images using information, explain their message in the textual content. This way, the screen reader user gets the same information, too – if the image is not described in the text content, you can describe it in about 100 character-long alt text (in image properties). The use of alternative texts benefits people with difficulties in perceiving visual information, understanding the meaning of images or perceiving or understanding audio information, as well as people who use braille (W3C 2018). When a screen reader finds an image, it reads out the content of the alt tag'. If non-text elements, such as images, charts, videos, audios or other elements, are used alone without explanatory texts, they should

be described with alternative texts using about 100 characters. However, as the limited number of characters may cause challenges in conveying the message, the heuristics recommend providing all the information in the body text. Further, repeating the same information in the text and alt text is unnecessary. Therefore, when organising text and images, it should be considered that the information presented in a way that the message gets conveyed.

Then, as a final heuristic for organising and ordering the text, H4 should be implemented to format the text. H4 refers to presentational style.

H4: 'When you list things, use bullets or numbers. Try to avoid using multi-level lists – by using bullets for main topics, you help readers scan your content and identify key areas. Multi-level lists can be confusing'. If the information, ideas or presentational style contains things that need to be listed, bullets or numbers should be used for the main topics or for the main information. Bullets or numbers help readers scan the content, identify key areas and contribute to the perception of content and the comprehension of important information, thus supporting learning, especially for people with dyslexia (Chen et al. 2015).

In the next process, in which the writer is about to translate ideas into a visible language (Flower & Hayes 1981), we suggest implementing heuristics H11, H12 and H15 for formulating the content of the text.

H11: 'Use clear and simple language - use common everyday words and avoid the use of jargon whenever possible'. The writer should always keep in mind who is reading his/her text. For texts addressed to wide, heterogeneous groups, the heuristics suggest using common everyday words and avoiding the use of jargon whenever possible, avoiding expressions whose meaning cannot be inferred from the meaning of individual words. The use of clear and simplest possible language appropriate benefits especially those people who have difficulty comprehending and interpreting written language (Plainlanguage.gov 2011; Richardson et al. 2017; W3C 2018). To reduce cognitive load, designers should, for example, avoid using

difficult terminology or jargon in the text content, as this may significantly increase not only understanding but also the motivation to use information (Sayago & Blat 2010).

H12: 'Provide the full meanings of abbreviations and acronyms at their first use - abbreviations and acronyms should be defined in full. The exception is established abbreviations, which may not even be recognised when written out (e.g. DVD)'. Abbreviations and acronyms should be used with caution and written in full for the first time (European Agency for Special Needs and Inclusive Education 2015; EU 2012). This benefits people who have difficulties decoding words or people with limited memory and people who use screen magnifiers (W3C 2018).

H15: 'Use *you* when addressing the reader - this way, readers feel that the text is speaking to them'. To improve comprehensibility in cases where the writer wants to address the text directly to the reader, the use of a you-form or active voice makes the reader feel that the text is meant for him/her (Plainlanguage.gov 2011).

Next, we suggest implementing H10, which relates to structuring the text. In our opinion, H10, which refers to the formulation of links, should be implemented during the translation of ideas into visible language because they can be presented in many visible forms.

H10: 'Separate links from other content with underlined blue colour and use text that properly describes where the link will go – name links according to the action that will occur or the place or name of the website to which the user will be taken (e.g. 'Go to calendar')'. If the text contains links, they should be presented with an action word, using the colour blue and underlining to separate the link from the body text. According to Nielsen (2004), this formulation has the strongest perceived affordance of clickability. Moreover, the writer needs to fit the words used in the links into the body text to make the reading fluent.

Lastly, when translating ideas into a visible language, H1–H3 and H5–H7 should be implemented for formatting the text visually.

H1: 'Emphasise verbally the important points you want to make. You may also use bolding or colours for emphasis, but do not use bolding to indicate titles - the reader may only listen to your written text, in which case the emphasis or use of colours is ignored'. Pointing out important information verbally benefits people with limited colour vision, people who use braille or screen magnifiers and people who have difficulties understanding cues or messages between colour and text (W3C 2018). As the reader may only listen to the written text with AT, text bolding, italics and text colours become irrelevant in these cases. Moreover, the writer should note that using only bolding to indicate a title does not make it structurally a title. However, the heuristics do not prohibit the use of visual formalisations in the text but emphasise that they should not be the only means of demonstrating information.

H2: 'Use font sizes 18–26 pt. for online content and 22–26 pt. for headings, depending on the heading level - larger font sizes improve online readability'. The text should be written in larger font sizes, such as 18–26 pt, depending on the heading level. This improves overall readability when reading from the screen, especially for people with dyslexia (Rello et al. 2016) or people with a lower level of visual impairments (ibid.; W3C 2018).

H3: 'Favour sans serif fonts, such as Verdana or Arial – a sans serif font is simple, so it is clear and easy to read online. Verdana is one of the most popular and aesthetically pleasing fonts designed for on-screen viewing. Arial is slightly faster to read'. When selecting the font for the text, a general rule is recommending using an endless font (i.e. sans serif or grotesque fonts, such as Verdana and Arial, which both significantly improve readability for people with dyslexia (Rello & Baeza-Yates 2013)). According to Rello and Baeza-Yates (2013), different fonts have pros and cons, so recommending one is difficult. Arial, for example, is faster to read, but Verdana is more pleasant looking and popular (ibid.).

H5: 'Make the text airy. Adjust the line and paragraph spacing - readability increases if the line spacing is 1.5 and the paragraph spacing

is twice the font size'. Formatting, such as line spacing, spacing of text paragraphs and spacing of letters and words – that is, the *airiness* of the text – could be even more important than the choice of fonts (Rello et al. 2012). Readability will improve if line spacing is at least 1.5, and paragraph spacing is two times the font size. Therefore, overcompressing the content is not recommended (Chisnell et al. 2006).

H6: 'Align text to the left - text aligned to the left margin makes it easier to find the start of the next line'. To help readers perceive the transition from one line to another, the text content should be aligned with the left margin instead of distributing the text between both margins (European Agency for Special Needs and Inclusive Education 2015; Plainlanguage.gov 2011).

H7: 'Pay attention to the contrast between the text and the background - to improve readability, you may use light tones of warm colours for the background'. According to Rello and Bigham (2017), the use of light tones of warm colours for the background improves readability for people with dyslexia.

The third process included in the writing process, *evaluating and revising,* is not aligned straight to the implementation of the heuristics, as this phase refers to the process in which the writer reads and evaluates what s/he has written and revises the text by moving back to planning and translating processes. However, in cases where the writer starts to evaluate previously written text against the heuristics, the whole writing process may start from the evaluating and revising process.

4. Summary and Conclusion

In this chapter, we discussed how heuristics for accessible online text could be implemented to support the writing process. The heuristics by Mäkipää and Isohella (2022) contain fifteen hands-on principles in three categories: text formatting, text structure and text content to improve the

production of accessible online text in the web context. The implementation of the heuristics makes the text content easier to perceive and the written language easier to navigate, read, interpret and understand, thus affecting the usability. However, the heuristics do not consider the writing process, during which they can be mentally demanding to implement.

By comparing and aligning the heuristics to Flower and Hayes's (1981) cognitive process theory of writing, we created an implementation model for online text accessibility for people who write or evaluate text content for the web to achieve or allow text accessibility.

Approaches to accessible online text content lack empirical investigation. There are various guidelines and heuristics, but it seems essential to better fit them into practice by recognising the writing, for example, content creation process. We believe that our implementation model makes the use of the heuristics more natural and efficient during the writing process, as they are fitted into phases when the writer is about to organise and order the text and translate ideas into visible language.

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