HAN_UNIVERSITY OF APPLIED SCIENCES

HAN GUIDELINES FOR ACCESSIBLE OPEN WEB CALENDARS

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INTRODUCTION

In this document, we will address the **research questions** (see page 2/10) regarding the accessibility of web calendars, along with potential solutions and best practices. It focuses on identifying both strengths and weaknesses of web calendars in terms of digital accessibility and highlights ways to improve them.

Web calendars are online tools or applications that allow users to schedule, manage, and share events, appointments, and tasks. They are accessible from any device with an internet connection and often support synchronization with other calendars and apps. Popular examples include Google Calendar, Microsoft Teams Calendar, and Apple iCloud Calendar. These tools help individuals and teams stay organized through features such as reminders, notifications, and collaborative options.

To ensure everyone can use web calendars effectively, including people with disabilities, it is important to follow the **WCAG 2.2 guidelines and the level A and AA success criteria**. These W3C Recommendations are internationally recognized and define how to make web content more accessible, particularly for users who depend on assistive technologies like screen readers or keyboard navigation. Following these guidelines not only creates an inclusive user experience but also fulfils **legal and ethical responsibilities of the European Accessibility Act** (EAA).

RESEARCH SCOPE

In this report we address the following topics:

1. **Common accessibility challenges in web calendars**
   This study reviews various web calendar tools, including Open Web Calendar, ccc-p.org, iCloud Calendar, Teams Agenda, and Google Calendar and identifies recurring accessibility challenges..

2. **Case Study of Web Calendars Provided by Client**
   This study examines accessibility features of the open source Open Web Calendar and ccc-p.org and suggests improvements.

3. **Case Studies of Other Web Calendars**
   This study examines the accessibility features of various web-based calendars, including Google Calendar, iCloud, and Teams Agenda. It highlights best practices, identifies partially functional features, and suggests improvements to enhance usability for all users. In addition, a few recommendations have been made.

4. **Conclusion**
   In this chapter we summarize the research and answer the main questions “What are the most common accessibility challenges in the researched web calendars?”

5. **References**
   A list of URLs used during the study.

Research questions

Main question

What are the most common accessibility challenges in the researched web calendars?

Sub-questions

- What are well-implemented accessibility features in web calendars?
- Which accessibility features in web calendars are only partially functional or require improvement?
- How to improve a web calendar, so that it conforms with WCAG2.2 Level AA Succes Criteria?

Research Approach

We used the tools listed below to review all the guidelines from the WCAG 2.2. We systematically evaluated the websites, with two testers and across different browsers, in a random order to observe what was working well and identify areas for potential improvement.

Software used: NVDA, Colour Contrast Analyzer
Plugin used: DevAxeTool, WAVE, Accessibility Insights for Web
OS & browser used: Windows 11, Chrome (&Opera), Edge

1 COMMON ACCESSIBILITY CHALLENGES IN WEB CALENDARS

This study reviews various web calendar tools, including Open Web Calendar, ccc-p.org, iCloud Calendar, Teams Agenda, and Google Calendar and identifies recurring accessibility challenges:

- Insufficient Colour Contrast
- Lack of Focus Indicators
- Poor Information and Relationship Structuring
- Inadequate Component Labelling (Name, Role, Value)
- Incorrect Implementation of ARIA
- Overwhelming or Inconsistent Keyboard Navigation
- Navigating at High Zoom Levels
- Insufficient Printability

Insufficient Colour Contrast

Issue: Colour combinations do not meet minimum contrast ratios.

Example: Blue (#0088D1) text on a white (#FFFFFF) background in Open Web Calendar only achieves a 3.9:1 ratio, which is below the required level for sufficient contrast.

Lack of Focus Indicators

Issue: When navigating via keyboard, visible focus indicators are missing or insufficient.

Example: Open Web Calendar does not show clear indicators for the focused element, making it hard for keyboard-only users to know their current position.

Poor Information and Relationship Structuring

Issue: Screen readers can struggle when content's structure and relationships are not programmatically determined.

Example: In Open Web Calendar, the agenda items are not properly conveyed by the screen reader, which limits the user's ability to understand the organization and context effectively.

Inadequate Component Labelling (Name, Role, Value)

Issue: User interface elements lack proper accessible names, roles, and / or values.

Examples:

1. Open Web Calendar's agenda items like which meetings there are that day, or other appointments are not adequately described by screen readers. Like what the appointment is about or the extra information like location or the other person that can be added to appointments.
2. In iCloud Calendar, some buttons like the + on the top right, are announced by the screen reader as "Button", leaving their purpose unclear.

3. The frame in ccc-p.org's calendar is missing an accessible name, preventing screen readers from conveying its content or purpose.

Incorrect Implementation of ARIA

Issue: Incorrect implementation of ARIA can lead to unexpected behaviours in assistive technologies, negatively impacting the user experience. For instance, applying ARIA attributes to non-interactive elements can confuse screen readers or other assistive devices.

Example: ccc-p.org's ARIA attributes are not properly implemented for dynamic content like pop-ups or expanding sections. For instance, screen readers fail to announce updates or interactions, such as when new content is added or when a user interacts with a dropdown menu. As a result, users who rely on screen readers are unable to access important information, and the content becomes invisible to them.

Overwhelming or Inconsistent Keyboard Navigation

Issue: Keyboard navigation may be confusing due to inconsistent practices or when a large amount of information is presented.

Examples:

1. In iCloud Calendar, users may encounter difficulties such as being overwhelmed by a large amount of information when navigating through daily events. The interface lists every event from 1 a.m. to 11 p.m. regardless of content.
2. The option to switch between day and month views is not fully accessible via keyboard.
3. Navigation inconsistencies arise when the interaction changes from using the Tab and Spacebar to Arrow keys and Spacebar.

Navigating at High Zoom Levels

Issue: When users zoom in (e.g., 300% magnification), calendar content goes off screen, affecting readability and functionality.

Example: Navigating Google Calendar at higher zoom levels makes certain sidebar elements disappear. These elements are accessible via keyboard only.

Insufficient Printability

Issue: Not all calendars provide print-friendly formats. Ensuring calendars are printable (for example, in A3 format) can offer an alternative way to view content.

Example: Google Calendar offers a print-friendly option, allowing users to print the calendar in A3 format for easier viewing. This provides an alternative way to access the information for users who may struggle with navigating the digital interface.

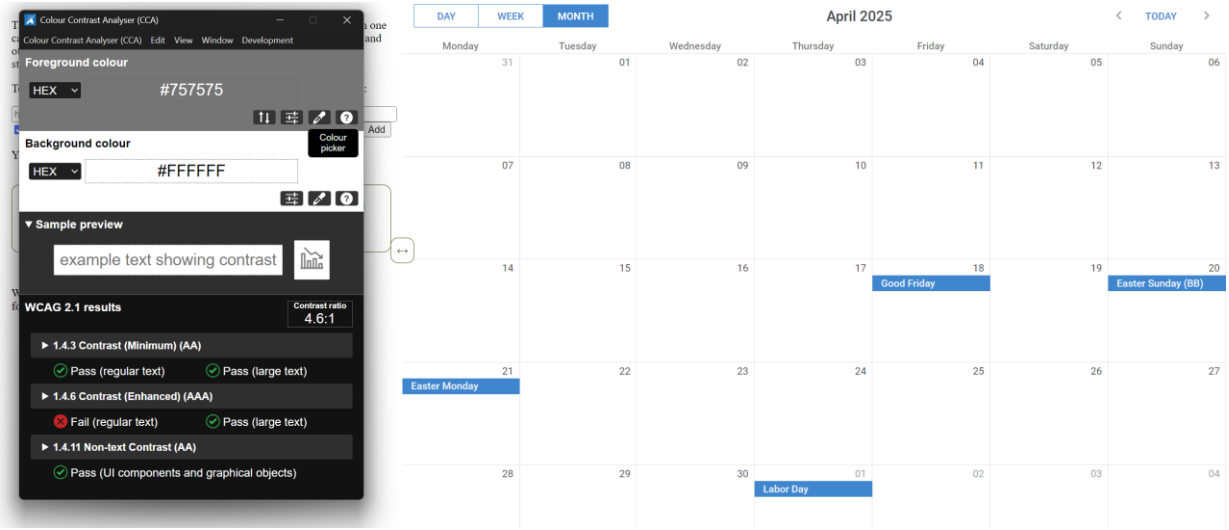
2 CASE STUDY OF WEB CALENDARS PROVIDED BY CLIENT

We have reviewed the provided web calendars **open source Open Web Calendar** and **ccc-p.org**.

Open Web Calendar

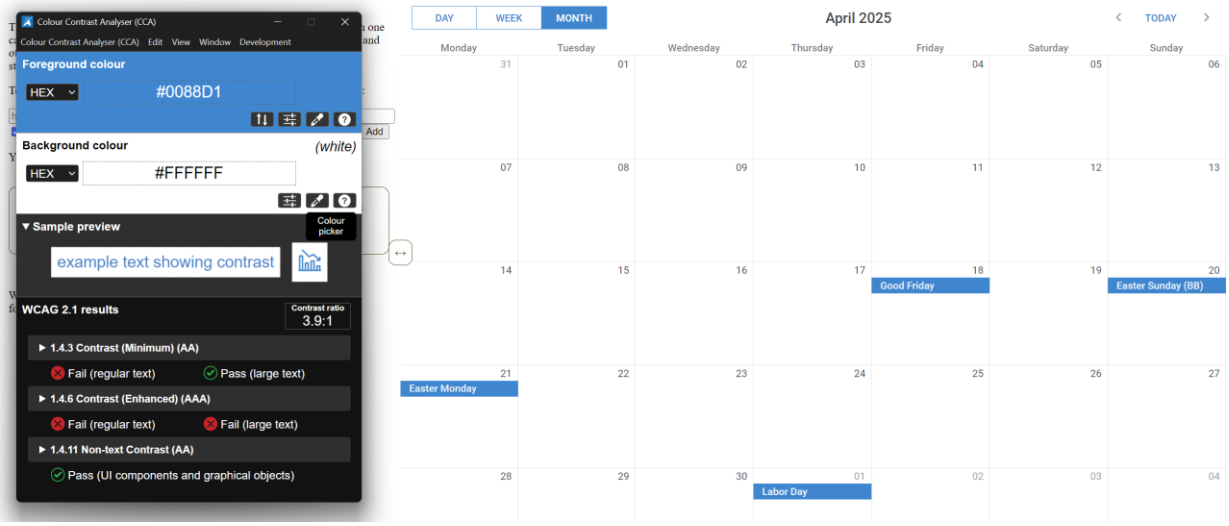
Strength

- **1.4.3 (Contrast (Minimum)):** The grey (#757575) text is well-chosen, offering sufficient contrast against its background. This improves readability for users with visual impairments.



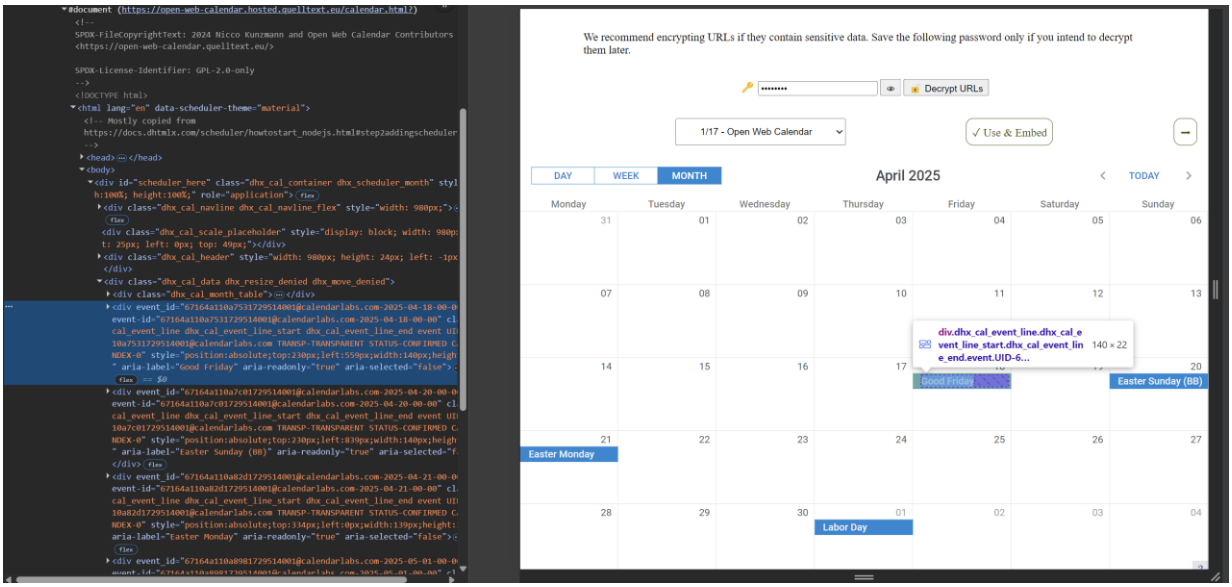
Weaknesses

- **1.4.3 (Contrast (Minimum)):** The blue (#0088D1) text on a white (#FFFFFF) background has a contrast ratio (3.9:1), which is below the 4,5:1 minimum required.

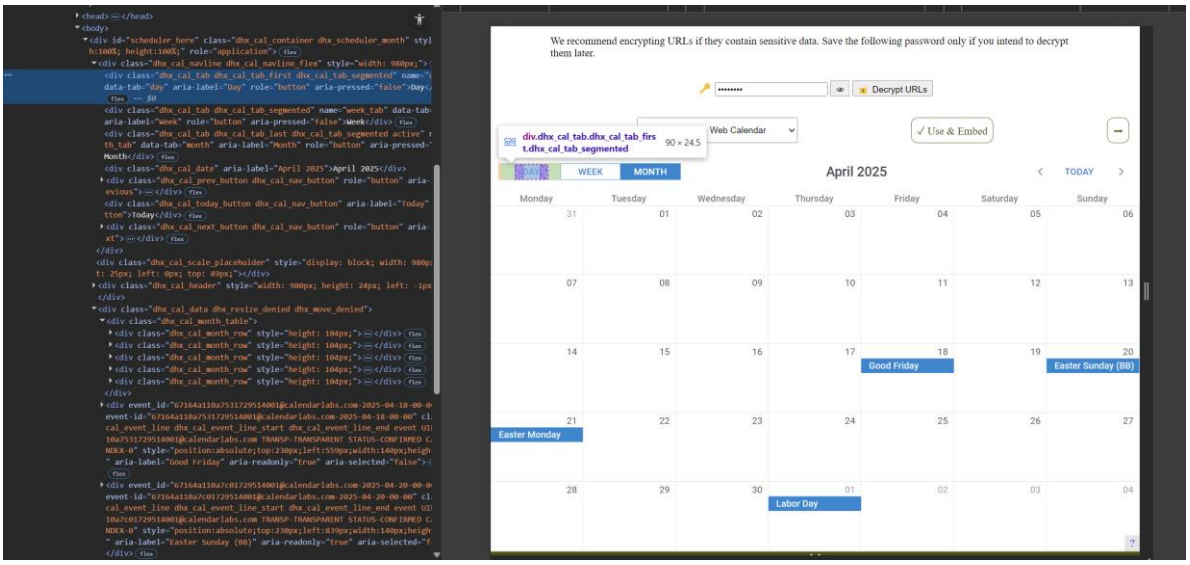


- **2.4.7 Focus visible:** During keyboard navigation, there are no visible indicator to show which element is in focus, making it hard for keyboard-only users to know their current position.

- **1.3.1 Info and relationships:** This criterion mandates that structure, hierarchy and relationships within content are programmatically determinable. Agenda items are not clearly conveyed, meaning screen readers cannot effectively communicate the content.



- **4.1.2 Name, Role, Value:** This guideline requires that all user interface components have their names, roles, and values correctly exposed to assistive technologies. If the text read by screen readers does not clearly describe the agenda's elements, users may not receive the necessary context or instructions to understand and interact with the content criterion.

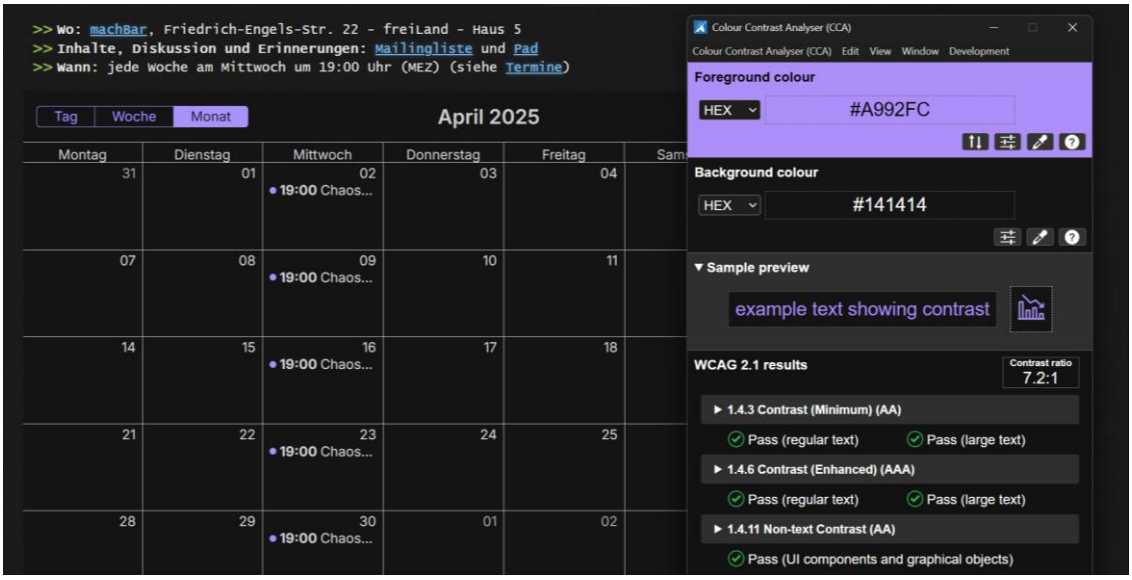


- **2.1.1 Keyboard:** Keyboard navigation functions well in the initial part of the interface, clearly indicating the user's position and following a logical flow (settings on the left, calendar on the right). However, when the user attempts to navigate through the calendar items, this section is not accessible via the keyboard.

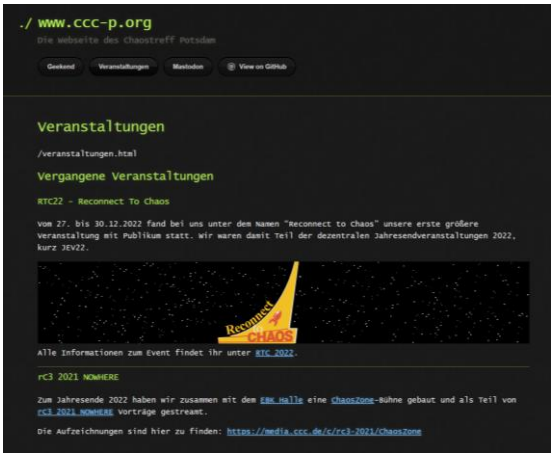
ccc-p.org

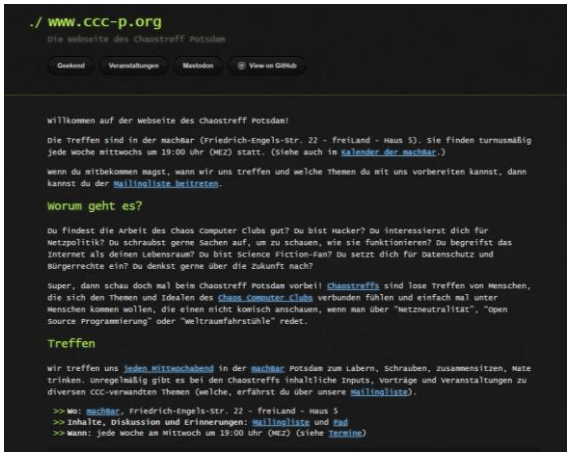
Strengths

- **1.4.3 (Contrast (Minimum)):** The combination of purple (#A992FC) text on a black (#141414) background achieves a contrast ratio of 7.2:1. This surpasses the minimum requirement of 4.5:1 for normal text, ensuring text is readable for users with visual impairments.



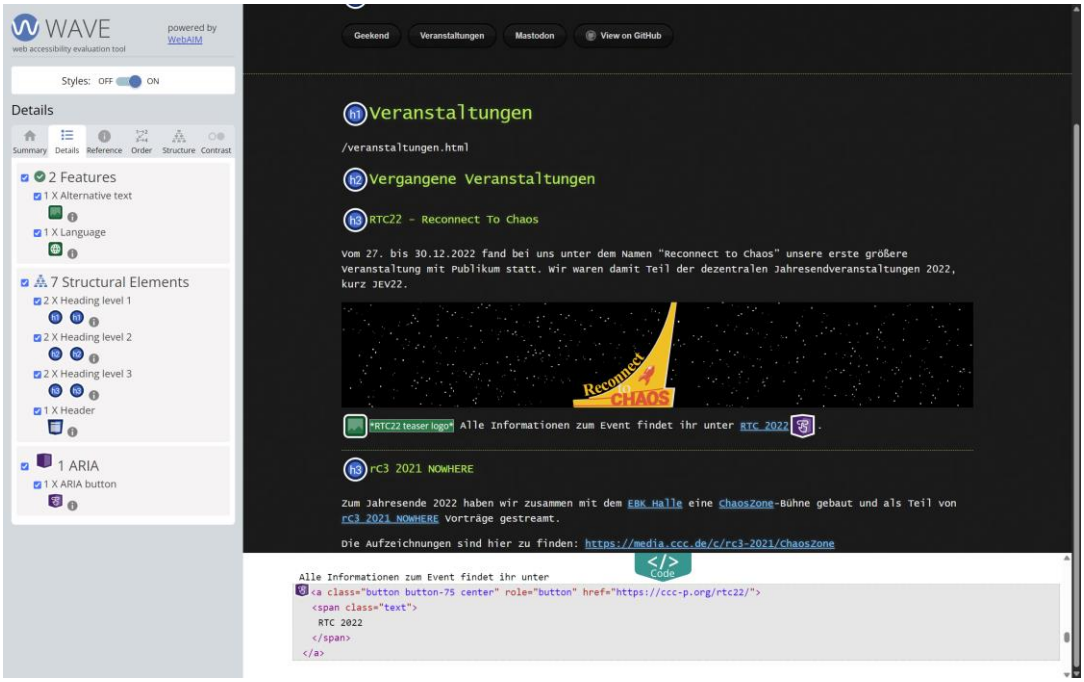
- **3.2.3: Consistent Navigation:** The website maintains a uniform navigation system across its pages, allowing users to predictably locate information. In the images you see that all linked text is blue and are underlined. Titles have the same size and colour, and text arias are provided with the same spacing throughout the pages.



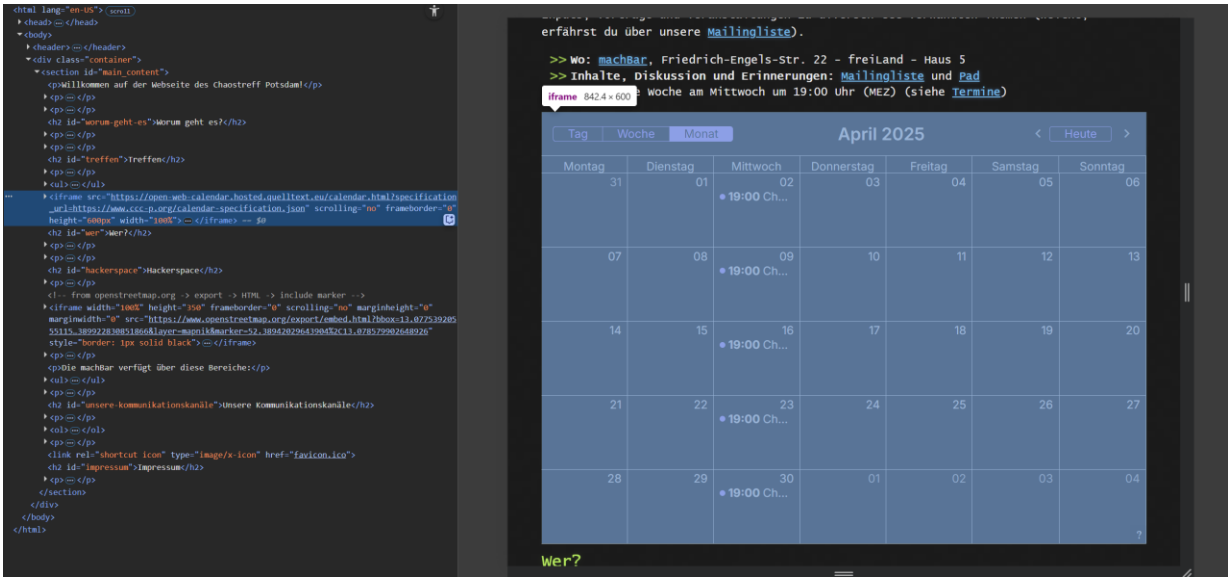


Weaknesses

- **4.1.2 Name, Role, Value**: It is crucial that ARIA-attributes are applied in the correct way. Misapplication can lead to unexpected behaviours in assistive technologies, hindering the user experience for certain individuals.



- **4.1.2 Name, Role, Value:** The frame containing the web calendar lacks an accessible name. All user interface components must have accessible names and roles. Without an accessible name, screen readers are unable to convey the purpose or content of the frame, effectively rendering the calendar inaccessible.



- **2.1.1 Keyboard:** It is not possible to reach or control the agenda in the current prototype stage. Therefore, it does not meet this Level A requirement. Ensure that the agenda is usable with only a keyboard, so everything can be done with a keyboard, except for freehand movements.

3 CASE STUDIES OF OTHER WEB CALENDARS

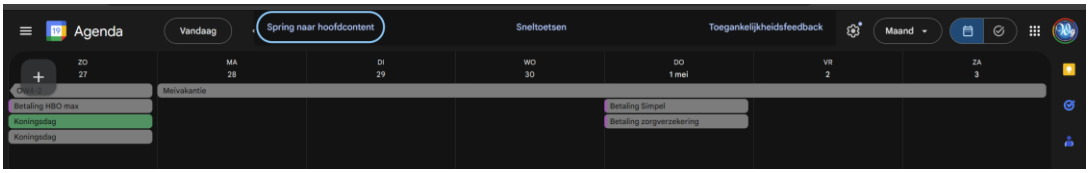
We have reviewed popular web-based calendars to identify best practices.

Google Calendar

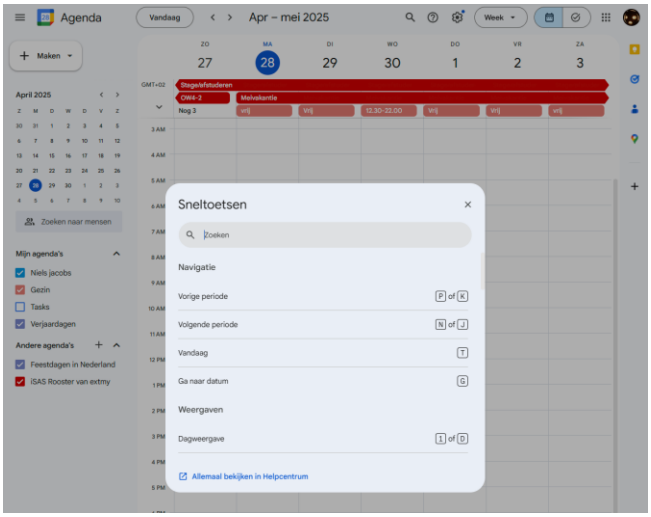
Strength

- **2.4.3 Focus Order** and **2.1.1 Keyboard Accessible**: Google Calendar has both clear tab navigation and focus indicators.
- **2.4.7: Focus Visible**: In Google Calendar, the focus is highly noticeable due to a blue border and small animation on focus. The illustration below shows this blue border when focusing the help button.

- **2.4.1 Bypass Blocks**: Keyboard Navigation and Accessibility Features:
  In Google Calendar, when navigating with the keyboard, users are provided with an option to skip repetitive content. See illustration(s) below.



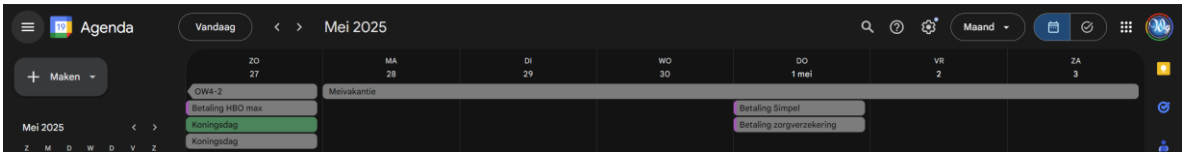
Right after this button, is a shortcut button, users are given a clear overview of all available keyboard shortcuts **(shortcuts for keyboard)**, improving accessibility and ease of use.

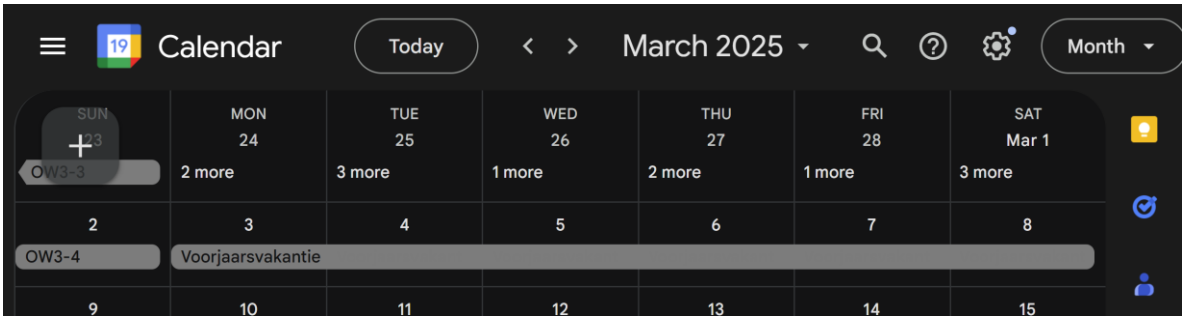


- **1.3.1 Info and Relationships** and **2.4.5 Multiple Ways** Google calendar allows users to print their agenda in A3 format for easier reading or viewing. This provides an alternative way to access the information for users who may have difficulty navigating the digital interface.

Weaknesses

- **1.4.4: Resize Text and 1.4.10 Reflow:** Google Calendar is no longer navigable with a mouse at 200% zoom (elements in the sidebar disappear). They can only be accessed using the keyboard (Tab navigation).





Teams Agenda

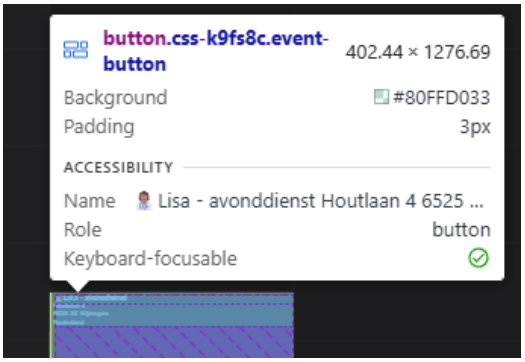
Strength

- **1.3.1 Info and Relationships and 3.3.2 Labels or Instructions** Teams Agenda announces keyboard shortcuts when focusing on a button. For example, when a user navigates to an appointment using the keyboard, the screen reader states the appointment's purpose, its location, and informs the user that pressing Shift+F10 enables quick changes. These announcements occur repeatedly; this makes Teams agenda more accessible than the others who do not.
- **4.1.2 Name, Role, Value** Ensure the web calendar is compatible with braille reading rule, as they often rely on the same code (ARIA) as screen readers. If the calendar works well with a screen reader, it is likely to work with braille as well. However, we could not evaluate this properly due to the lack of a braille reading rule.

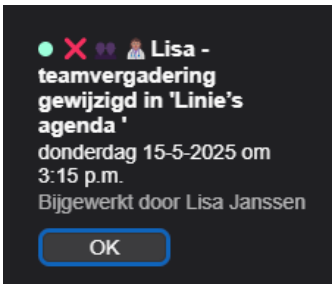
iCloud Calendar

Weaknesses

- **4.1.2: Name, Role, Value:** In iCloud Calendar, some buttons are only labelled as "Button" by the screen reader, making it unclear what their function is.



- **1.3.1: Info and Relationships:** Keyboard navigation presents challenges in iCloud Calendar: the screen reader provides excessive and unnecessary information, such as listing all events from 1 AM to 11 PM when navigating through the day. This overwhelms users instead of focusing on relevant details. In iCloud Calendar, when reviewing suggested changes in a shared calendar, the screen reader announces the "Accept" button but does not read the suggested change itself.



- **2.1.1: Keyboard:** When using the keyboard to navigate through events in iCloud Calendar, appointments are neither visually outlined nor editable, limiting usability. This is also a problem when the user wants to switch the calendar view in iCloud Calendar between day and month, this option is not accessible via keyboard navigation.
- **3.2.3: Consistent Navigation:** In iCloud Calendar the keyboard navigation changes from using the Tab and Spacebar to Arrow keys and Spacebar, creating inconsistency in navigation.
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Recommendation

After reviewing these popular web-based calendars we recommend the following best practices in addition to the WCAG 2.2 guidelines:

- **Offer a print-friendly (A3) version:** of the calendar to support a wider range of user preferences and needs.
- **Provide detailed user documentation:** that clearly explains keyboard shortcuts and how to navigate the calendar using assistive technologies like screen readers.

4 CONCLUSION

This research examined the accessibility of various web calendars. The central question was: *What are the most common accessibility challenges in the researched web calendars?* To answer this main question thoroughly, three sub-questions were explored, and the insights from those are brought together below.

To begin with, the analysis shows that **some accessibility features are well implemented** (*Sub-question 1*). A positive example is the Microsoft Teams calendar, which largely complies with the WCAG 2.2 guidelines and applies additional techniques to enhance accessibility. Some calendars demonstrate good practices such as clear labelling of buttons, support for high contrast modes, and a consistent layout structure. These features contribute to a better user experience for individuals with disabilities.

However, the research also highlights that **many features remain only partially functional or need improvement** (*Sub-question 2*). Interactive elements do not always have descriptive labels, keyboard navigation is often inconsistent, and there is a lack of clear instructions or shortcuts for users who rely on assistive technologies. These shortcomings make interaction more difficult for users with visual or motor impairments.

Based on these findings, several **concrete improvements can be recommended to ensure that web calendars conform to WCAG 2.2 Level AA** (*Sub-question 3*). Every interactive element should include a clear, descriptive label, using native HTML elements or ARIA attributes if need, so that screen readers can accurately interpret each function, also aligning with braille reading conventions. Keyboard navigation should be consistent, with standardized commands and a “skip to main content” feature. An easily accessible overview of all available keyboard shortcuts should be provided, ideally as a separate downloadable PDF. Visual customisation options, such as adjusting event colours, can further support users with colour vision deficiencies. Moreover, the design must remain fully responsive, ensuring that key elements remain visible even at a 400% zoom level.

In summary, the **most common accessibility challenges** (*Main question*) include information overload for screen reader users, inconsistent keyboard navigation, and a lack of personal sable visual options. These issues show that many web calendars are not yet fully inclusive. Implementing the suggested improvements will not only bring calendars into compliance with WCAG 2.2 standards but also make them genuinely accessible for all users.

5 REFERENCES

Website’s suggested by the client:

- **https://open-web-calendar.quelltext.eu/**
- **https://www.ccc-p.org/#treffen**

Other Web Callender's:

- **https://calendar.google.com/**
- **https://www.icloud.com/calendar/**
- **https://support.microsoft.com/nl-nl/office/**

WCAG 2.2:

- **https://www.w3.org/WAI/WCAG22/Understanding/?**