The Modern Web Browser as Assistive Technology

A Case for People with Low Vision

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Abstract

This paper argues that the modern web browser is classifiable as assistive technology, especially for those with low vision impairment. Included is an overview of low vision and demonstrates how web browsers meet the needs of those afflicted. Supplementarily included is an interview of a person with low vision disability, a recommendation after surveying current web browsers, and a training outline containing learning objectives for the recommended browser. Featured in closing is a resource kit providing references to community resources and research trends worth monitoring in the future.

Keywords: web browser, assistive technology, low vision, accessibility

The Modern Web Browser as Assistive Technology

A Case for People with Low Vision

"The web browser is my assistive technology": this is a truth valid concerning everyone who surfs the Web, although surfers with low vision impairment would be most likely to put it into such abstract terms. If one does so, this person truly understands their relationship with this technology. It has become evident to this person that one does not know a Web, but only a Web Browser that interprets a Web; that the Web is there only as representation, in other words, only in reference to another thing, namely that which represents, and this is one's Web Browser. Therefore no truth is more defined, more independent of all others, and less in need of proof than this, namely that everything that exists for knowledge in the whole of this World Wide Web is only object relative to the subject, perception of the perceiver, in a word, representation. A browser will inevitably consume everything that in any way belongs to or can belong to the World Wide Web, as its creation presupposes its interpretation by a Browser. The reason for this is that the fundamental nature of Web content is that its construction must be of Web Platform technologies. The Web is a representation.

This truth is by no means new. It has been apparent to the low-vision-impaired population who alter their browser's representation of Web content. They do this to meet their unique consumption needs. As such, To take part in a debate about this, it's crucial to understand the nature of low vision impairment to grasp how it places a burden on those afflicted – a burden to experience the Web, not as Web content publishers intend, but as they see fit. The matter at hand leaves web content publishers with an ultimatum: either provide accessible representations of their content or have it altered by a user agent.

Nature of Low Vision

Definition

"People with low vision have residual vision with some light perception, but their vision loss does not lend itself to improvement by standard spectacles or medical or surgical treatment. Such persons have the potential for enhanced functional vision if they receive appropriate low vision care services" (Pararajasegaram, 2004).

Functional Limitations

The Working Draft of *Accessibility Requirements for People with Low Vision* published by the W3C specifies five categories of visual impairment that impact web use, not including total blindness:

- Visual acuity (clarity)

- Light sensitivity

- Contrast sensitivity

- Field of vision

- Color vision

Causes

Excluding total blindness, the American Optometric Association lists macular degeneration, cataracts, glaucoma, and diabetic retinopathy as common causes (*What causes low vision?*).

Progression

Low vision does not always follow a linear trend towards blindness. "Some causes of low vision can be improved through surgery or medication, and it is not uncommon for someone to have deteriorating vision over several months, and then experience improved vision after treatment" (*Accessibility Requirements for People with Low Vision*). Aging may also be a contributor to low vision. "Starting around age 40, most people have declining vision that is not caused by disease" (*Accessibility Requirements for People with Low Vision*).

~ End Nature ~

Interview of Person with Low Vision

To better understand how a person with low vision operates, I had the pleasure of interviewing a technical writer who had previously told me how she uses browser extensions to assist with content consumption – her name omitted in the interest of confidentiality. She is a very busy person, so I challenged myself to come up with half a dozen fundamental questions whose answers would shed light on her process. The conversation was started by her asking me what questions I had prepared for her. I informed her that my inquiry was mainly to learn about coping mechanisms in a workplace environment. Along with her responses, the queries are what follow.

1. ***What type of low vision impairment do you have?***

   I struggle with light sensitivity, sometimes called photophobia.

2. ***What web browser do you use?***

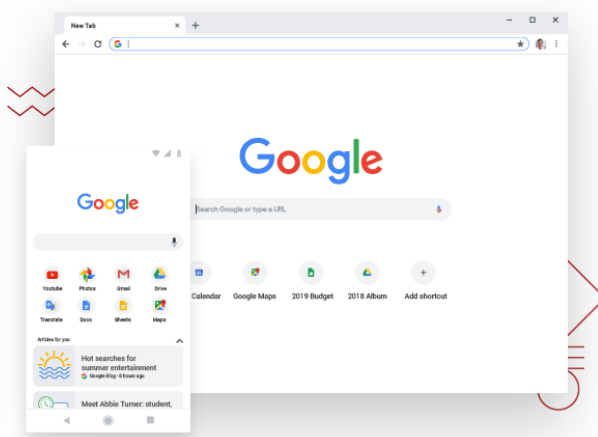   I mainly use Google Chrome due to its large number of available extensions.

Fig. 1 Google Chrome on desktop and mobile

*3. **What browser extension(s) assist(s) you with content consumption?***

I use a Chrome extension named Stylus that allows me to apply persistent styles to websites that do not provide a way of their own to make their pages less bright. Pre-made styles are maintained by the community for the very popular websites, while the more obscure sites require me to create the custom styles for them. Sometimes it can be annoying to keep my custom styles up to date when publishers make UI changes.
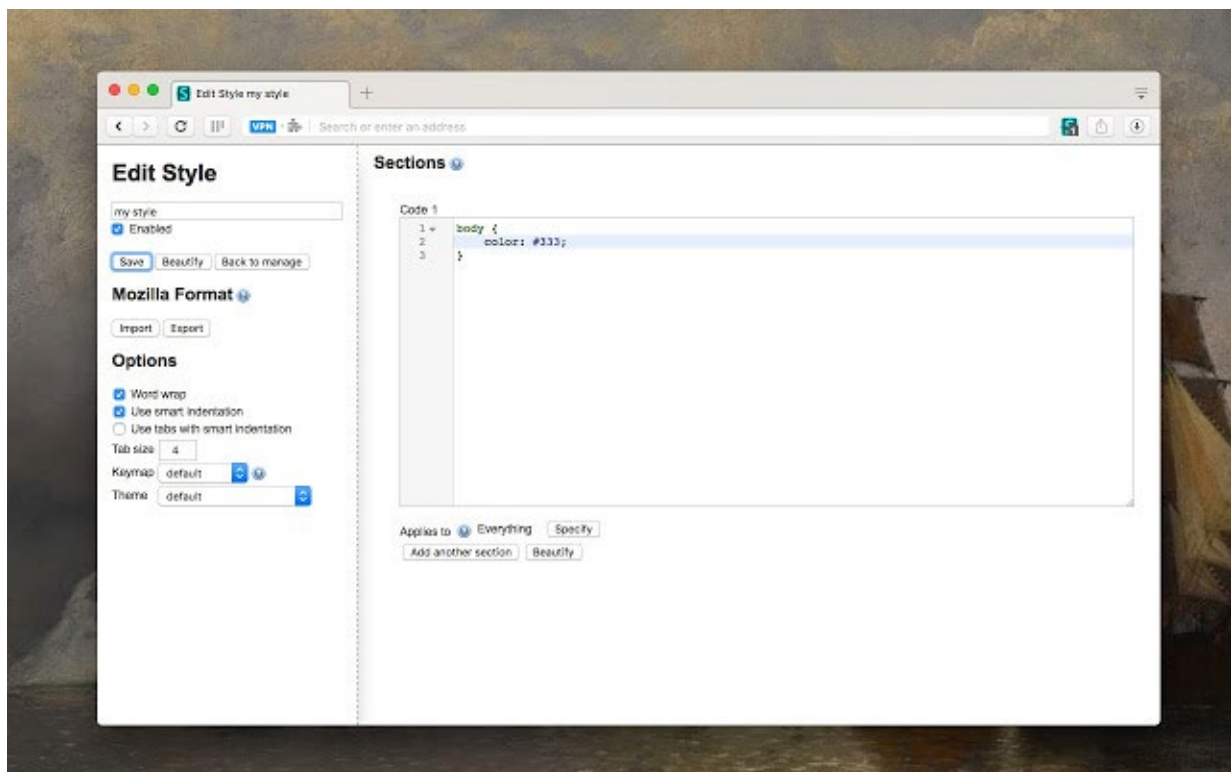

Fig. 2 The Stylus extension's style editor in Google Chrome

*4. **Do these extensions alter the representation of the web content? If so, in what way(s)?***

What I do is akin to creating a "night mode" for the sites that I frequently visit, like ones that I use for my job. I invert the web page's colors so that it has light text on a dark background instead of black text on a white background. I keep these sites in this mode.
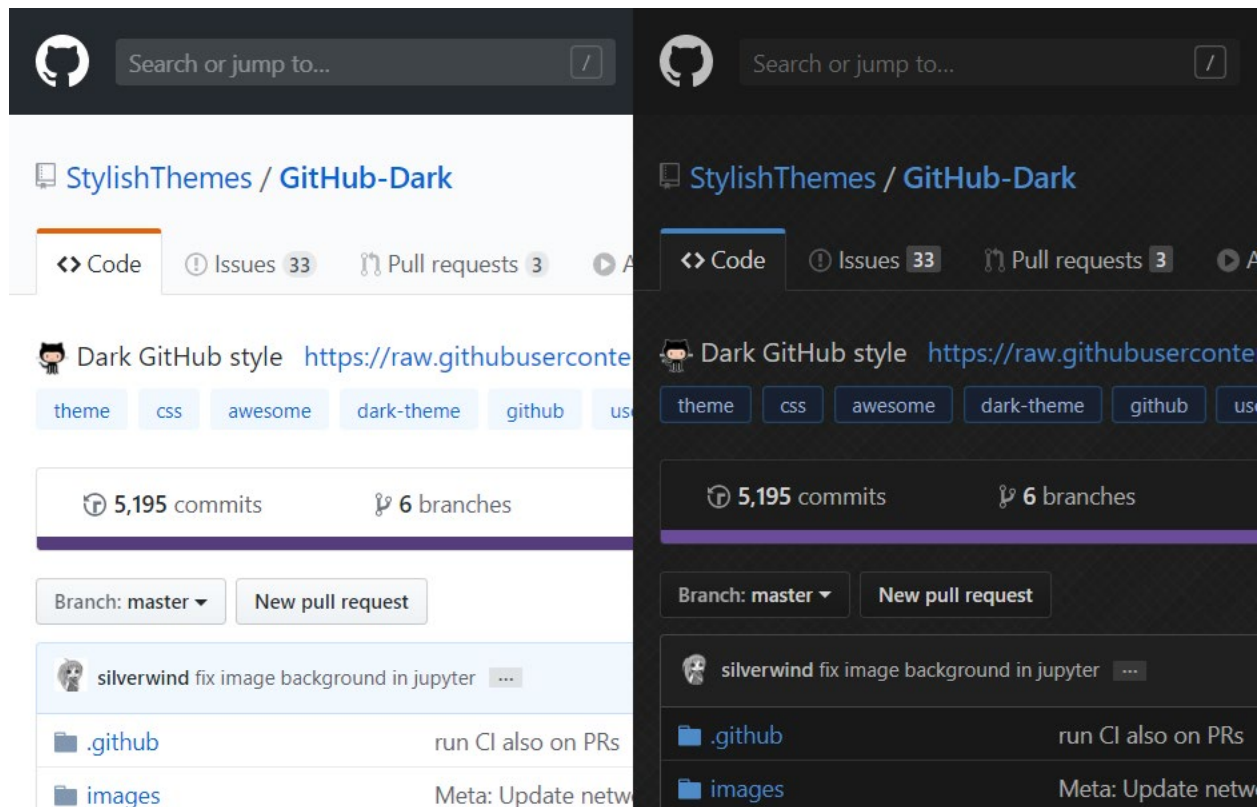
Fig. 3 Side-by-side comparison of community-maintained Stylus theme applied to GitHub

5. *How does this alteration assist you in consuming web content?*

The darker pages dim the screen enough so as not to cause my eyes pain when looking at it. Without it, I wouldn't be able to get any work done due to the discomfort caused by my condition. Dimming the entire screen via its settings makes the pages difficult to read.

6. *Do you feel as though your solution is adequately accommodating your needs?*

No, I do not think so. I believe content publishers and browser vendors can do a better job of providing the features that I not only want in my web applications but need to carry out daily tasks. Accessibility features implemented by either one of them would relieve me of the burden of having to implement them myself, which are painful to execute.

Once the interrogation was over, I thanked her for her time, but before going our separate ways, she wanted to inform me about some newer browser features that were emerging to facilitate this process. She told me about something called "reader mode" that extracts a page's content and puts the browser into a mode that isolates the text that was on the page, dims the screen, and allows one even to have the browser read the book.
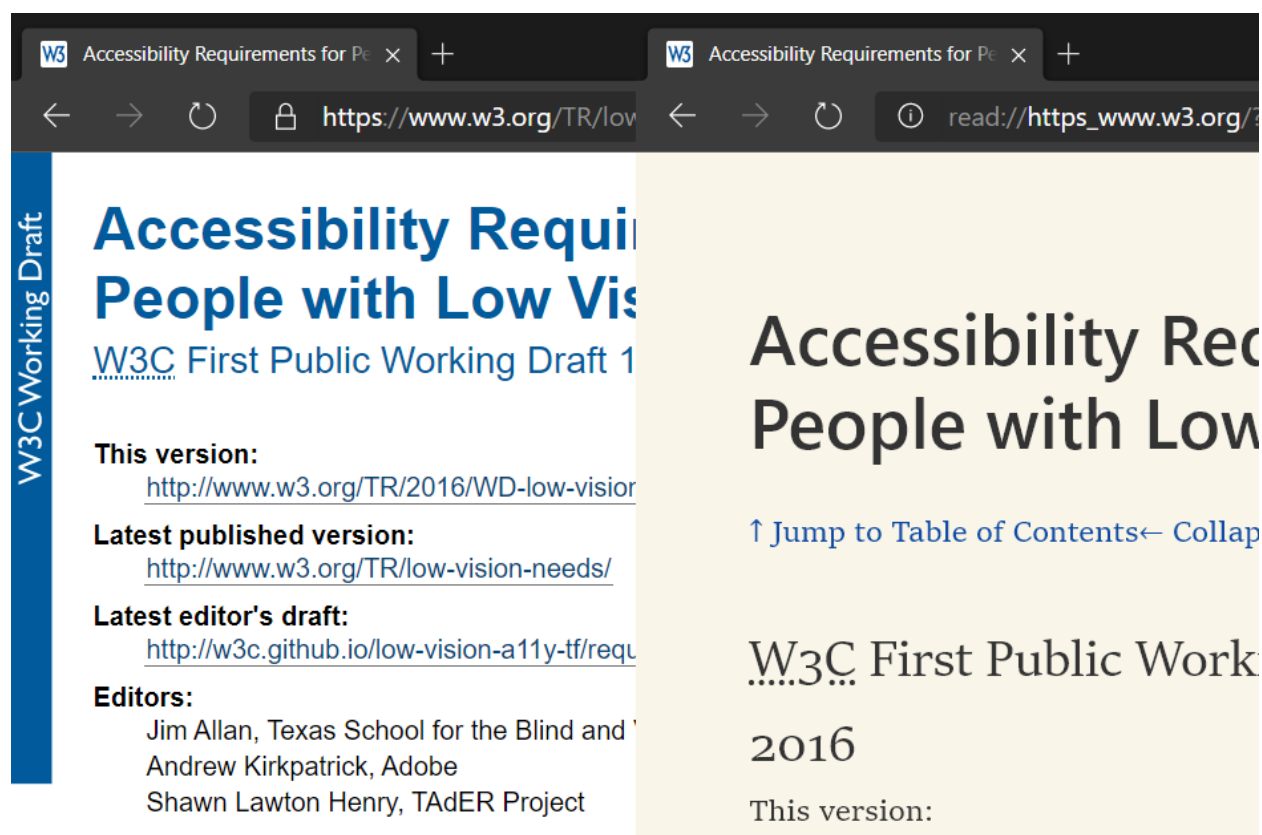
Fig. 4 Side-by-side comparison of a W3C working draft in Microsoft Edge's reader mode

~ End Interview ~

Resource Kit

This section contains a collection of current and future needs pertinent to the five categories of low vision that impact web use as described in *Accessibility Requirements for People with Low Vision*. Although the needs are verbatim, this compiled representation facilitates consumption.

Visual acuity (clarity)

- *Text Size:* Users can change the text size (font size) of all text without zooming the entire interface.

- *Font:* Users can change the font face (also called font family or typeface) of all text, choosing from a wide range of fonts, including serif and sans serif fonts.

- *Capitalization:* Users can change the capitalization (all capital letters, small capital letters, sentence style) of blocks of text.

- *Leading:* Users can change the leading (line spacing, line height) of blocks of text.

- *Letter Spacing:* Users can change the letter spacing (space between the letters / characters) of blocks of text.

- *Word Spacing:* Users can change the word spacing (space between words) of blocks of text.

- *Justification:* Users can change the justification / alignment (left, right, full / both, centered) of blocks of text.

- *Margins and Borders:* Users can change the margins (blank space) and borders — including line color, width, style — around blocks of text.

- *Spacing Between Elements:* Spacing groups related elements and separates less related elements.

- *Element-level Customization:* Users can customize text differently for specific elements, such as headings, lists, and paragraph text.

Field of vision

- *Rewrap:* Blocks of text rewrap so that only one direction of scrolling is needed.

- *Reflow:* Users can set blocks of text in one continuous block, instead of in multiple columns.

- *Line Length:* Users can set the line length for blocks of text. Often the easiest way to do this (for developers, designers, and users) is for users to resize text areas and the text rewraps to change the line length.

- *Hyphenation:* Users can turn hyphenation on or off.

- *Point of Regard:* The point of regard remains visible within the viewport when the viewport is resized, when content is zoomed or scaled, or when content formatting is changed.

- *Related Information:* Users know about and can find related information.

Light sensitivity

- *Brightness:* Users can set the overall brightness of a display.

Color vision

- *Color:* Color is not the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.

Contrast sensitivity

- *Contrast:* Users can set the background color and the text color from the full color spectrum.

All Categories

- *All Elements:* Users can see all interface elements that are intended for users to see, including when users have changed display settings such as text size.

- *User Settings:* Content picks up all relevant user settings, such as Dark Mode, Reader Mode, et al.

~ End Resource Kit ~

Community Resources

This section contains a collection of references to recognized community resources pertinent to people with low vision impairment and even total blindness.

1. **American Academy of Ophthalmology**

   Website: www.aao.org

   Distributes information on eye disorders and low vision.

2. **American Council of the Blind**

   Web site: www.acb.org

   Provides services to blind and visually impaired individuals and publishes a magazine.

3. **American Foundation for the Blind**

   Website: www.afb.org

   Publishes a peer-reviewed magazine that includes information and original research; advocates for policies that promote accessibility.

4. **Glaucoma Research Foundation**

   Website: www.glaucoma.org

   Provides financial support for research in the field of glaucoma.

5. **The Low Vision Centers of Indiana**

   Website: www.eyeassociates.com

   The Low Vision Centers of Indiana is a nationally recognized practice devoted to low-vision rehabilitation.

6. **National Eye Institute**

   Web site: www.nei.nih.gov

   Has information on visual impairment, supports the training of eye researchers, and conducts research on eye and vision disorders.

7. **Smith-Kettlewell Eye Rehabilitation Engineering Research Center**

   Website: www.ski.org

   Develops new technology and methods for understanding, assessment, and rehabilitation of blindness and visual impairment.

~ End Community Resources ~

Research Trends to Monitor

A web content accessibility trend worth monitoring is a practice dubbed *removal of barriers to entry*, which browser vendors accomplish by having accessibility features built directly into the browser itself as opposed to requiring it to be furnished by web content publishers or via browser extensions. In the case of light sensitivity, the necessity of an extension like Stylus is a *barrier to entry* that can be removed by either the web content publisher or the browser vendor. In the case of web content publishers, the Twitter web application is an excellent example of this. It allows users to customize the site's theme based on their own personal preferences. Without this feature, an extension like Stylus would have been necessary to accomplish the same task.
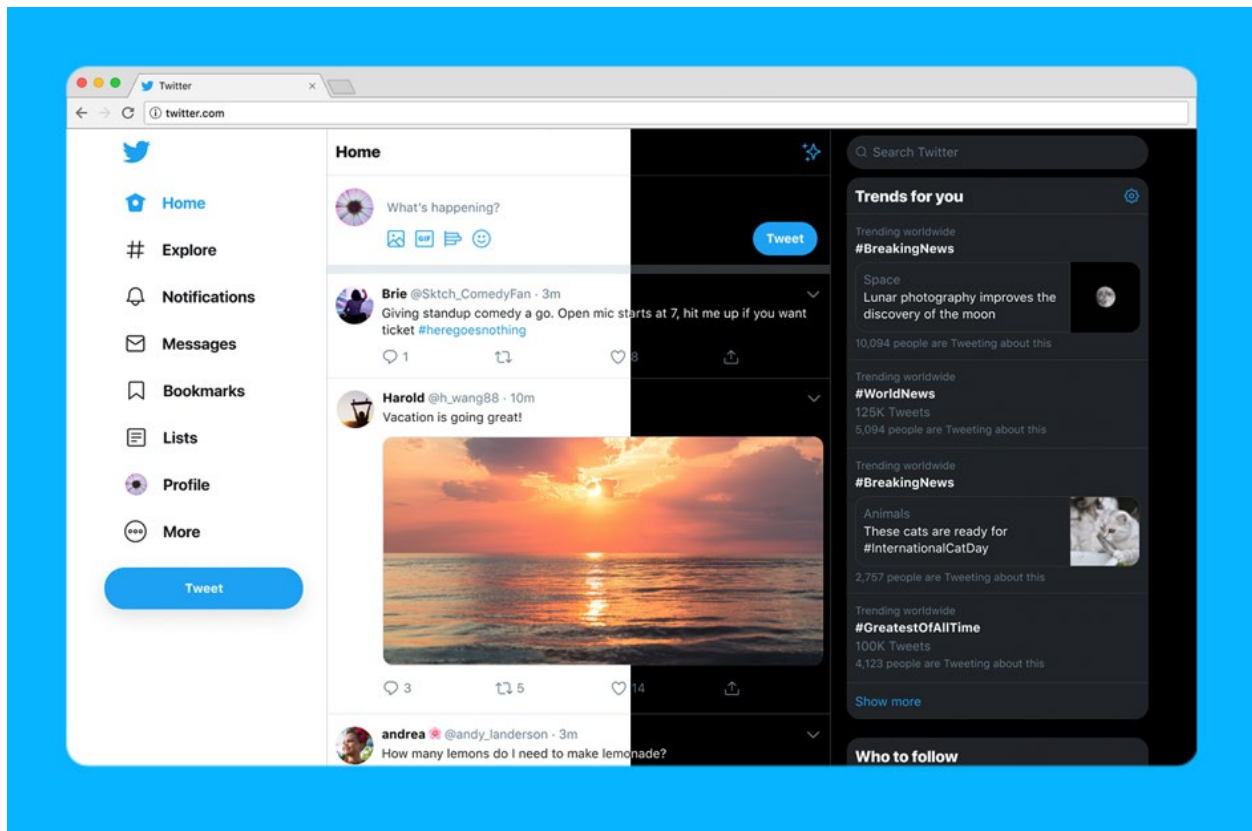

Fig. 5 Before & after comparison of Twitter's dark mode theme called "lights out."

In the case of browser vendors doing this, Opera Mobile for Android is an excellent example of this, which now has a "dark web pages" feature that applies dark mode user agent styles to *every* web page one visits. What follows are notable features to check for when determining whether a web browser is a suitable assistive technology.
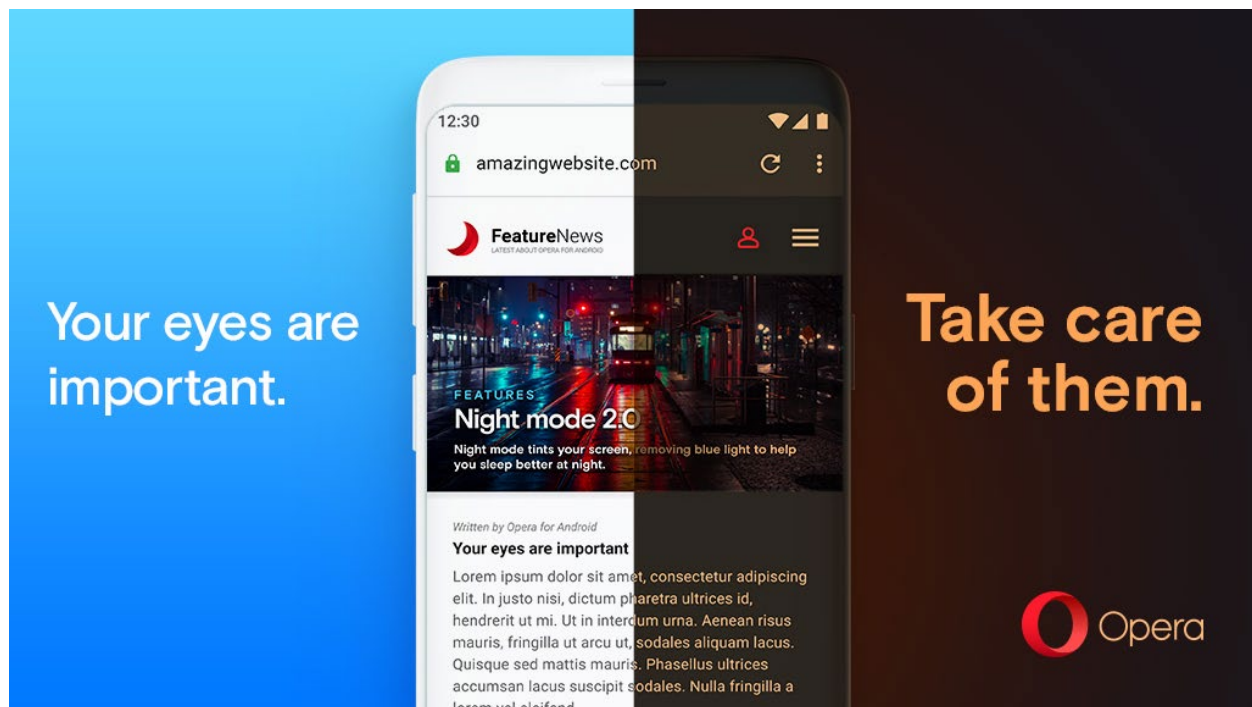

Fig. 6 Marketing image of Opera for Android 55 dark mode feature called "dark web pages."

Most notable trends.

- Dark mode

- Reader mode

- Text-to-speech

Notable trending browsers.

- Google Chrome

- Microsoft Edge

- Opera for Android

~ End Trends ~

Assistive Technology Evaluations and Recommendation

This section contains a systematic evaluation and recommendation of the appropriate assistive technology, namely the web browser, intended to serve the needs of someone in the workplace; hence, features to be evaluated will be those exclusively related to productivity tasks.

Feature evaluation

Reader mode

Built-in:

Extension:

Text-to-speech

Built-in:

Extension:

Dark-mode styles

Built-in:

Extension

Recommendation

It is recommended to use all three browsers to perform the various tasks that they support. Built-in support is generally a more polished and delightful experience than the equivalent alternatives furnished via third-party plugins.

Key	
=> Opera for Android	
=> Microsoft Edge	
=> Google Chrome	

~ End Evaluation & Recommendation ~

Training Outline

This section contains learning objectives for the trending web browsers. As not all required features are readily available by default, the execution of additional procedures must occur in order to enable the functionality required by people with low vision.

Learning objectives

- ➢ Enable Reader Mode in Chrome

- ➢ Activate Reader Mode in Microsoft Edge

- ➢ Install Text-to-Speech Extension in Chrome

- ➢ Install Stylus Extension in Chrome

- ➢ Install Community Dark Mode Stylus Themes

- ➢ Enable Dark Mode with Dark Web Pages Feature in Opera Mobile for Android

~ End Training Outline ~

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