



# Building Accessible Software

Anna Maier, TOPdesk

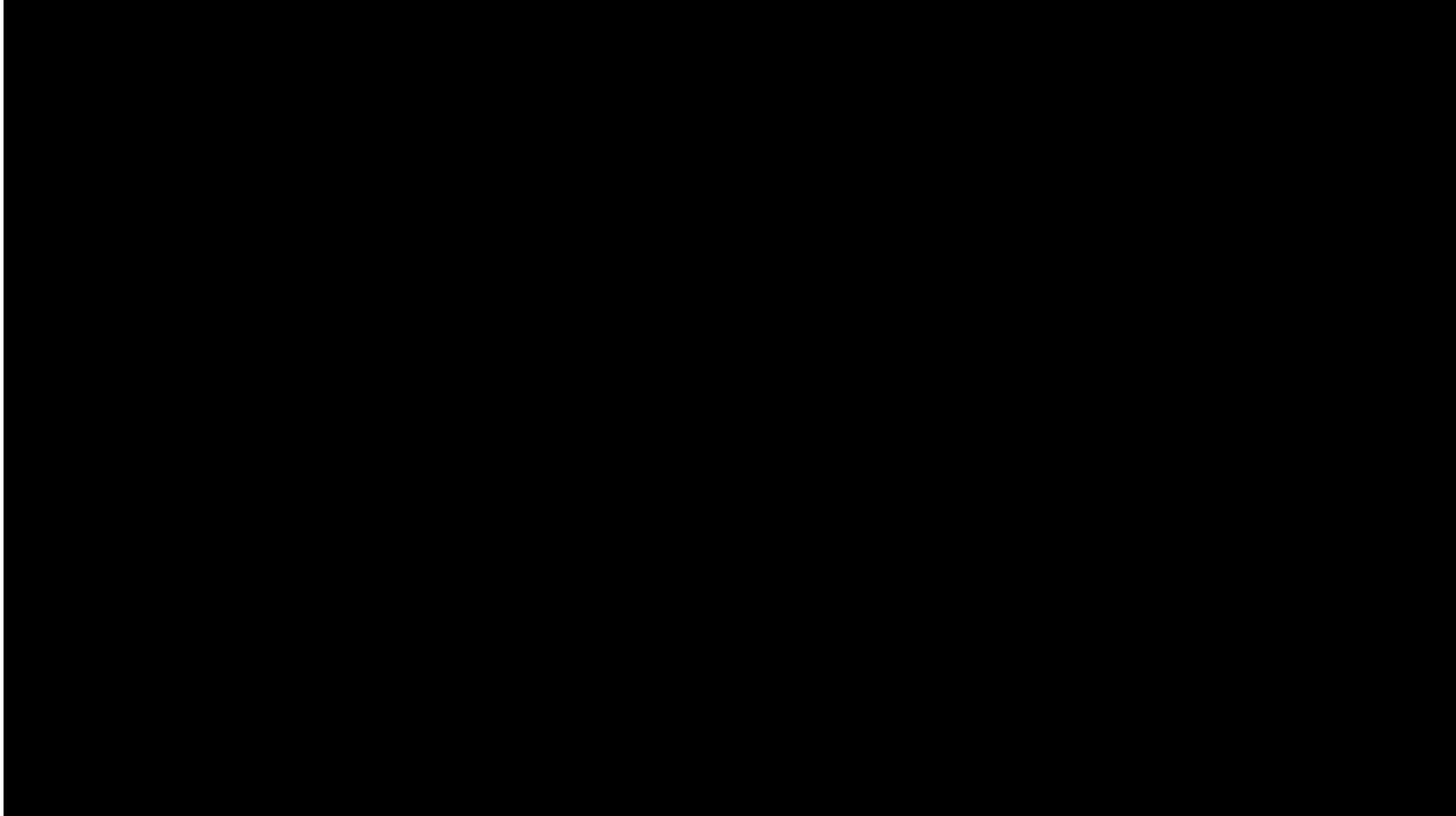
# About me



- Software Developer since 2007 (Java + Web)
- Busy with Accessibility since 2019
- Develop Service Mgt Software @ TOPdesk



**Let's start with a video**



# Why consider accessibility?





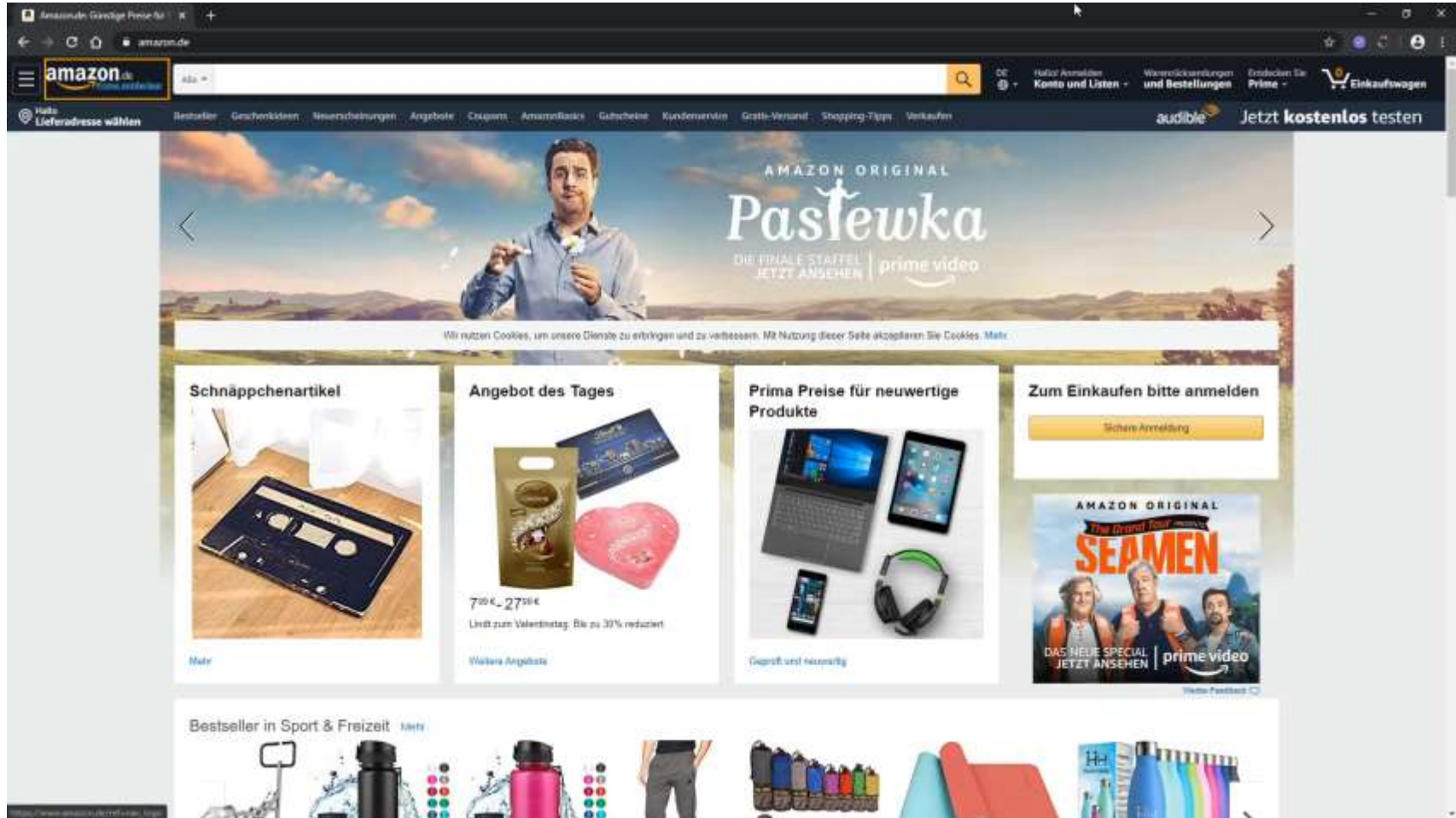
# Why consider accessibility?

~80 million people with a disability in the EU!

# Low vision

The screenshot displays the Amazon.de homepage with a low-vision user interface. The browser address bar shows the URL <https://www.amazon.de/>. The main navigation bar includes the Amazon logo, a search bar, and links for account management, orders, and Prime. A secondary navigation bar features categories like 'Bestseller', 'Geschenkkästen', and 'Angebote'. The main banner is for the Amazon Original series 'STAR TREK PICARD', featuring a large image of Captain Picard and the text 'AMAZON ORIGINAL STAR TREK PICARD' and 'JEDEN FREITAG EINE NEUE FOLGE | prime video'. Below the banner are three promotional boxes: 'Angebot des Tages' for a Sony TV and Heimkino system (229,00 € - 539,00 €), 'Prima Preise für neuwertige Produkte' for a laptop, tablet, smartphone, and headphones, and a 'SEAMEN' special announcement. A 'Werbe-Feedback' button is visible. At the bottom, there is a 'Zum Einkaufen bitte anmelden' button with a 'Sichere Anmeldung' link, and a 'Herren-Lieblingssuhren' section with a 'Mehr' link.

# Motor impairment





# Cognitive impairments

The image shows a screenshot of the Amazon.de homepage. At the top, there is a navigation bar with the Amazon logo, a search bar, and various utility links like 'Hilf bei Anmelden', 'Konto und Listen', 'Warnmeldungen und Bestellungen', and 'Bestellen Sie Prime'. Below the navigation bar is a large banner for the Amazon Original series 'Pastewka', featuring a man in a blue shirt holding a small object. The banner text reads 'AMAZON ORIGINAL Pastewka DIE FINALE STAFFEL JETZT ANSEHEN | prime video'. Below the banner is a small cookie consent message: 'Wir nutzen Cookies, um unsere Dienste zu erbringen und zu verbessern. Mit Nutzung dieser Seite akzeptieren Sie Cookies. Mehr'. The main content area is divided into several promotional tiles. The first tile is titled 'Schnäppchenartikel' and shows a black cassette tape. The second tile is titled 'Anprobier das Tragen' and shows a gold-colored bag and a pink heart-shaped object, with text 'Leidt zum Valentinstag. Bis zu 30% reduziert'. The third tile is titled 'Prima Preise für neuwertige Produkte' and shows a laptop, a smartphone, and headphones. The fourth tile is titled 'Zum Einkaufen bitte anmelden' and has a yellow button that says 'Sichere Anmeldung'. Below these tiles is a section for 'Bestseller in Sport & Freizeit' with various sports-related items like water bottles and bags. A purple text overlay is positioned over the middle of the page, reading 'Should I answer that text message?'.

amazon.de

AMAZON ORIGINAL  
**Pastewka**  
DIE FINALE STAFFEL  
JETZT ANSEHEN | prime video

Wir nutzen Cookies, um unsere Dienste zu erbringen und zu verbessern. Mit Nutzung dieser Seite akzeptieren Sie Cookies. Mehr

**Schnäppchenartikel**

**Anprobier das Tragen**

**Prima Preise für neuwertige Produkte**

**Zum Einkaufen bitte anmelden**

Sichere Anmeldung

**Should I answer that text message?**

AMAZON ORIGINAL  
**The Grand Tour**  
**SEAMEN**  
DAS NEUE SPECIAL  
JETZT ANSEHEN | prime video

Bestseller in Sport & Freizeit



# It could be you!

```
1  import React from 'react';
2  import styled from 'styled-components';
3
4  function IconButton() {
5
6  }
7
8  export default IconButton;
9
```

Source: <https://www.joshwcomeau.com/blog/hands-free-coding/>

**It could be you!**



**It could be you!**



**It will be you!**





# It is for you!

- Accessible software benefits everyone!



# Where to start with accessibility?

- Web Content Accessibility Guidelines (WCAG)
  - Basis for laws
  - Three levels of conformance: A, AA, AAA





# Conformance levels

- Example: Videos:
  - A: captions on pre-recorded videos
  - AA: captions on live videos
  - AAA: sign-language interpretation on pre-recorded videos



# WCAG Principles

- Perceivable
- Operable
- Understandable
- Robust
- <https://www.w3.org/WAI/WCAG21/quickref/>

# All hands on accessibility



# User research



[An Alphabet of Accessibility Issues](#)

# Screen conditions

- Minimal Resolution: 1280 x 1024
- Maximum Zoom: 400%



# Keyboard navigation







# Color as information

Some text here with a [link](#).

Normal colour vision

Some text here with a [link](#).

Deuteranopia (green-blind)

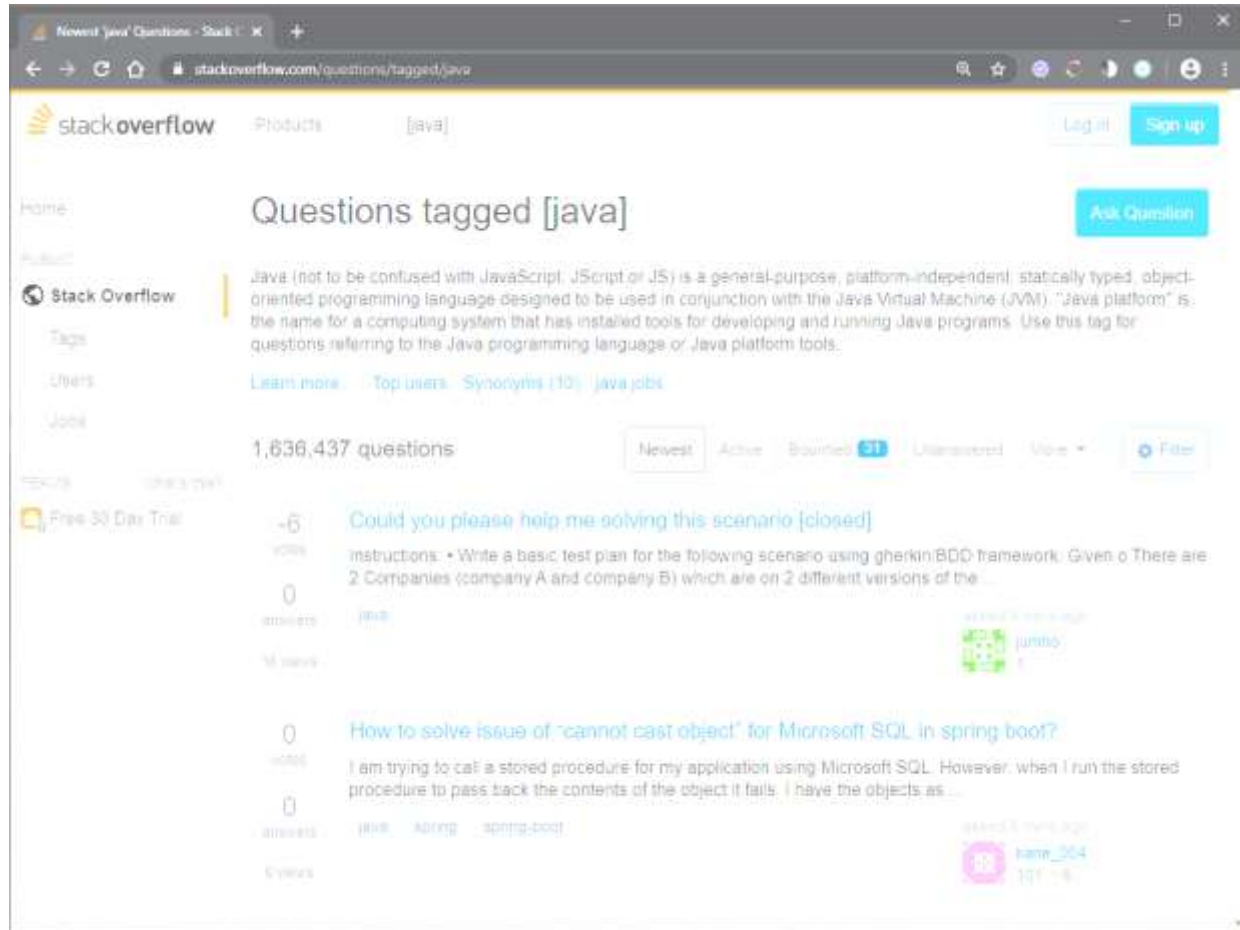
Some text here with a [link](#).

Protanopia (red-blind)

Some text here with a [link](#).

Monochromacy

# Color contrast



The screenshot displays the Stack Overflow interface for the 'Questions tagged [java]' page. The browser address bar shows the URL `stackoverflow.com/questions/tagged/java`. The page header includes the Stack Overflow logo, 'Products', the tag '[java]', and 'Log in' and 'Sign up' buttons. A sidebar on the left contains navigation links: Home, About, Stack Overflow, Tags, Users, and Jobs. The main content area is titled 'Questions tagged [java]' and includes an 'Ask Question' button. Below the title is a descriptive paragraph about Java: 'Java (not to be confused with JavaScript, JScript or JS) is a general-purpose, platform-independent, statically typed, object-oriented programming language designed to be used in conjunction with the Java Virtual Machine (JVM). "Java platform" is the name for a computing system that has installed tools for developing and running Java programs. Use this tag for questions referring to the Java programming language or Java platform tools.' Below this is a link to 'Learn more' and a list of related tags: 'Top users', 'Synonyms (10)', 'java jobs'. The page shows '1,636,437 questions' and a filter bar with options: 'Newest', 'Active', 'Bountied 21', 'Unanswered', and 'More'. A 'Filter' button is also present. The first question listed is 'Could you please help me solving this scenario [closed]', which has 0 votes, 0 answers, and 14 views. The second question is 'How to solve issue of "cannot cast object" for Microsoft SQL in spring boot?', which has 0 votes, 0 answers, and 0 views. The page also features a 'Free 30 Day Trial' banner on the left and user avatars for 'jumbo' and 'hany\_304'.

# Color contrast examples

Example	Ratio	Small text (min 4.5:1)	Large text (min 3:1)
Hello	3.94:1	fail	fail
Hello	4.3:1	fail	pass
Hello	4.69:1	pass	pass



# Implementing Accessibility

# Images



```
<a href="/home" ></a>
```



NVDA Speech Viewer
home%E2%80%9D graphic link
<input checked="" type="checkbox"/> Show Speech Viewer on Startup

# Images



```
<a href="/home" ></a>
```



NVDA Speech Viewer

Logo graphic link

Show Speech Viewer on Startup



# Images



```
<a href="/home" ></a>
```



NVDA Speech Viewer

Home page graphic link

Show Speech Viewer on Startup

# Images



```

```

# Alt decision tree

- <https://www.w3.org/WAI/tutorials/images/decision-tree/>

## An alt Decision Tree

This decision tree describes how to use the `alt` attribute of the `<img>` element in various situations. For some types of images, there are alternative approaches, such as using CSS background images for decorative images or web fonts instead of images of text.

Does the image contain text?

No:

Continue.

Yes:

- ... and the text is also present as *real* text nearby.  
→ Use an empty `alt` attribute. See [Decorative Images](#).
- ... and the text is only shown for visual effects.  
→ Use an empty `alt` attribute. See [Decorative Images](#).
- ... and the text has a specific function, for example is an icon.  
→ Use the `alt` attribute to communicate the function of the image. See [Functional Images](#).
- ... and the text in the image is not present otherwise.  
→ Use the `alt` attribute to include the text of the image. See [Images of Text](#).

Is the image used in a link or a button, and would it be hard or impossible to understand what the link or the button does, if the image wasn't there?

No:

Continue.

Yes:

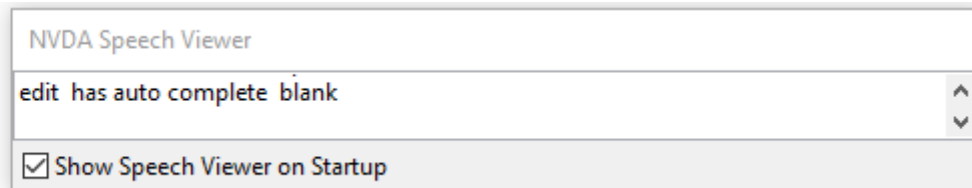
- Use the `alt` attribute to communicate the destination of the link or action taken. See [Functional Images](#).

# Form labels

```
<span>Name</span>  
<input type="text"/>
```

Name

Name



NVDA Speech Viewer

edit has auto complete blank

Show Speech Viewer on Startup

The screenshot shows a dialog box titled "NVDA Speech Viewer". It contains a text input field with the text "edit has auto complete blank" and a scrollable list of options. The first option is "Show Speech Viewer on Startup", which is checked. There are up and down arrow buttons on the right side of the list.

# Form labels

```
<input type="text" placeholder="Name"/>
```

# Form labels

```
<label for="nameField" >Name</label>  
<input id="nameField" type="text"/>
```

Name

Name

NVDA Speech Viewer
Name edit has auto complete blank
<input checked="" type="checkbox"/> Show Speech Viewer on Startup

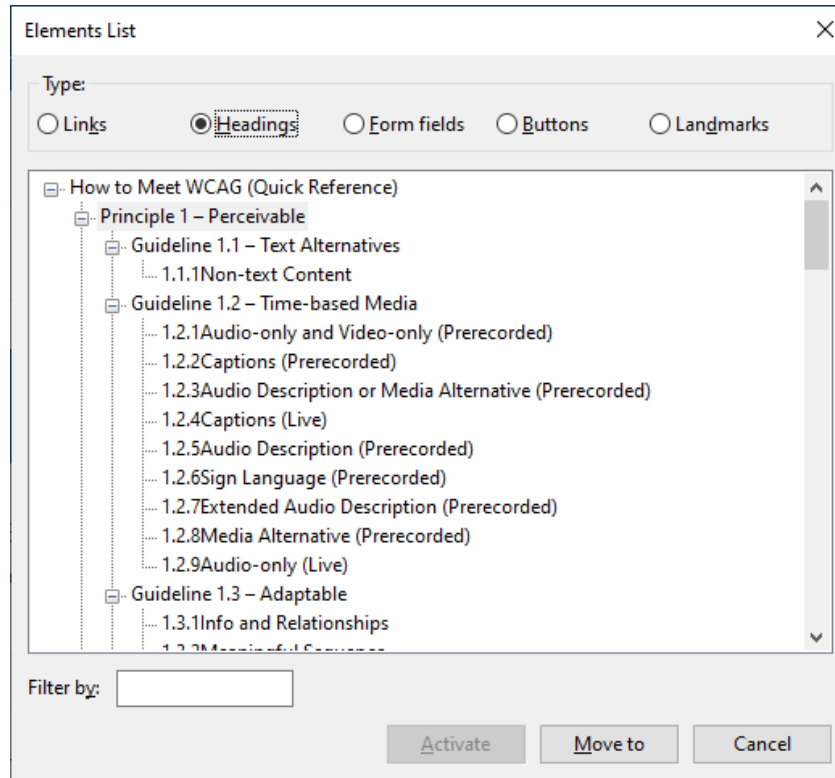




# Semantic markup

- Provide information about the purpose of an element
- Helps assistive technologies understand the structure

# Semantic markup



# Semantics of interactive elements



```
<button>  
    
</button>
```

- ▼ Checks
  - No checks for this node.
- ▼ Properties
  - name: "Search"
  - role: "pushbutton"
  - ▶ actions: [...]
  - value: ""
  - DOMNode: button ⚙
  - description: ""
  - keyboardShortcut: ""
  - childCount: 1
  - indexInParent: 19
  - ▶ states: [...]
  - ▶ relations: {...}
  - ▶ attributes: {...}

# Semantics of custom controls



```
<div class="button">  
    
</div>
```

- ▼ Checks
  - No checks for this node.
- ▼ Properties
  - name: "Search"
  - role: "graphic"
  - ▶ actions: []
  - value: ""
  - DOMNode: img
  - description: ""
  - keyboardShortcut: ""
  - childCount: 0
  - indexInParent: 0
  - ▶ states: [...]
  - ▶ relations: {...}
  - ▶ attributes: {...}

# Semantics of custom controls - fixed



```
<div class="button" role="button" tabindex="0">  
    
</div>
```

▼ Checks

**Keyboard**

❗ Interactive elements must be able to be activated using a keyboard. [Learn more](#)

▼ Properties

name: "Search"

role: "pushbutton"

▶ actions: []

value: ""

DOMNode: img 🗑

description: ""

keyboardShortcut: ""

childCount: 0

indexInParent: 0

▶ states: [...]

▶ relations: {...}

▶ attributes: {...}

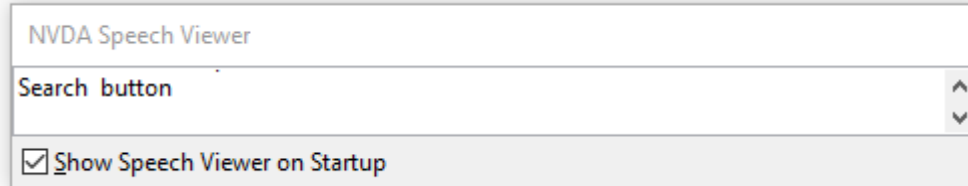


# ARIA

- Accessible Rich Internet Applications
- HTML Extension for Assistive Technologies
- Purely semantic – no actions

# ARIA labels

```
<button aria-label="Search">  
    
</button>
```



# ARIA states

```
<button disabled>
```

```
  
```

```
</button>
```

```
<div class="button disabled" role="button" tabindex="0" aria-disabled="true" >
```

```
  
```

```
</div>
```





# ARIA guide

<https://www.w3.org/TR/wai-aria-practices-1.1/>



# Testing Accessibility

- Check against WCAG criteria
- Automatic testing gets max 30% of issues
- Manual tests necessary

# Testing – automatic WCAG checks

The screenshot shows the WAVE web accessibility evaluation tool interface. The tool is powered by WebAIM and displays 18 errors and 205 contrast errors. The main content area shows a Stack Overflow question titled "Java access dynamically created JFrame" with 1,636,621 questions tagged with [java].

**WAVE web accessibility evaluation tool**  
powered by WebAIM

Styles: OFF  ON

**Details**  
Summary Details Reference Structure Contrast

**18 Errors**

- 1 X Spacer image missing alternative text
- 2 X Missing form label
- 1 X Document language missing
- 8 X Empty link
- 2 X Broken ARIA reference
- 4 X Broken ARIA menu

**205 Contrast Errors**  
205 X Very Low Contrast

**Questions tagged [java]**  
1,636,621 questions

**Java access dynamically created JFrame**  
I'm creating an application which monitors a users desktop in Java. There are clients which are sending static images to the server and the server refreshes the dynamically created JFrame for that.

[Code](#)

# Testing – color contrast

The image shows a browser window with two tabs. The active tab is 'WCAG Color Contrast checker', which displays a list of visible elements with their contrast ratios and sizes. The 'Color tool' section shows a foreground color of #FFFFFF and a background color of #0085FF. A table below shows contrast results for different font sizes and weights.

Size	Contrast	AA	AAA
small	3.11	✗	✗
Large	3.11	✓	✗

The second tab is 'Stack Overflow', showing a search for 'java' and a list of questions. The top question is 'Java access dynamically created JFrame' with 0 votes and 7 answers. The second question is 'Java org.mockserver load response body from file' with 0 votes and 4 answers. The third question is 'How to Secure Resources in Android' with 0 votes and 0 answers.

# Guided Manual Testing

The screenshot displays the 'Accessibility Insights for Web' application interface. The browser address bar shows the URL: <https://chrome.google.com/webstore/detail/accessibility-insights-for-web/pbjkligggfmakdaogkfomddhfmjni>. The application title is 'Accessibility Insights for Web' with a sub-tab for 'Assessment'. The target page is identified as 'Newest 'java' Questions - Stack Overflow'. The left sidebar contains a navigation menu with 15 categories: Overview (8% Completed), Automated checks, Keyboard, Focus (selected), Landmarks, Headings, Repetitive content, Links, Native widgets, Custom widgets, Timed events, Errors / status, Page navigation, Parsing, Images, and Language. The main content area is titled 'Focus' and includes a 'Getting Started' section with introductory text about keyboard navigation and focus. Below this is a 'Requirements' section with five items, each with a radio button: 1. Visible focus, 2. Revealing content, 3. Modal dialogs, 4. Closing content, and 5. Focus order. A 'Visible focus' panel is open on the right, showing a 'Visual helper' toggle set to 'On' and a 'How to test' section with three numbered steps for manual testing.

Target page: Newest 'java' Questions - Stack Overflow

Export result Start over

Overview 8% Completed

Automated checks

Keyboard

**3 Focus**

4 Landmarks

5 Headings

6 Repetitive content

7 Links

8 Native widgets

9 Custom widgets

10 Timed events

11 Errors / status

12 Page navigation

13 Parsing

14 Images

15 Language

## Focus

Getting Started

When interacting with a website or web app using a keyboard, users need to know which component currently has the input focus. By default, web browsers indicate focus visually, but custom programming, styles, style sheets, and scripting can disrupt it.

When navigating sequentially through a user interface, keyboard users need to encounter information in an order that preserves its meaning and allows them to perform all supported functions.

### Requirements

- 1 Visible focus.** Components must provide a visible indication when they have the input focus.
- 2 Revealing content.** Activating a component that reveals hidden content must move input focus into the revealed content.
- 3 Modal dialogs.** Users must not be able to Tab away from a modal dialog without explicitly dismissing it.
- 4 Closing content.** Closing revealed content must return input focus to the component that revealed it.
- 5 Focus order.** Components must receive focus in an order that preserves meaning and operability.

### Visible focus

Visual helper  On

How to test

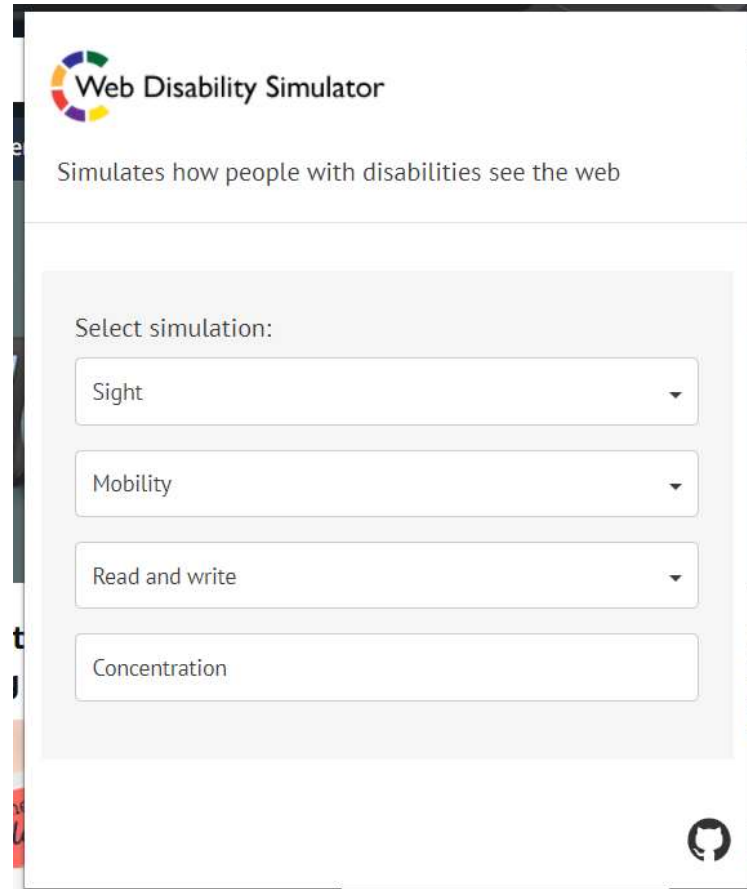
The visual helper for this requirement records elements in the target page that receive the input focus.

- Use the keyboard to navigate through all the interactive interface components in the target page.
  - Use **Tab** and **Shift+Tab** to navigate between widgets both forwards and backwards.
  - Use the arrow keys to navigate between the focusable elements within a composite widget.
- As you move focus to each component, verify that it provides a visible indication that it has received the focus. (In addition to the circle drawn by Accessibility Insights for Web.)
- Record your results:
  - If you find any failures, select **Fail**, then add them as failure instances.
  - Otherwise, select **Pass**.

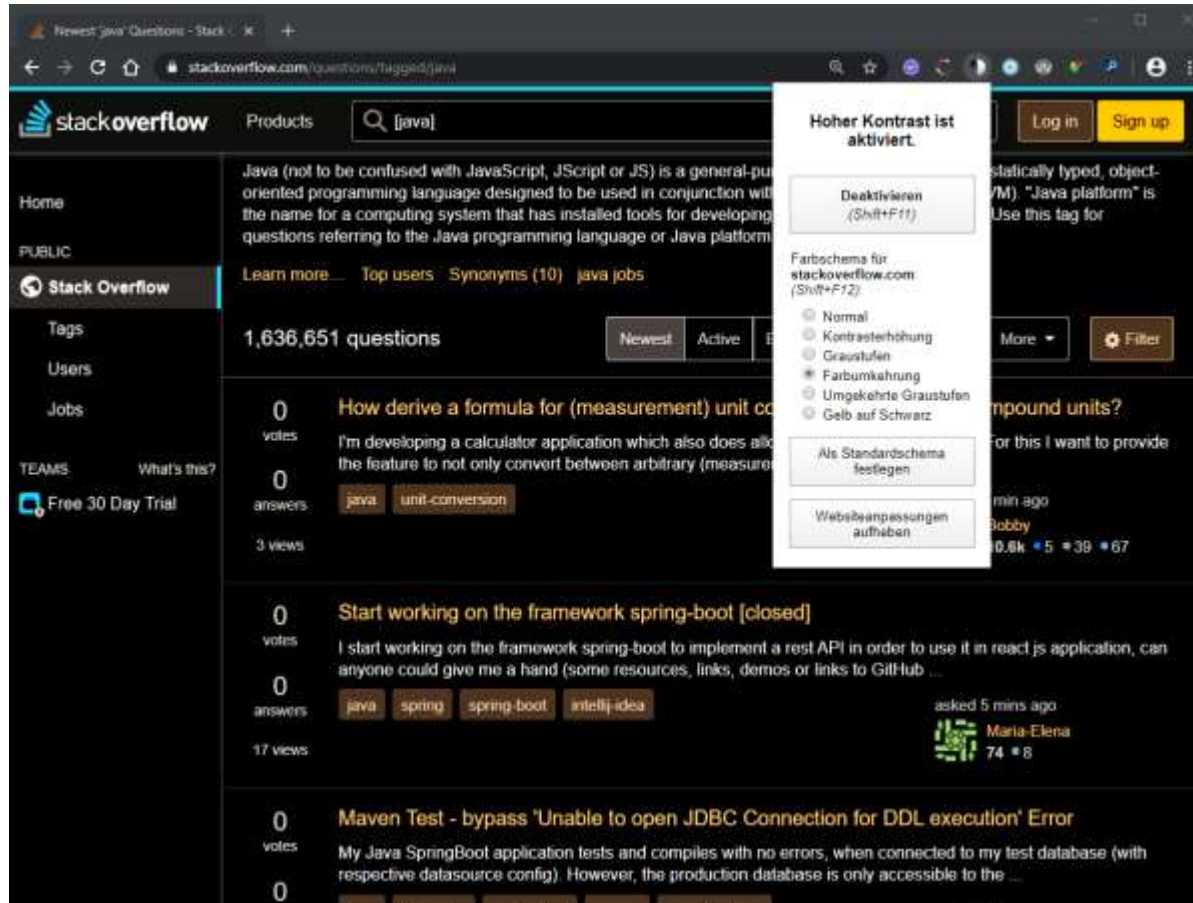


# Understanding the user

# Simulate impairments



# Change contrast



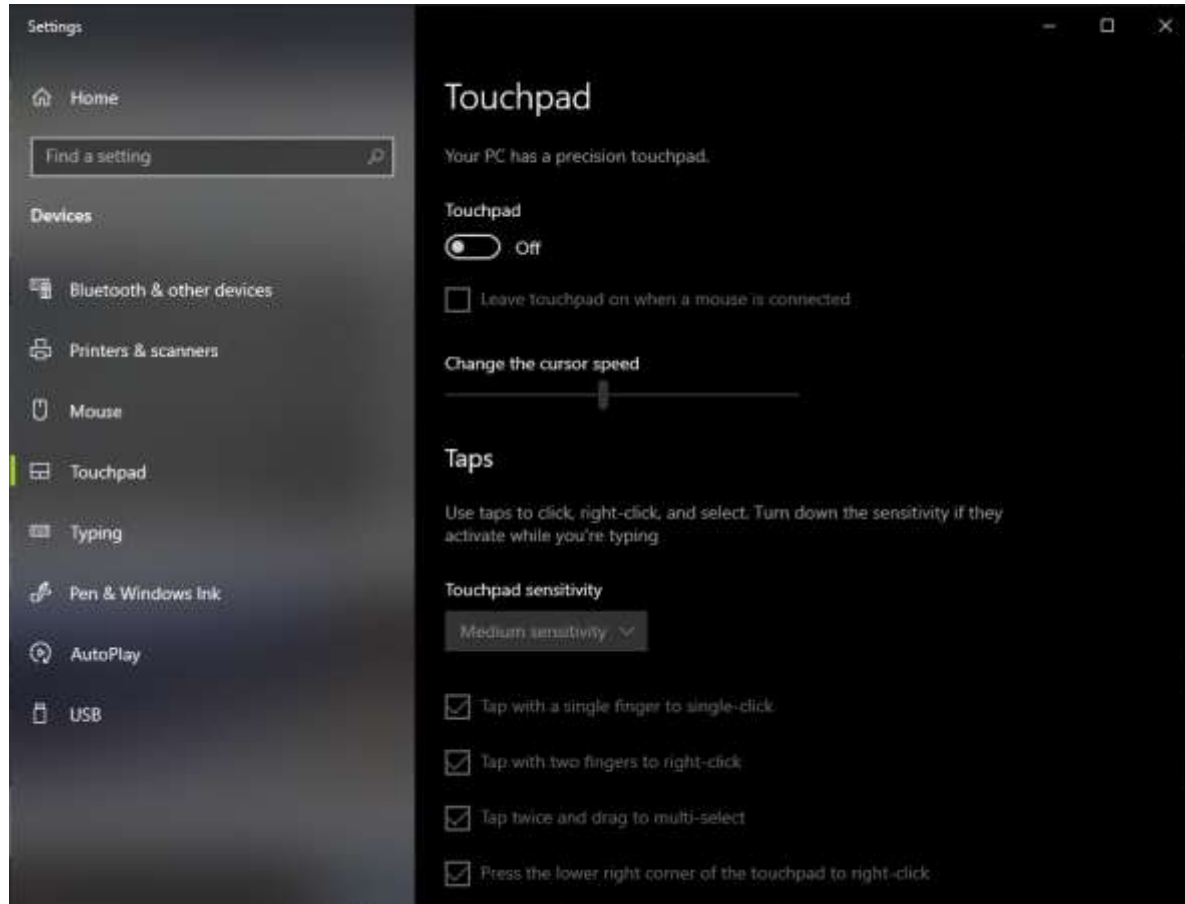
The image shows a screenshot of the Stack Overflow website with a high contrast accessibility menu open. The menu is titled "Hoher Kontrast ist aktiviert." and contains the following options:

- Deaktivieren (Shift+F11)
- Farbschema für stackoverflow.com (Shift+F12)
- Normal
- Kontrasterhöhung
- Graustufen
- Farbumkehrung
- Umgekehrte Graustufen
- Gelb auf Schwarz
- Als Standardschema festlegen
- Webanpassungen aufheben

The background shows the Stack Overflow interface with a search bar containing "[java]", a sidebar with navigation links, and a list of questions. The first question is "How derive a formula for (measurement) unit conversion" with 0 votes and 0 answers. The second question is "Start working on the framework spring-boot [closed]" with 0 votes and 0 answers. The third question is "Maven Test - bypass 'Unable to open JDBC Connection for DDL execution' Error" with 0 votes and 0 answers.

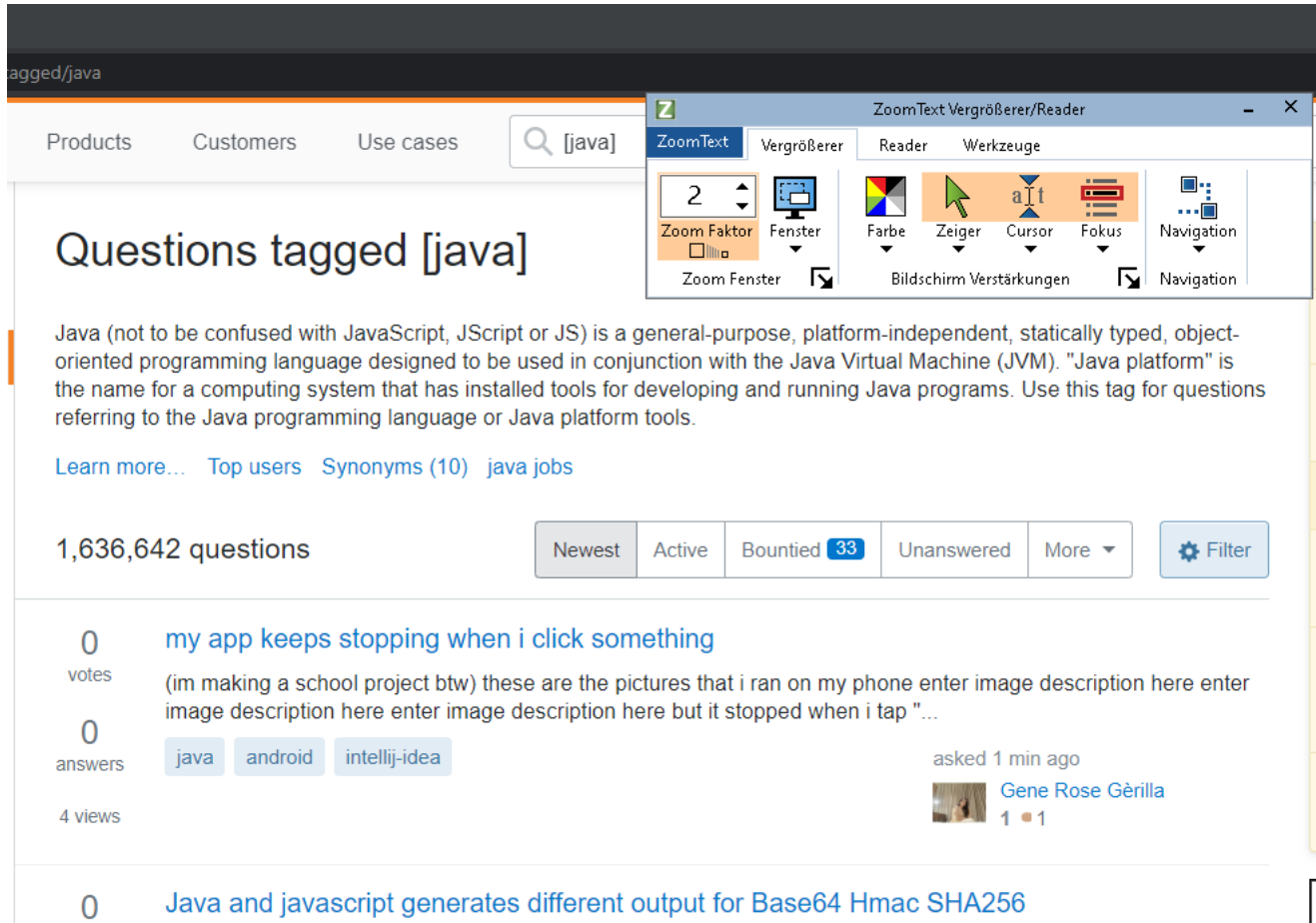


# Disable mouse



[I used the web for a day with just a keyboard](#)

# Zoom in



The screenshot shows a web browser window displaying a Stack Overflow page for the tag "[java]". The page title is "Questions tagged [java]". Below the title, there is a paragraph of text describing Java: "Java (not to be confused with JavaScript, JScript or JS) is a general-purpose, platform-independent, statically typed, object-oriented programming language designed to be used in conjunction with the Java Virtual Machine (JVM). 'Java platform' is the name for a computing system that has installed tools for developing and running Java programs. Use this tag for questions referring to the Java programming language or Java platform tools." Below this text are links for "Learn more...", "Top users", "Synonyms (10)", and "java jobs". The page shows "1,636,642 questions" and a filter bar with buttons for "Newest", "Active", "Bountied 33", "Unanswered", and "More". A list of questions is visible, with the first one titled "my app keeps stopping when i click something". The question text is "(im making a school project btw) these are the pictures that i ran on my phone enter image description here enter image description here enter image description here but it stopped when i tap "...". The question has 0 votes, 0 answers, and 4 views. It is tagged with "java", "android", and "intellij-idea". The question was asked 1 min ago by Gene Rose Gèrilla, who has a profile picture and a score of 1.

ZoomText Vergrößerer/Reader

ZoomText Vergrößerer

Zoom Faktor 2

Zoom Fenster

Fenster

Farbe

Zeiger

Cursor

Fokus

Bildschirm Verstärkungen

Navigation

# Use a screen reader

Windows:



[NVDA](#)



[Jaws](#)

IOS:



[VoiceOver](#)



# Questions?

- Twitter: @a\_n\_n\_a\_m
- Github: <https://github.com/annam002>