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Black Box Accessibility Testing: A Heuristic Approach

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Special Thanks

#a11y online and local community

For raising awareness and providing tons of materials online

Michael Larsen

For collaboration and critique of my ideas

Co-authoring the research on Black Box Accessibility Testing

James Bach & Michael Bolton

For development of Rapid Software Testing™ methodology that empowers testers to create their own testing methodologies for any context

To YOU – for coming to this presentation

Slide Encoding

>	Extra material. Fast forward.
i	Information and references.
?	Exercise / Experiment.
!	Important conclusions.

?

What is Accessibility?

User Conditions

Cognitive

- Attention deficit
- Limited awareness
- Limited memory

Visual

- Can’t see whole page content
- Limited ability to see small text

Operational

- Can operate with one hand only
- Cannot use mouse
- Limited ability to type text

>

Users with Special Needs (1/3)

- **Users with full vision impairment**

  Users of screen readers and Braille readers.

  This category also includes users that have vision, but cannot use it: either cannot look at the screen, or have to use devices in dark conditions, or experience technological limitations – thin connection bandwidth not allowing to display video content and images.

- **Users with partial vision impairment**

  Color-blind users – persons that cannot distinguish certain colors.

  This category also includes users of devices that alter or lose original colors, for example gray-scale screens.

  Low-vision users – users of screen magnifiers; sometimes they use just the accessibility features offered by the operating systems, like reducing screen resolution, increasing font-size, contrast levels, and color polarity.

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Users with Special Needs (2/3)

- **Users with hearing impairment**

  Users that cannot hear or with significantly reduced hearing abilities.

  This category also includes users that have to use a website in a context where the audio is not available or not possible to hear.

- **Users with motion impairment**

  Users that have challenges with controlling of their upper body, especially arms and/or hands.

  This category also includes users that are temporarily disabled (e.g. had an arm broken) or users that have to use a website in unusual postures (e.g. with one hand; standing while giving a lecture; etc.).

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Users with Special Needs (3/3)

- **Users with cognitive impairment**

  Users with limited abilities to process and memorize information, to make choices or to learn. These include learning disabilities (affected by dyslexia and dysgraphia), attention disorders, developmental disorders (Down's syndrome, autism), neurological disorders (Alzheimer), and other.

  This category also includes people that have to use a website under stress conditions (e.g. in a hurry, in a noisy and distracting environment, while carrying out some other important task) or during temporary impairment (under influence of medications or drugs). This category also includes people not fluent in the language.

- **Users with risks of seizures**

  Users that have epilepsy that is photosensitive– their seizures can be triggered by flickering or flashing light.

- **Users with combinations of impairments**

  Users that have two or more impairments of the enlisted above.

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What is Accessibility?

Disability

Equality

User Experience

Barriers

Web Standard

Diversity

Special Needs

Inclusion

Customer Care

Social Responsibility

Laws and regulations

Business Opportunity

>

What is Accessibility?

Users group:

- **~15%** of people in the world have a disability
- **285,000,000** are visually impaired
- **39,000,000** are blind

Reference: http://www.hopesandfears.com/hopes/future/technology/215239-internet-blind-braille

!

What is Accessibility?

Definition

“Disability - a physical or mental condition that limits a person's movements, senses, or activities”.

- What person?
- In what context?
- What activities?
- What is the purpose?
- Limits to what extent?

- What is the “norm”?
- Temporary?
- Permanent?
- Changing limits?

Cannot verify this requirement..

Let's test them!

Heuristic Approach

- Learning about Context
  - Real life user experiences
  - Assistive Technologies
- Guiding Heuristics (Testing Techniques)
- Decision-Making Heuristics (Oracles)

>

Real Life User Experiences

Begin with..

- Quora: How does a visually impaired computer programmer do programming?

  (http://www.quora.com/How-does-a-visually-impaired-computer-programmer-do-programming)
- YouTube: Watch personal experience videos
- Twitter: Ask questions. #Accessibility #AUX #A11Y

i

Assistive Technologies

Tools and Oracles

- User-facing: specialized devices and software

  Examples: Braille device, Screen Reader, Voice Input

Verify Compatibility

- Platform technologies

  HTML, Web Browsers, Output Devices

Explore and Evaluate

- Design and implementation

  Structure, Logic, Contents, Layout, Color/Contrast

>

User-Facing Assistive Technologies

- **Screen Readers**
- **Voice User Interface Programs**
- **Braille Devices**
- **Screen Magnifiers**
- **Built-in Accessibility Features**

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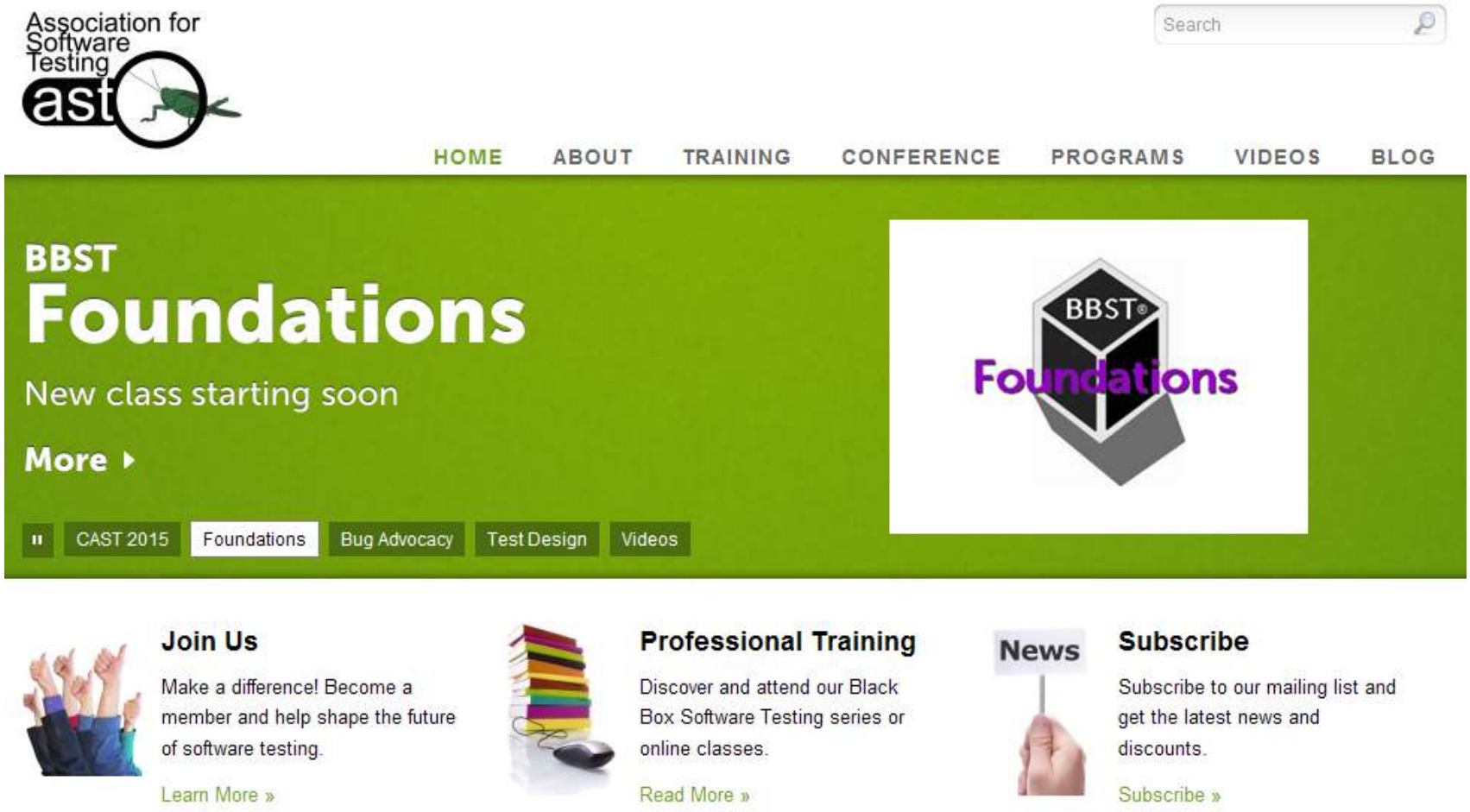
Screen Reader - Demo



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Accessibility of Web Elements

Text. Naturally accessible. Structure and formatting matters!

Images. Need textual description.

Simple GUI Controls. Need attached text.

Complex GUI Controls. Need attached text and descriptions.

Audio and Video. Need audio and text alternatives.

Animations / Live Content. Avoid if you can. Provide text.

Decorative Content. Mark to be ignored.

Landmarks and ARIA Attributes. Invisible to sighted users.

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Screen Reader – GUI Controls

NVDA Speech Viewer

Parking Calculator
PARKING CALCULATOR

Choose a Lot
combo box collapsed
Short-Term Parking
Choose Entry Date and Time
edit
12:00
radio button checked

AM
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PM
edit
MM/DD/YYYY
link
graphic
Pick a date
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AM
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edit
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link
graphic
Pick a date
COST
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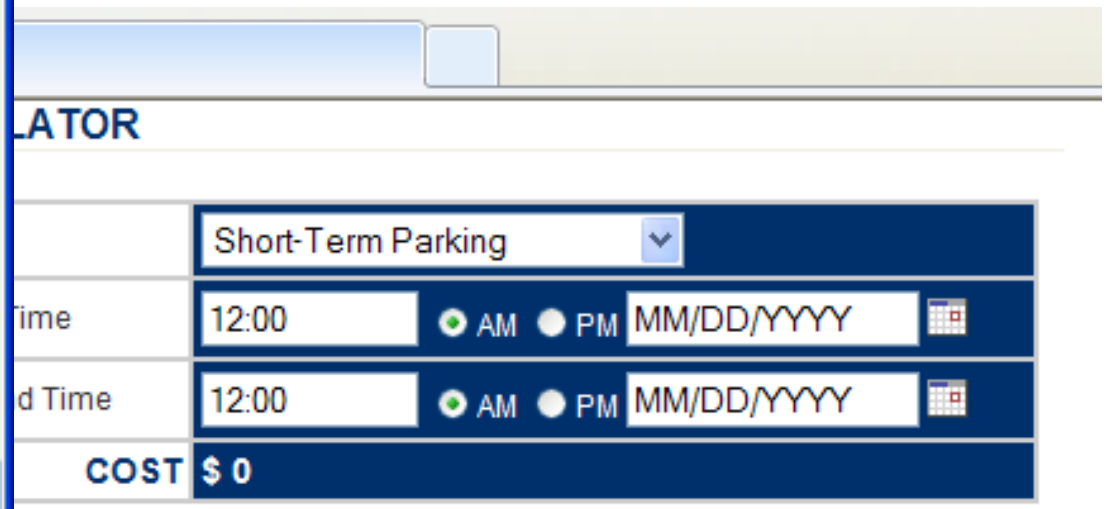
button
Calculate



Web Content Accessibility Guidelines

WCAG 2.0 - www.w3.org/WAI

Heuristics

- **Perceivable**
  - Alternatives for non-text and audio/video
  - Adaptable content (info and relationships)
  - Distinguishable content (Size, shape, color, contrast)
- **Operable**
  - All commands available from a keyboard
  - Give enough time // Prevent seizures
  - Navigable
- **Understandable**
  - Readable
  - Predictable
  - User assistance
- **Robust**
  - Cross-compatibility: web browsers X assistive technologies

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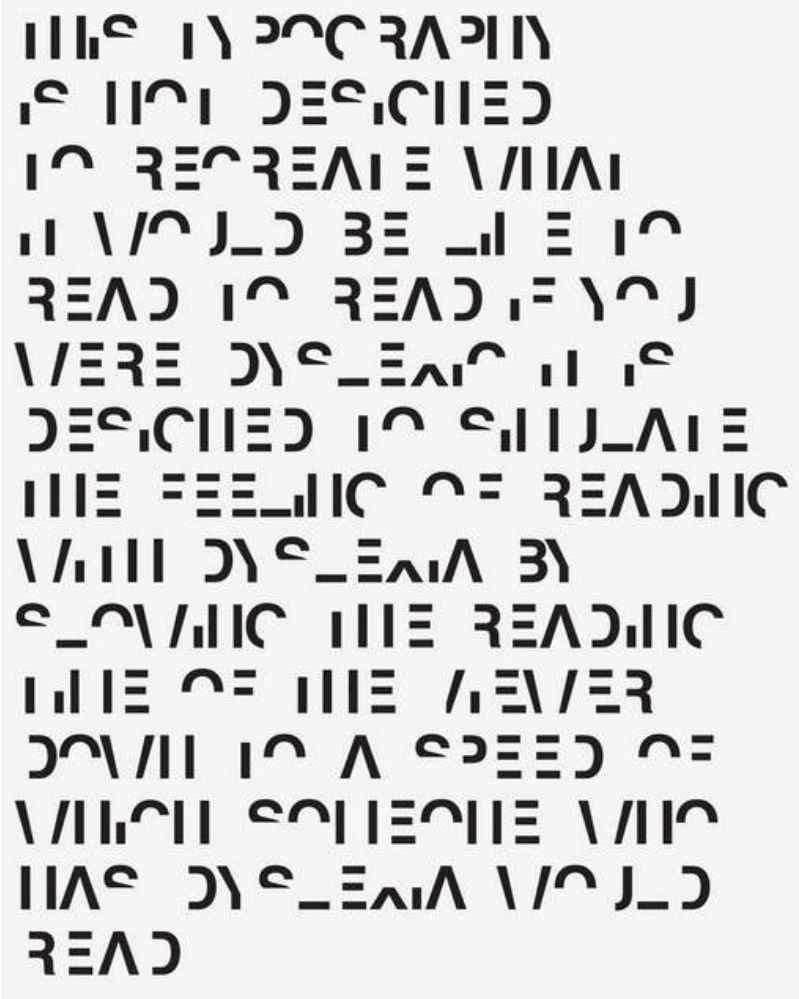
Perceivable? Understandable?



“This typography is not designed to recreate what it would be like to read if you were dyslexic, it is designed to simulate the feeling of reading with dyslexia by slowing the reading time of the viewer down to a speed of which someone who has dyslexia would read.”

Source:
http://danielbritton.info/195836/2165784/design/dyslexia

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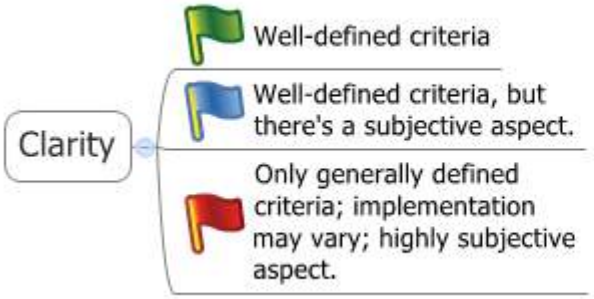
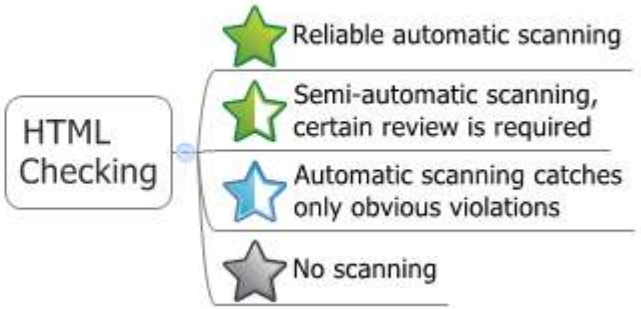
WCAG Analysis (1/2)

- Clarity of guidelines
- Possibility of automatic accessibility checking





Detailed mindmap:
http://automation-beyond.com/2014/12/10/accessibility-testing-requirements-mindmap/

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WCAG Analysis (2/2)

- **Perceivable**
  - Alternatives for non-text and audio/video
  - Adaptable content (info and relationships)
  - Distinguishable content (Size, shape, color, contrast)
- **Operable**
  - All commands available from a keyboard
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- **Robust**
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Assistive Technologies

Tools and Oracles

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  Examples: Braille device, Screen Reader, Voice Input

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Heuristic Approach

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- Decision-Making Heuristics (Oracles)

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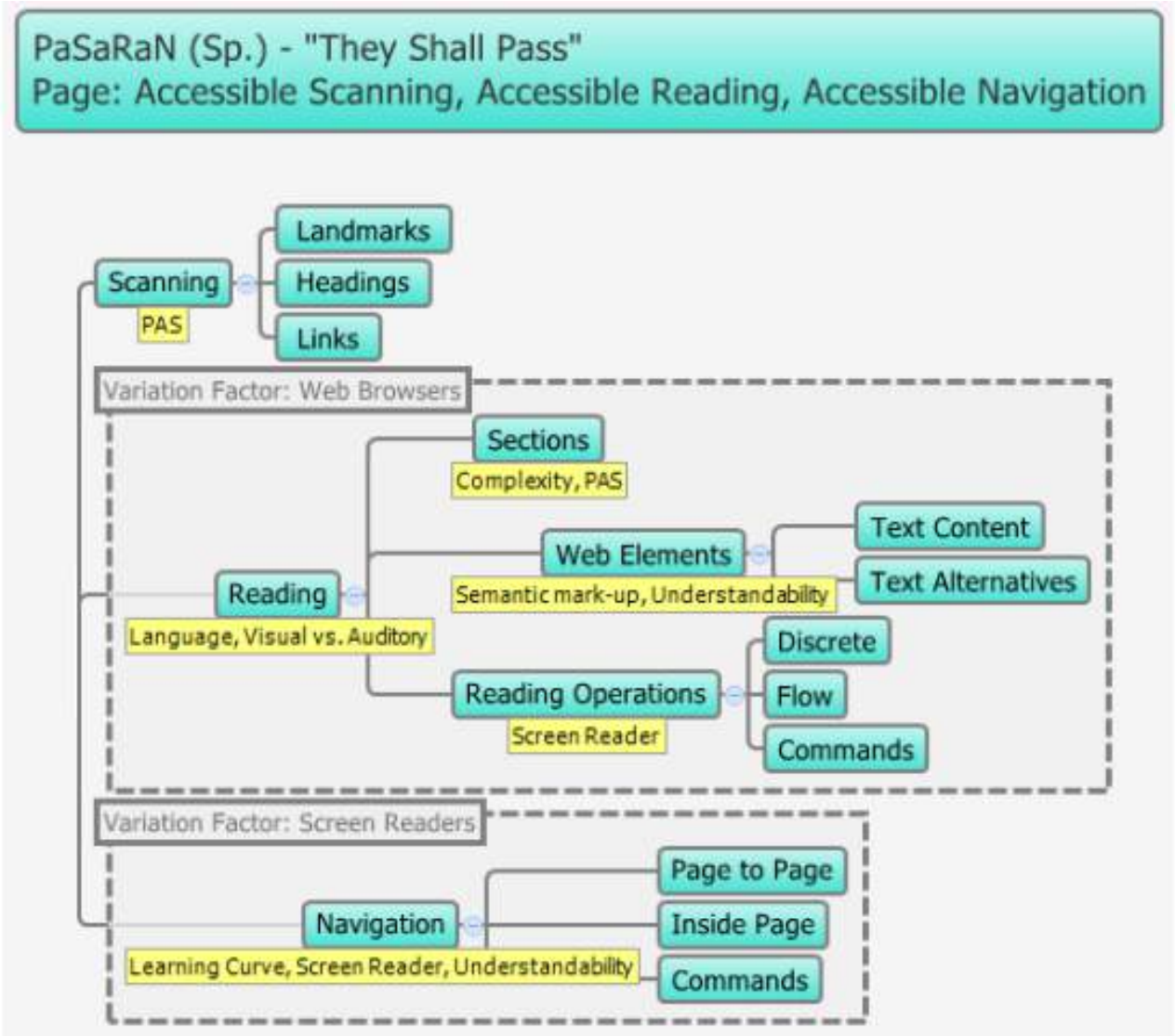
Accessibility Testing Techniques



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Accessibility Testing Techniques

Mnemonic (“PaSaRaN”)

Based on the purposes and interactions of the users the following overlapping categories might be defined:

Page Scanning – also called “screening” or “skimming through” – quick assessment of the displayed information in order to understand “where” the user is and what they can do.

Page Reading – focused and attentive process of obtaining of the displayed information.

Page Navigation – can be within the screen – by moving eyesight and focus of attention – and from page to page by using input commands.

All three processes are often run somewhat in parallel as users naturally and unconsciously switch from one to another. Adding “accessible” requirement to all three we get “Page: Accessible Scanning, Accessible Reading, Accessibile Navigation”. I like to think of a mnemonic acronym “PASARAN”, which also stands for “They shall pass” in Spanish – our goal in creating accessible applications.

How do we recognize a problem?

Heuristic Oracles

The concept of consistency oracles – heuristic principles that help to recognize a problem – is central in black-box testing and Rapid Software Testing.

- **Technology Oracles**

Involvement of technology (platform or assistive) as the problem recognition mechanism.

- **Psychology Oracles**

Based on human perception and thinking processes used as the problem recognition mechanisms.

- **Common Oracles**

Adopted from Rapid Software Testing methodology, common principles of problem recognition.

>

Technology Oracles

- **Visual vs. Auditory**

In general, whatever information is available on the visual perception channel must be consistent with what's available on auditory perception channel.

- **Semantic mark-up**

Appropriate HTML tags and attributes must be used for headings, lists, tabular data, web controls, etc.

- **Screen Reader**

In general, web pages should be consistently handled with screen readers. Consistent handling includes Scanning, Reading, and Navigation modes.

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Psychology Oracles

- **Memory**

In general, amount of implicit and explicit memory requirements (i.e. how many things user needs to know and remember) should be consistent with the value of the information that user gains or the operation the user tries to accomplish.

- **Understandability, Interpretation**

In general, the information should be understandable and not misleading. The more complex information or workflow is, the more details should be available.

- **Learning Curve**

In general, time to learn should be consistent with the value of the information that user gains or the operation the user tries to accomplish. Simple or little features should not be hard to learn for users with special needs. Similar functions should have similar interface and operations.

?

Understandability?
Interpretation?

>

Common Oracles

- **Consistency**

Consistency is a family of heuristic principles. Examples:

  - Product – we expect each element of the system (or product) to be consistent with comparable elements in the same system.
  - Purpose – we expect the system to be consistent with the explicit and implicit uses to which people might put it.

- **Complexity**

The more complex web pages and workflows are, the harder is to learn and memorize it, the harder to navigate and operate, and the higher chances of making a mistake.

- **Time Spent**
- **Communication**

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Is there a problem?..

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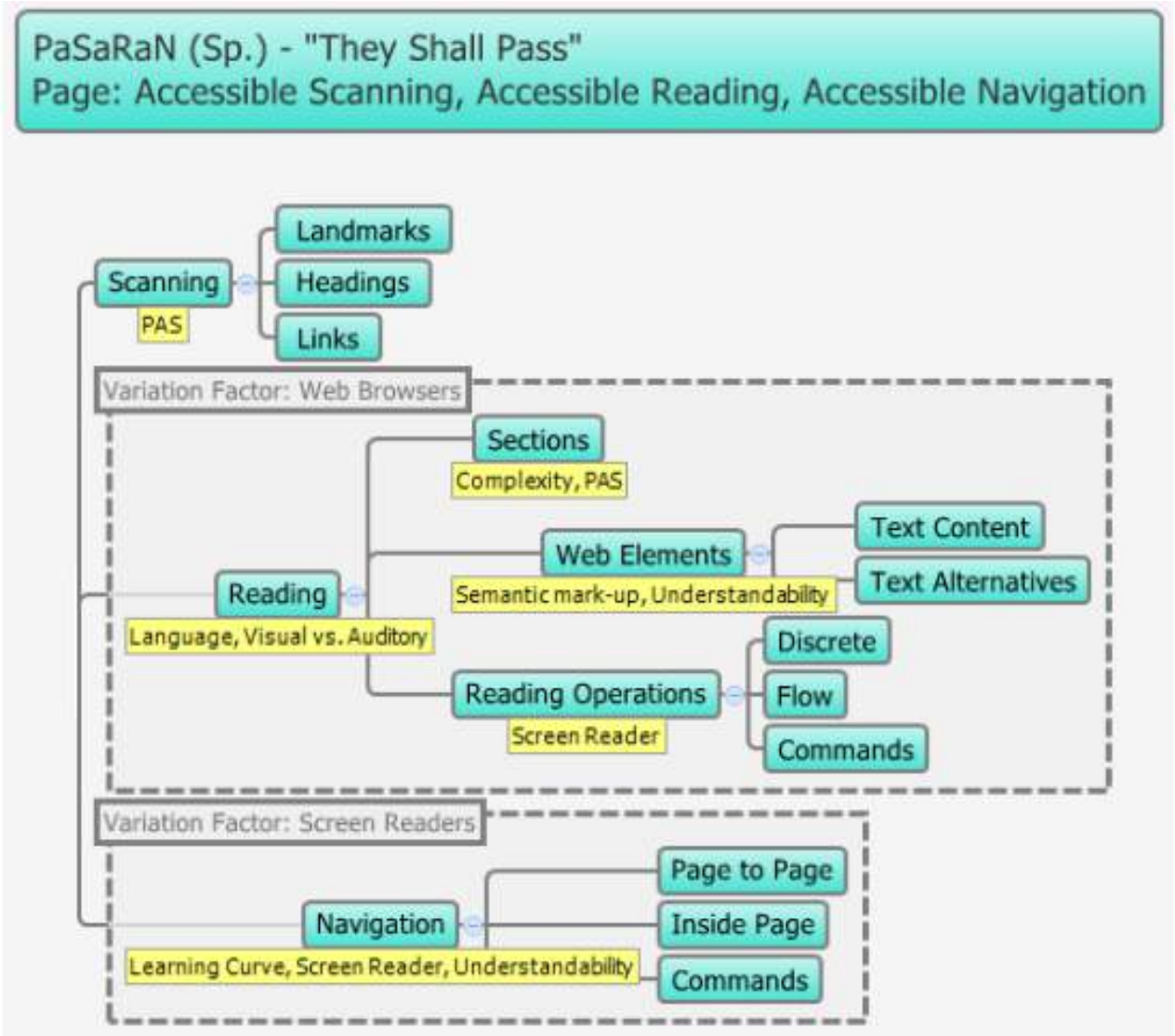
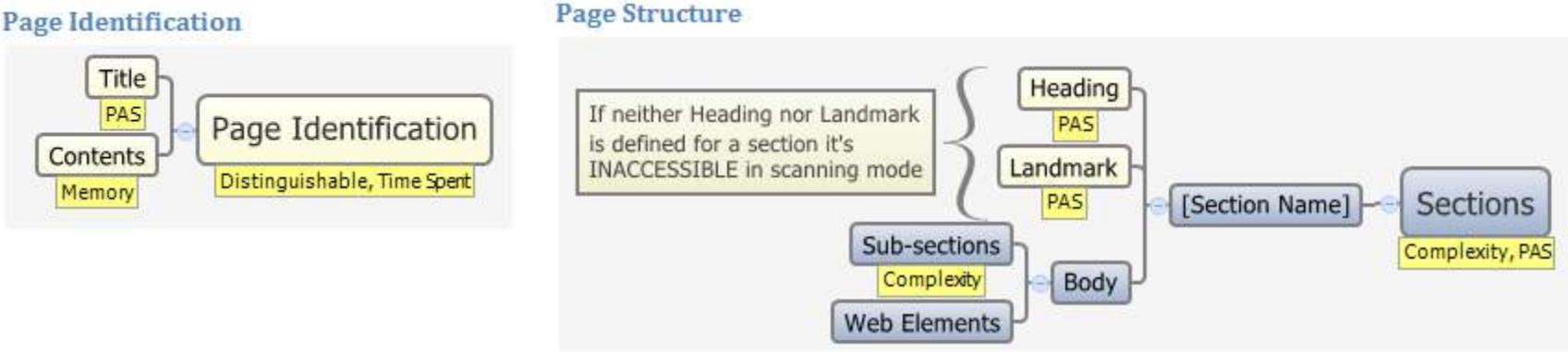
Accessibility Testing Techniques



Accessible Scanning



Testing for Accessible Scanning involves assessment of Page Identification and Page Structure elements.

Users need to be able to distinguish one page from another while browsing as well as while switching between pages and applications running on their device.

The first attempt is to recognize by page title. The second attempt is to recognize by structure and keywords on the page, mainly headings and landmarks.

Note that only visual analysis will not result in accurate assessment – page DOM analysis and simulation with a Screen Reader must be involved in all operations.

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Page Identification

Users need to be able to distinguish one page from another while browsing as well as while switching between pages and applications running on their device.

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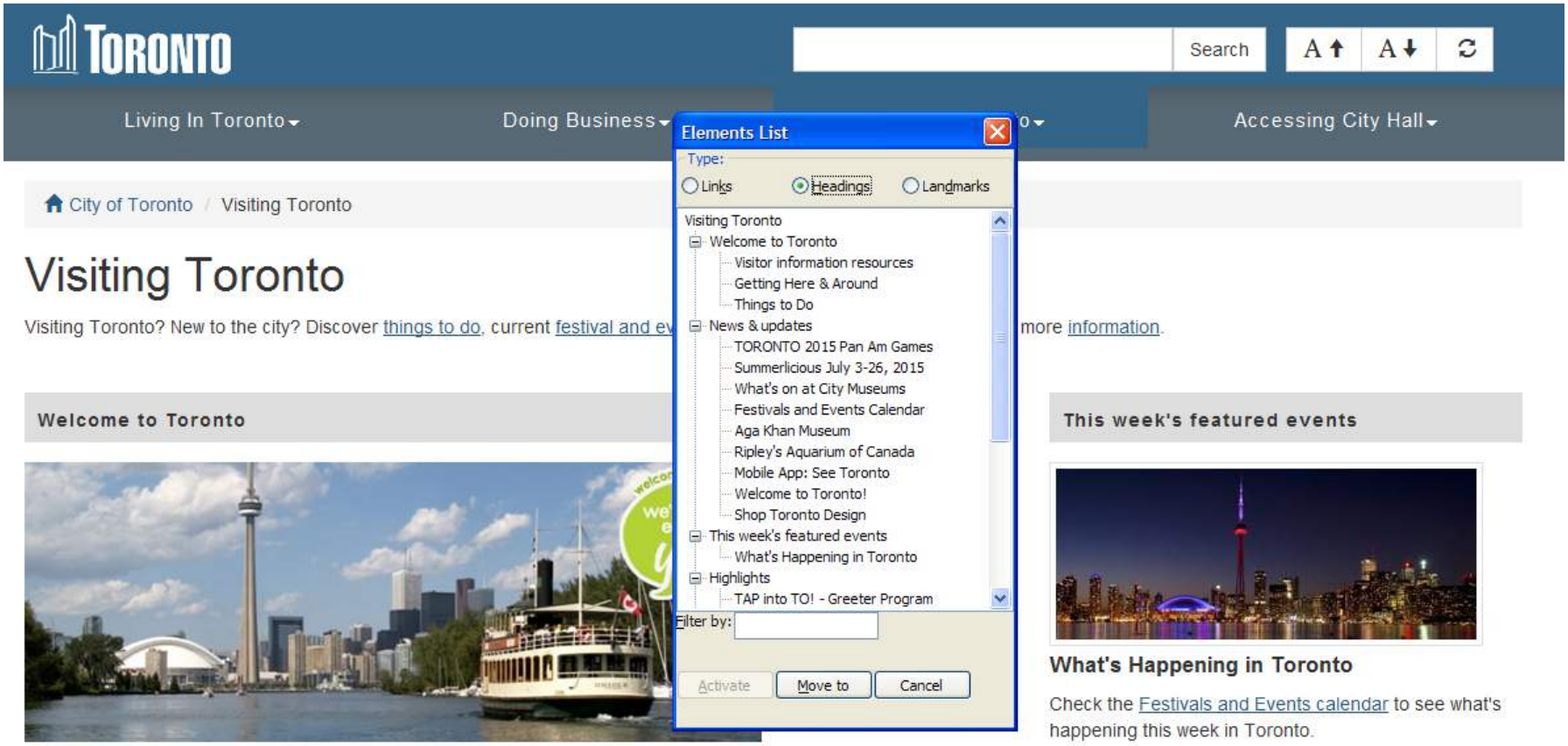
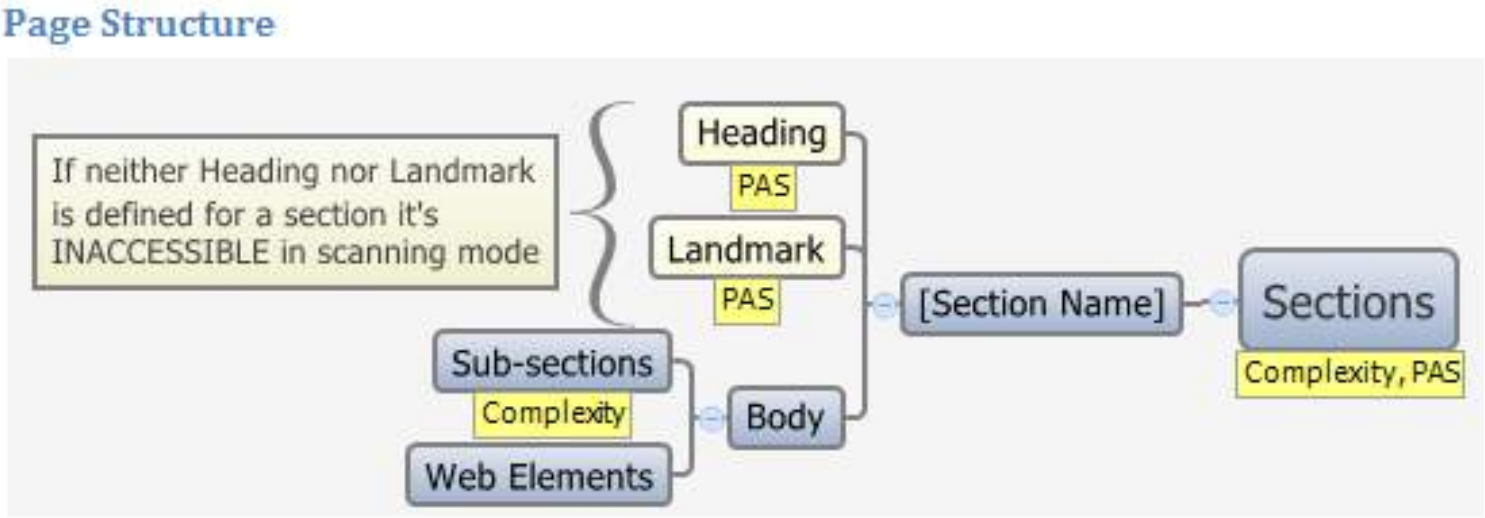
Page Structure (1/2)



Page Structure (2/2)



In scanning (also referred as screening) mode, users need to be able to learn about the page contents as quickly as possible.

Accessible Reading

- Testing of Accessible Reading involves assessment of page readability with Screen Reader and analysis of Page Structure elements.
- The important aspect is to assess cognitive components of perception, which are affected by page structure and organization, complexity of elements and their relationships.
- Note that only visual analysis will not result in accurate assessment – page DOM analysis and simulation with a Screen Reader must be involved in all operations.

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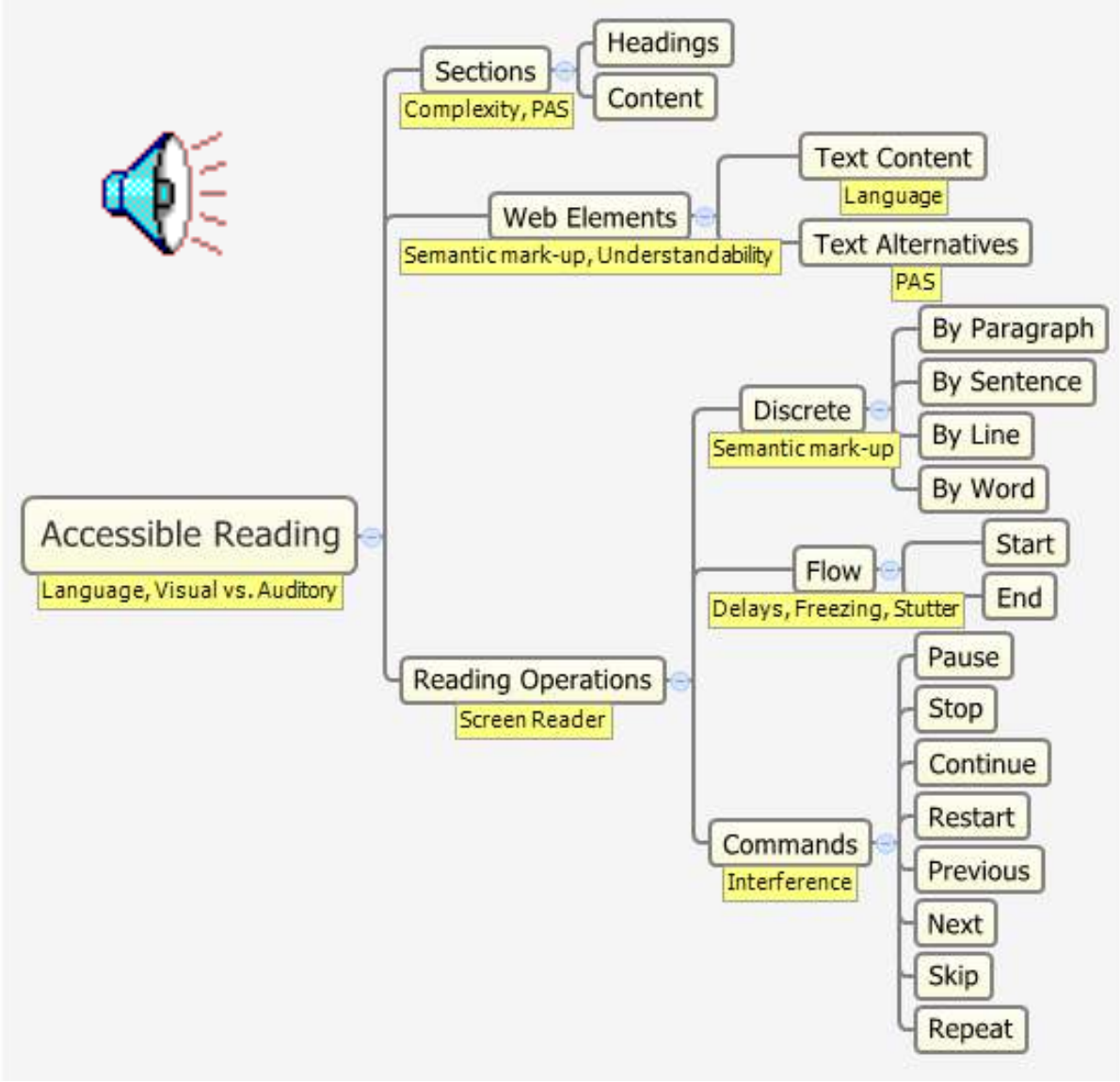
Accessible Reading

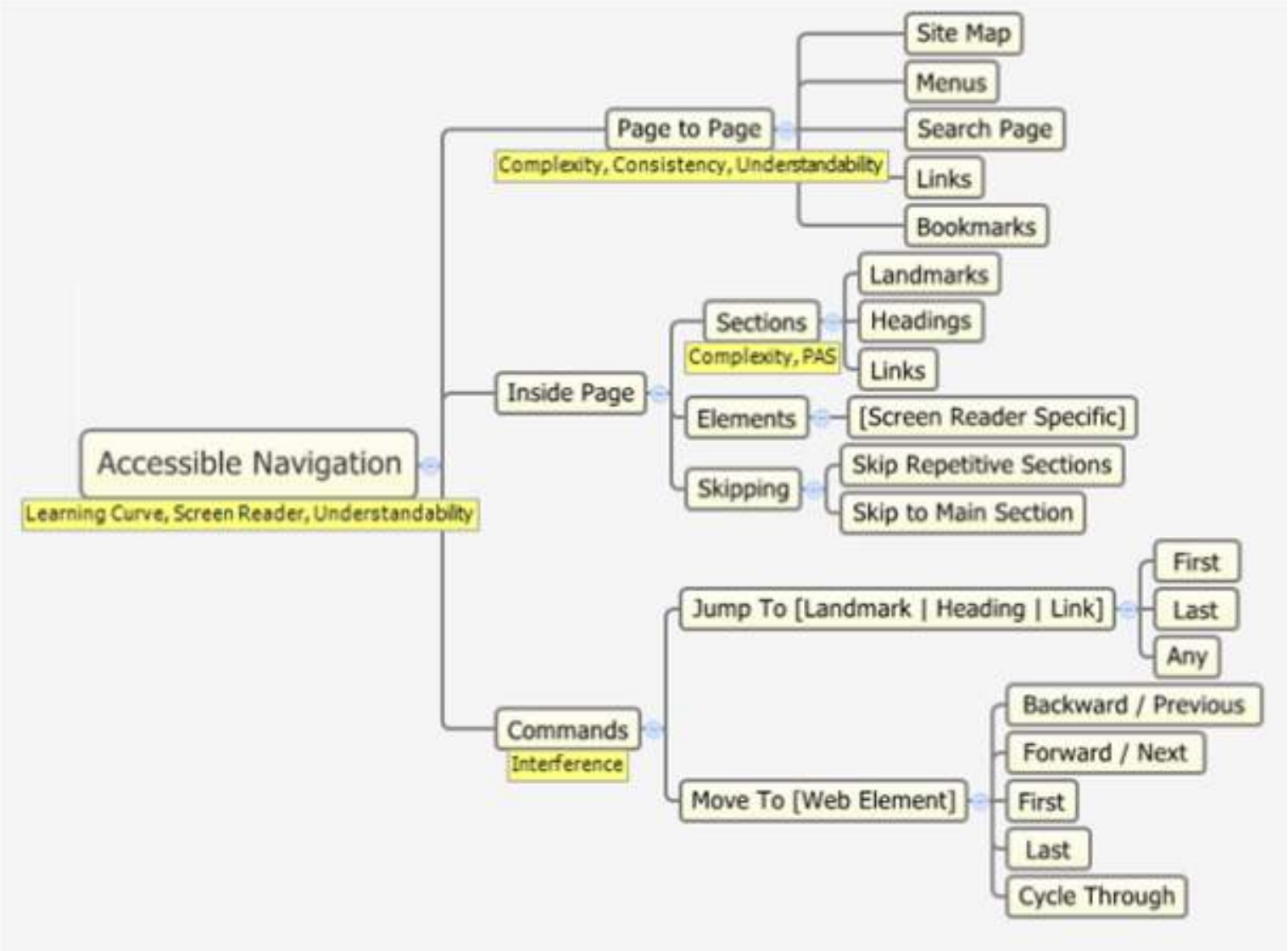


Accessible Navigation

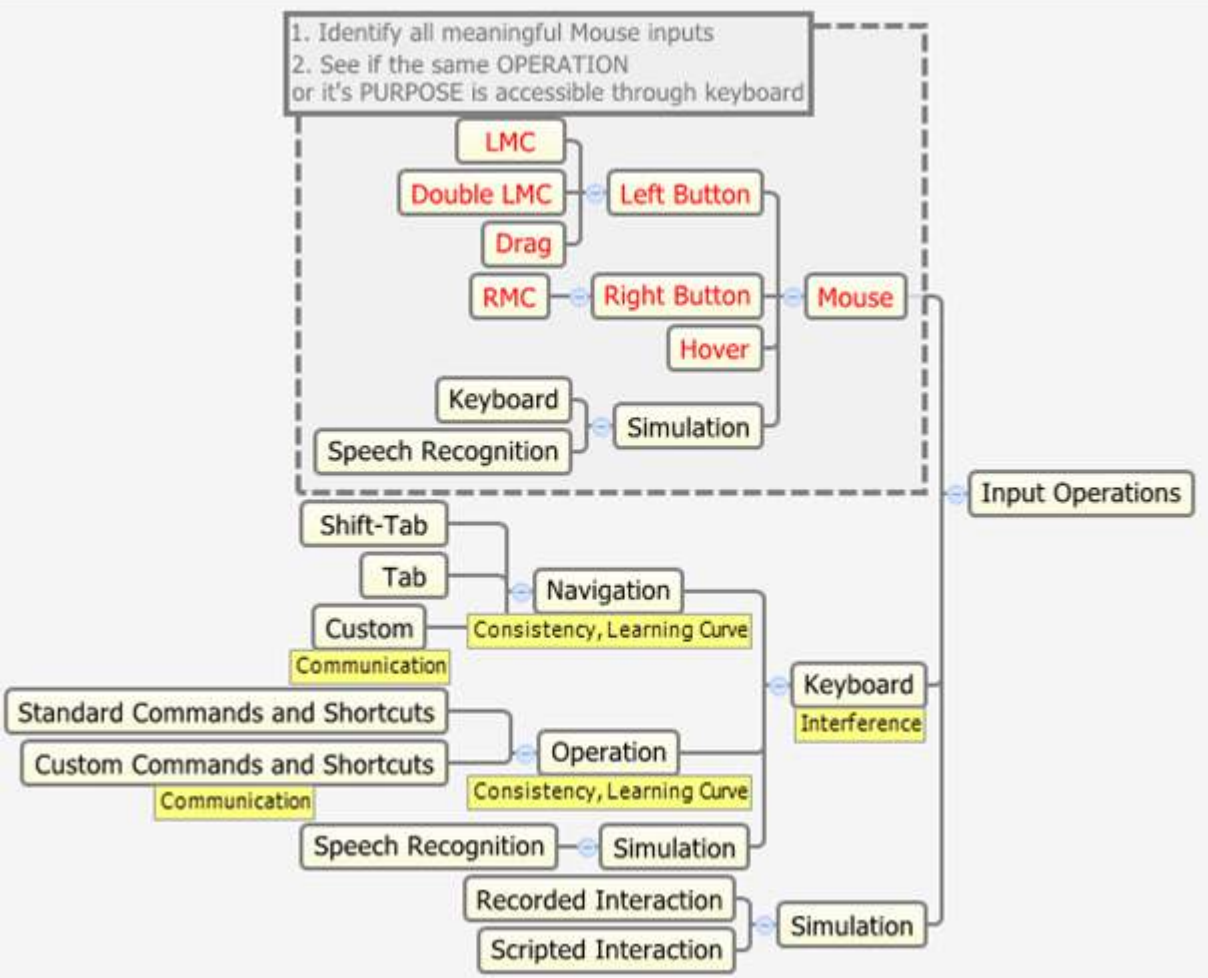
Users navigate through the pages by operating their Screen Reader and the application directly.

Testing of Accessible Navigation involves simulation and assessment of Screen Reader assisted navigation within the page – from section to section, from element to element, and operating the GUI controls. All operations are done through keyboard only (mouse is not an accessible device).

Accessible Navigation



Navigation – User Input



Thank you!

Are you ready to test? – More exercises coming..

References

- Section 508 – Laws: http://www.section508.gov/section508-laws
- Accessibility for Ontarians with Disabilities Act: http://www.ontario.ca/laws/statute/05a11
- Web Content Accessibility Guidelines: http://www.w3.org/TR/WCAG20/
- Adapted version of “Barrier Walkthrough – User Categories”: http://users.dimi.uniud.it/~giorgio.brajnik/projects/bw/bw.html
- Refreshable braille display, Wikipedia: http://en.wikipedia.org/wiki/Refreshable_braille_display
- Screen magnifier, Wikipedia: http://en.wikipedia.org/wiki/Screen_magnifier
- Accessible Rich Internet Apps: http://www.w3.org/TR/wai-aria/
- Rapid Software Testing:
- James Bach http://www.satisfice.com/classes2.shtml
- Michael Bolton http://www.developsense.com/courses.html
- Article on oracles by Michael Bolton: http://www.developsense.com/blog/2012/04/problems-with-problems/
- Article on oracles by Michael Bolton: http://www.developsense.com/blog/2012/04/all-oracles-are-heuristic/

Images

- www.webaim.org
- www.idigitaltimes.com
- www.w3.org/WAI

Exercises
Q&A

?

Screen Reader – GUI Controls

NVDA Speech Viewer

Parking Calculator
PARKING CALCULATOR

Choose a Lot
combo box collapsed
Short-Term Parking
Choose Entry Date and Time
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radio button checked

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graphic
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radio button not checked

PM
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MM/DD/YYYY
link
graphic
Pick a date
COST
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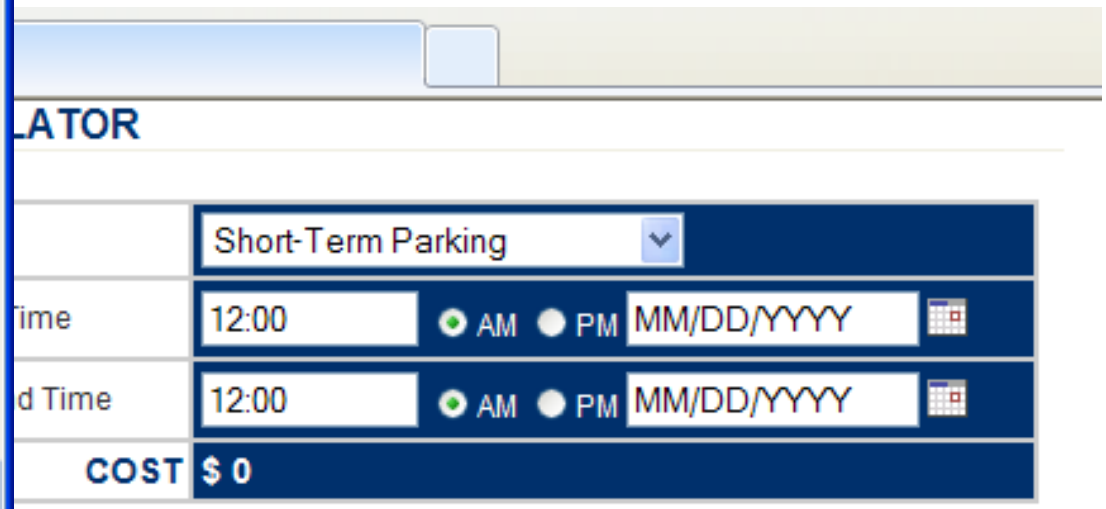
button
Calculate



Test Pages

- http://archive.tlt.psu.edu/accessibility/untitledonpurpose.html
- http://test.cita.uiuc.edu/html/index.php
- http://www.dhs.state.il.us/page.aspx?item=49733