UCI University of California, Irvine

Informatics 134

Software User Interfaces
Spring 2024

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Agenda

1. Upcoming

2. Graphical Toolkits and Accessibility

3. References

Upcoming

Upcoming

Agenda

Today:

- Accessibility and Toolkits lecture
- A1 DUE TONIGHT

Thursday:

- Design and Methods

Next Week:

- Keep working on A2/A3 (DUE 4/23)
- Start working on course project

Graphical Toolkits and Accessibility

What is accessibility?

Accessibility

Historical Perspective

Transition from the terminal to a GUI

- Ushered in personal computing era (good)
- Ushered in the accessibility era (not so good)

[Wikipedia, 2021, theverge.com, 2021]

Accessibility

Historical Perspective

Although millions of new people were now **able** to understand and make use of computational systems, millions of people were simultaneously **unable** to use and operate new graphical based systems.

[theverge.com, 2021]

Accessibility

The Graphical User Interface Crisis: Danger and Opportunity

> “Our intuition tells that the more an interface is optimized for a person who can see, the less useful that computer will be to people who cannot see.”
>
> ——[Boyd et al., 1990]

Accessibility

Historical Perspective

According to [Boyd et al., 1990], the problem manifested in two major categories:

1. Perceptual: Screen rendering via pixels requires deciphering of graphical information
2. Control: Interaction with visual representations of information and manipulation and control of the flow of information

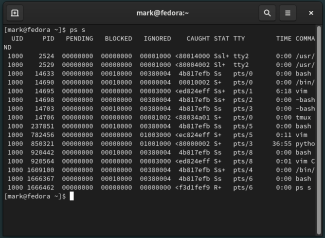
[theverge.com, 2021]

Accessibility

Historical Perspective

WIMP (?):

- Transition from a concise command language
- To visual metaphors – graphical representations of everyday objects



```
[mark@fedora ~]$ ps s
  UID     PID   PENDING   BLOCKED   IGNORED    CAUGHT STAT TTY        TIME COMMA
ND
 1000    2524  00000000  00000000  00001000 <80014000 Ssl+ tty2       0:00 /usr/
 1000    2529  00000000  00000000  00001000 <80004002 Sl+  tty2       0:00 /usr/
 1000   14633  00000000  00010000  00380004  4b817efb Ss   pts/0      0:00 bash
 1000   14690  00000000  00010000  00000004  00010002 S+   pts/0      0:00 /bin/
 1000   14695  00000000  00000000  00003000 <ed824eff Ss+  pts/1      6:18 vim
 1000   14698  00000000  00000000  00380004  4b817efb Ss+  pts/2      0:00 -bash
 1000   14703  00000000  00010000  00380004  4b817efb Ss   pts/3      0:00 -bash
 1000   14706  00000000  00000000  00081002 <88034a01 S+   pts/0      0:00 tmux
 1000  237851  00000000  00010000  00380004  4b817efb Ss   pts/5      0:00 bash
 1000  782456  00000000  00000000  01003000 <ec824eff S+   pts/5      0:11 vim
 1000  850321  00000000  00000000  01001000 <80000002 S+   pts/3     36:55 pytho
 1000  920442  00000000  00010000  00380004  4b817efb Ss   pts/8      0:00 bash
 1000  920564  00000000  00000000  00003000 <ed824eff S+   pts/8      0:01 vim C
 1000 1609100  00000000  00000000  00380004  4b817efb Ss+  pts/4      0:00 /bin/
 1000 1666367  00000000  00010000  00380004  4b817efb Ss   pts/6      0:00 bash
 1000 1666462  00000000  00000000  00000000 <f3d1fef9 R+   pts/6      0:00 ps s
[mark@fedora ~]$ 
```

[theverge.com, 2021]

Accessibility

Historical Perspective

Gaining Access: Enter the Screen Reader

- IBM Screen Reader/DOS (1984)
- IBM Screen Reader/2 (1986-1994)

...

James Thatcher at IBM adapted early work on speech synthesis to create SAID, the Synthetic Audio Interface Driver [Thatcher, 1994].

Accessibility

Historical Perspective

Gaining Access: Enter the Screen Reader

- Early version of SR/2 relied on a separate custom keyboard to control speech synthesis to avoid system conflicts!
- The key principle from Thatchers work was that text-based DOS and GUI are different interfaces for doing the same thing. So, the solution was to map GUI to textual equivalents [Thatcher, 1994].
- ‘‘Abstract away what is *graphical* about the graphical user interface.”

Accessibility

Historical Perspective

From *access* to *degrees of access*

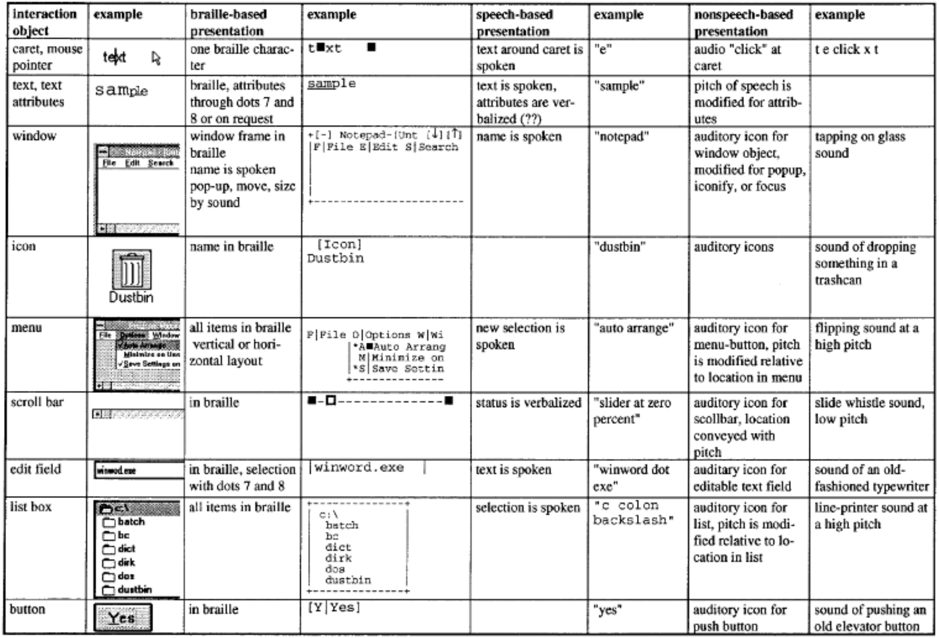
- By mid-1990’s focus changed to efficiency, coherence, exploration, and cost
- Refinement of the abstraction – developing a consistent, reusable, lexical understanding of graphical widgets
- Locate widgets without a mouse, support exploration, interact without clicking
- Consistent mental model (WHY?)

Accessibility

Historical Perspective

From *access* to *degrees of access*

- The Mercator Project (Georgia Tech, Center for Rehab Technology)
- GUIB: Textual and Graphical User Interfaces for Blind People (European Commission, Technology Initiative for the Disabled and Elderly Persons or TIDE)



interaction object	example	braille-based presentation	example	speech-based presentation	example	nonspeech-based presentation	example
caret, mouse pointer	text	one braille character	t■xt ■	text around caret is spoken	"e"	audio "click" at caret	t e click x t
text, text attributes	sample	braille, attributes through dots 7 and 8 or on request	sample	text is spoken, attributes are verbalized (??)	"sample"	pitch of speech is modified for attributes	
window	File Edit Search	window frame in braille name is spoken pop-up, move, size by sound	+[-] Notepad-(Unt (↓](↑] |F|File E|Edit S|Search +------------------------	name is spoken	"notepad"	auditory icon for window object, modified for popup, iconify, or focus	tapping on glass sound
icon	Dustbin	name in braille	[Icon] Dustbin		"dustbin"	auditory icons	sound of dropping something in a trashcan
menu	File Options Window ✓Auto Arrange Minimize on Use ✓Save Settings on	all items in braille vertical or horizontal layout	F|File O|Options W|Wi |*A■Auto Arrang | M|Minimize on |*S|Save Settin +---------------	new selection is spoken	"auto arrange"	auditory icon for menu-button, pitch is modified relative to location in menu	flipping sound at a high pitch
scroll bar		in braille	■-□-------------■	status is verbalized	"slider at zero percent"	auditory icon for scollbar, location conveyed with pitch	slide whistle sound, low pitch
edit field	winword.exe	in braille, selection with dots 7 and 8	|winword.exe |	text is spoken	"winword dot exe"	auditary icon for editable text field	sound of an old-fashioned typewriter
list box	c:\ batch bc dict dirk dos dustbin	all items in braille	c:\ batch bc dict dirk dos dustbin	selection is spoken	"c colon backslash"	auditory icon for list, pitch is modified relative to location in list	line-printer sound at a high pitch
button	Yes	in braille	[Y|Yes]		"yes"	auditory icon for push button	sound of pushing an old elevator button

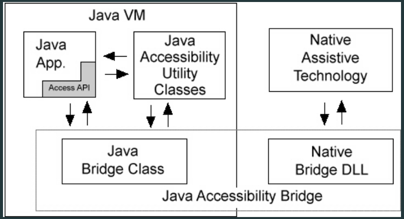
[Mynatt and Weber, 1994]

Accessibility

Historical Perspective

From *access* to *degrees of access*

> Projects like Mercator and GUIB influenced the design and implementation of accessibility API's in programming languages like Java, .Net, Cocoa (OSX)


Java VM
Java App.
Access API
Java Accessibility Utility Classes
Native Assistive Technology
Java Bridge Class
Native Bridge DLL
Java Accessibility Bridge

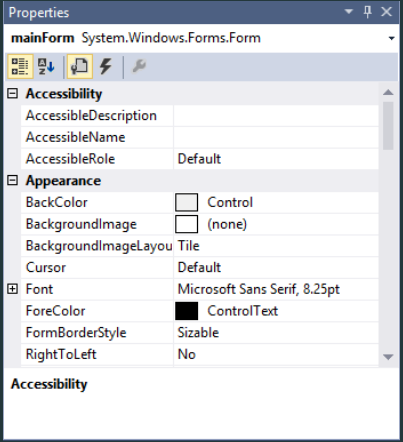
[Harper et al., 2005]

Accessibility

Historical Perspective

From *access* to *degrees of access*

- An example from Microsoft Visual Studio



Properties

mainForm System.Windows.Forms.Form

⊟ **Accessibility**	
AccessibleDescription	
AccessibleName	
AccessibleRole	Default
⊟ **Appearance**	
BackColor	□ Control
BackgroundImage	□ (none)
BackgroundImageLayou	Tile
Cursor	Default
⊞ Font	Microsoft Sans Serif, 8.25pt
ForeColor	■ ControlText
FormBorderStyle	Sizable
RightToLeft	No

Accessibility

When converted to code:

```
//describes control
mainForm.AccessibleDescription = "the main form";
//name reported to accessibility aids
mainForm.AccessibleName = "My Program";
```

learn more

From *degrees of access* to *supporting access*

Accessibility

Supporting Access

The WebAIM Million: 2019-2021

Over 51 million a11y errors, avg of 51.4 errors per page

97.4% of home pages had detectable WCAG2 failures

65% missing alt text for images

25% empty buttons or button misuse

Today we *have* the ability to make software accessible, but we lack the *desire or awareness* to make it so.

Why is the second example *more* accessible?

```html
<div>Next</div>
```

```html
<button>Next</button>
```

Why is the second example *more* accessible? Semantics

```html
<div>Next</div>
```

```html
<button>Next</button>
```

Which example is *harder* to implement?

Accessibility

Semantic HTML

They require the same amount of effort :) Plus:

- Easier to reason about, less code (don't have to add accessibility)
- Therefore...lighter/faster/better optimization (SEO, etc.)
- Browser accessibility engine translates accessible functions automatically (*e.g.*, Tab and Enter keys, purpose)

see: HTML: A good basis for accessibility for a more detailed overview.

Accessibility

The Visuospatial Sketchpad

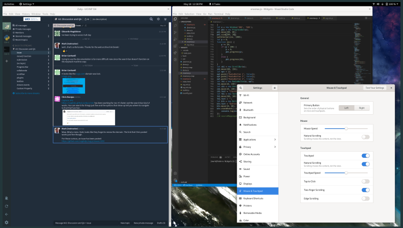
Making graphical interfaces accessible is more than just semantics. In his work on human working memory, Alan Baddeley [Baddeley, 1992] identifies the visuospatial sketchpad as:

> “virtual environment for physical simulation, calculation, visualization, and optical memory recall.”
>
> Move optically retained information from short-term to long-term memory and back again
>
> Think about how humans recognize faces
>
> visual cache - holds information about form and color
>
> inner scribe - manages spatial and movement information

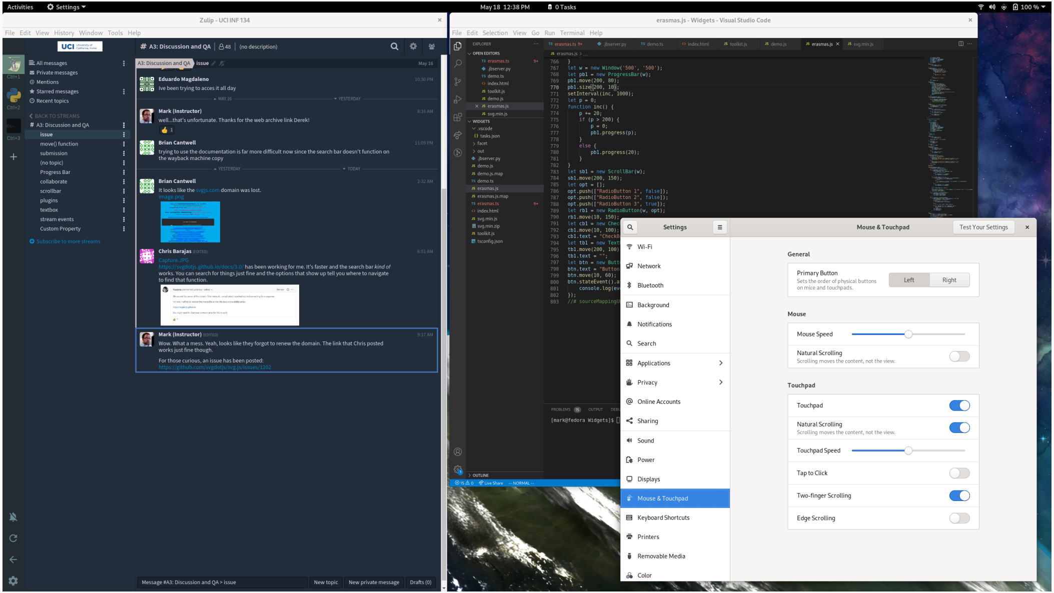
Accessibility

The Visuospatial Sketchpad

Take a minute to study the screen shot pictured here. Can you identify some ways that information is communicated visually?



Remind Mark: Full screen image on next slide ;)



A3: Discussion and QA | 48 | (no description)

A3: Discussion and QA > issue — May 16

Eduardo Magdaleno 10:30 PM
Ive been trying to acces it all day

MAY 16 — YESTERDAY

Mark (Instructor) 8:16 AM
well...that's unfortunate. Thanks for the web archive link Derek!
👍 1

Brian Cantwell 11:09 PM
trying to use the documentation is far more difficult now since the search bar doesn't function on the wayback machine copy

YESTERDAY — TODAY

Brian Cantwell 2:32 AM
It looks like the svgjs.com domain was lost.
image.png

Chris Barajas (EDITED) 6:51 AM
Capture.JPG
https://svgdotjs.github.io/docs/3.0/ has been working for me. It's faster and the search bar *kind of* works. You can search for things just fine and the options that show up tell you where to navigate to find that function.

Mark (Instructor) (EDITED) 9:17 AM
Wow. What a mess. Yeah, looks like they forgot to renew the domain. The link that Chris posted works just fine though.

For those curious, an issue has been posted:
https://github.com/svgdotjs/svg.js/issues/1202

```
}
let w = new Window('500', '500');
let pbl = new ProgressBar(w);
pbl.move(200, 80);
pbl.size(200, 10);
setInterval(inc, 1000);
let p = 0;
function inc() {
    p += 20;
    if (p > 200) {
        p = 0;
        pbl.progress(p);
    }
    else {
        pbl.progress(20);
    }
}
let sbl = new ScrollBar(w);
sbl.move(200, 150);
let opt = [];
opt.push(["RadioButton 1", false]);
opt.push(["RadioButton 2", false]);
opt.push(["RadioButton 3", true]);
let rbl = new RadioButton(w, opt);
rbl.move(10, 150);
let cbl = new Chec
cbl.move(10, 100);
cbl.text = "CheckB
let tbl = new Text
tbl.move(200, 100)
tbl.text = "";
let btn = new Butt
btn.text = "Button
btn.move(10, 60);
btn.stateEvent().a
    console.log(ev
});
//# sourceMappingU
```

```
[mark@fedora Widgets]$ 
```

General

Primary Button — Sets the order of physical buttons on mice and touchpads. — Left / Right

Mouse

Mouse Speed

Natural Scrolling — Scrolling moves the content, not the view. — Off

Touchpad

Touchpad — On

Natural Scrolling — Scrolling moves the content, not the view. — On

Touchpad Speed

Tap to Click — Off

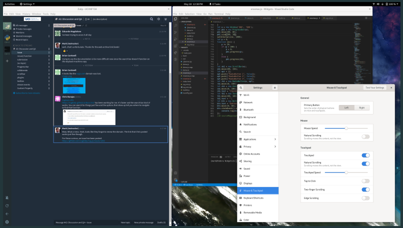
Two-finger Scrolling — On

Edge Scrolling — Off

Accessibility

The Visuospatial Sketchpad

- Visual glance
- Spatial arrangement
- Color



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Mark (instructor): well...that's unfortunate. Thanks for the web archive link Brian!

Brian Cantwell: trying to use the documentation is far more difficult now since the search bar doesn't function on the wayback machine copy

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Mouse & Touchpad

General

Primary Button: [✓ Left] Right

Mouse

Mouse Speed

Natural Scrolling: off

Touchpad

Touchpad: on

Natural Scrolling: on

Touchpad Speed

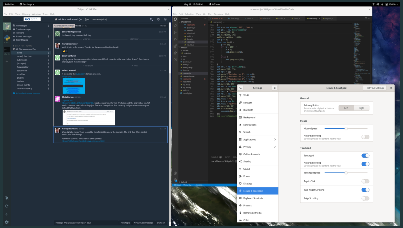
Tap to Click: off

Two-finger Scrolling: on

Edge Scrolling: off

Accessibility

How do we make these visual enhancements more accessible?



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For those curious, an issue has been posted:
https://github.com/svgdotjs/svg.js/issues/[illegible]

Mouse & Touchpad

General

Primary Button — Sets the order of physical buttons on mice and touchpads. [✓ Left] Right

Mouse

Mouse Speed

Natural Scrolling — Scrolling moves the content, not the view. Off

Touchpad

Touchpad — On

Natural Scrolling — Scrolling moves the content, not the view. On

Touchpad Speed

Tap to Click — Off

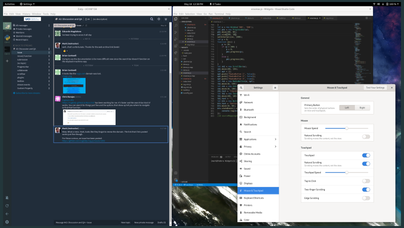
Two-finger Scrolling — On

Edge Scrolling — Off

Accessibility

How do we make these visual enhancements more accessible?

- Hierarchy!
- Shortcuts (skip links, etc.)
- Color alternatives, high contrast



Accessibility

How do we make these visual enhancements more accessible?

- Hierarchy!
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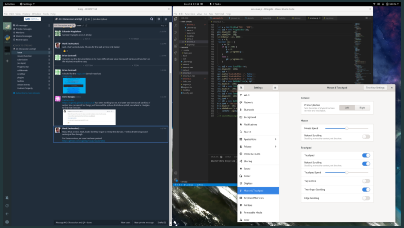

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Chris Barajas: [illegible] has been working for me. It's faster and the search bar kind of works. You can search for things just fine and the options that show up tell you where to navigate to find that function.

Mark (Instructor): Wow. What a mess. Yeah, looks like they forgot to renew the domain. The link that Chris posted works just fine though.

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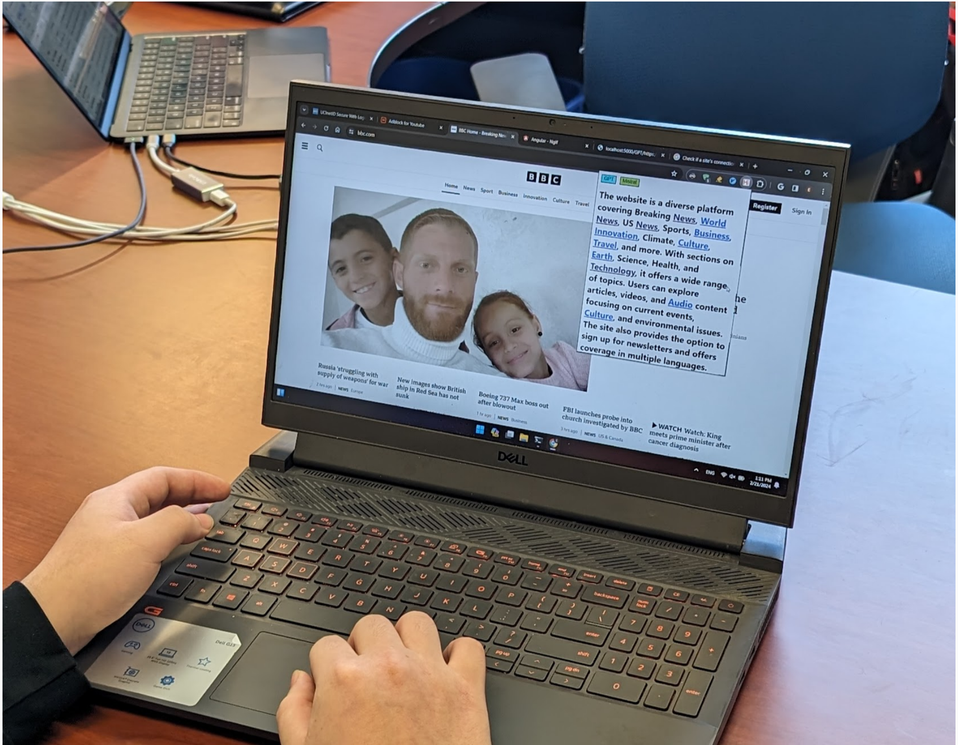
Demo Video

https://vimeo.com/231640164



The website is a diverse platform covering Breaking News, World News, US News, Sports, Business, Innovation, Climate, Culture, Travel, and more. With sections on Earth, Science, Health, and Technology, it offers a wide range of topics. Users can explore articles, videos, and Audio content focusing on current events, Culture, and environmental issues. The site also provides the option to sign up for newsletters and offers coverage in multiple languages.

Russia 'struggling with supply of weapons' for war

New images show British ship in Red Sea has not sunk

Boeing 737 Max boss out after blowout

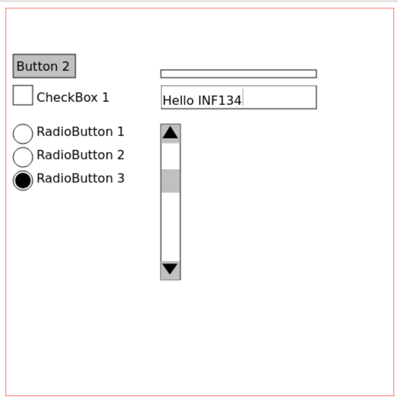
FBI launches probe into church investigated by BBC

WATCH Watch: King meets prime minister after cancer diagnosis

Accessibility

Supporting Access

How can we make our custom toolkit widgets accessible?



Supporting Access

Based on SVG, so at a minimum follow web standards

Rely on Aria roles with custom widgets

```typescript
enum RoleType {
    button = "button",
    checkbox = "checkbox",
    ...
}

interface IAccessibility {
    set role(role: RoleType);
    get role(): RoleType;
}
```

Supporting Access

Based on SVG, so at a minimum follow web standards

Rely on Aria roles with custom widgets

```
// set Aria role
class Button extends Widget{
    constructor(parent:Window){
        this.role = RoleType.button;
    }
}

```

```
<svg>
    <g role="button" tabindex="2">
        <rect ... ></rect>
        <text>
            <tspan ...>Click Me</tspan>
        </text>
    </g>
</svg>
```

Team Activity

How does your chosen toolkit (either one) support accessibility?

Accessibility

Let’s return to the topic of supporting access...

Today we *have* the ability to make technology accessible, but we often lack the *desire or awareness* to make it so.

Access to technology is democratizing. It is our responsibility, as creators of technology to accommodate all people, regardless of ability.

Accessibility

What are some ways that you can be an ally and advocate for accessible design?

References

References i

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