

Canadian Museum of Human Rights “Universal Keypad” Design Report

*Inclusive Design Research Centre, Toronto, ON
May 30, 2013*

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Canadian Museum of Human Rights -- “Universal Keypad” Design for Kiosks

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Background

Keypad Design Considerations

The CMHR keypad developed out of an integrated design process that is rooted in the IDRC’s accessible design practice while being informed by the following:

- research into the requirements and recommendations for accessible keypad design;
- the study of existing keypads, keyboards, and related assistive technologies;
- past IDRC design work on museum kiosks;
- accessibility standards (including W3C); and
- the results of user testing carried out at the IDRC on the CMHR testing prototype keypad.

For a summary of design considerations as well as additional research references please see Appendices A and B respectively.

Design Gaps

During the process of designing the keypad, several gaps were identified with regard to the kiosk design as well as the use of a keypad to provide “universal” accessibility. For details of our gap analysis, please see Appendix C.

Testing

Testing Prototype Keypad

Several keypad concepts were considered during the design process. The design on which the testing prototype keypad was based can be seen in figure 1. One exception to the design was the screen reader key symbol, which, prior to testing, was changed to a square speech bubble containing three sequential dots (see image in figure 4).

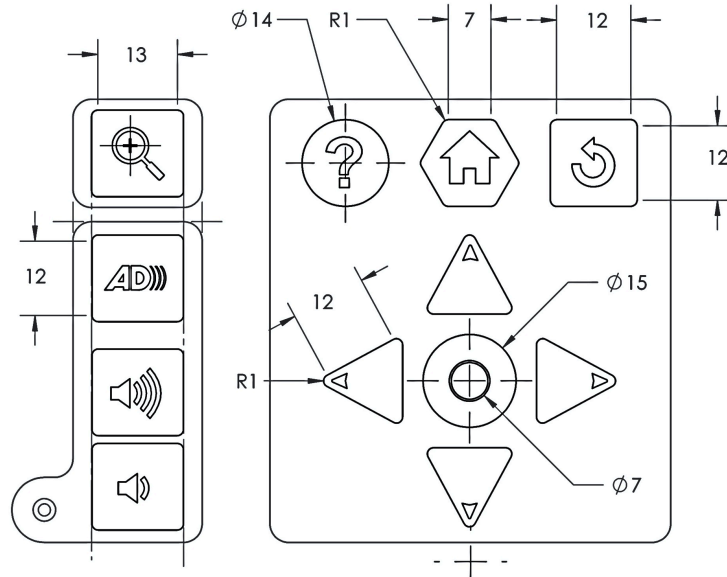


Figure 1. Testing prototype keypad.

The testing prototype keypad was built based on the design shown in figure 1 and on the construction method shown in figure 2.

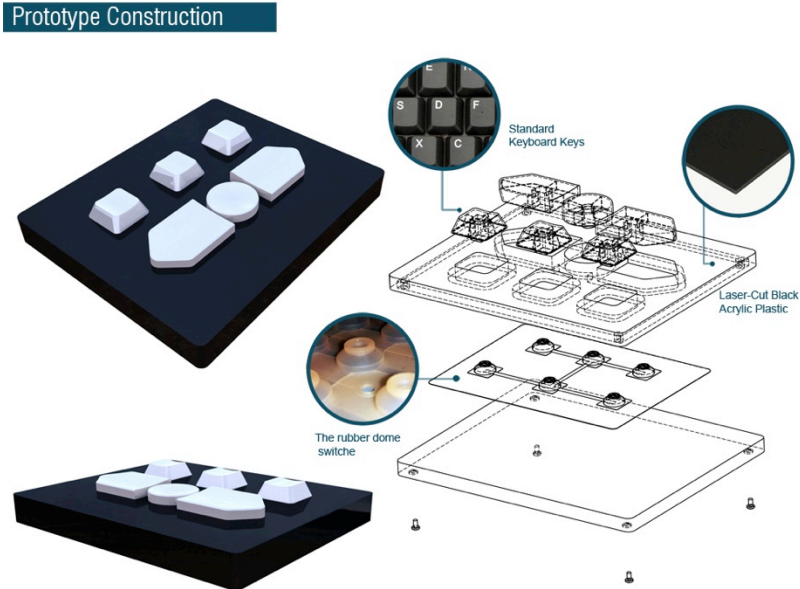


Figure 2. Proposed construction of testing prototype keypad.

The testing prototype keypad was made up of the following components:

- 3D printed keys
- heavy-weight card-stock casing
- rubber dome key-press mechanism from a standard computer keyboard
- Intellikeys programmable keyboard

The testing prototype keypad and test setup can be seen in figures 3 and 4.



Figure 3. User testing setup showing testing prototype keypad with interactive interface.



Figure 4. Testing prototype keypad detail.

User Testing Protocol

Please see detailed user testing protocol in Appendix D.

User Testing Results Summary

Diverse user testing was carried out over a period of two weeks at the Inclusive Design Research Centre. Test participants were both visual and non-visual and used various mobility and communication aids. Users also expressed varying levels of comfort with technology. A total of 7 user tests were completed in addition to informal testing with paper prototypes of the final design within the IDRC.

User testing revealed a number of issues with the keypad design. A common response was that the symbols on the keys were too small and/or too detailed to identify in a tactile manner. Some of the symbols were also difficult to interpret visually. The back key and the screen reader on/off key introduced the most confusion. Several visual users identified the back key as a refresh key, and recommended changing the symbol from a circular arrow to a straight arrow. In some cases the zoom key was identified as a search key (there was no tactile “+” sign during testing), and the screen reader key as a captions key. In other cases the home key was tactilely identified as an arrow key. Tactile users were not able to identify the volume controls. Some users found it unclear as to how to zoom back out again once they had zoomed in.

Some users suggested the addition of tactile text and braille labels on the keypad. This is not recommended due to space constraints on the kiosk, and because increased key size and improved key symbols in the final keypad design should address the issues of key function/symbol identification. In addition, braille labels are not recommended since many non-visual users do not read braille.

Several users recommended the addition of a second zoom key to provide both a zoom in key and a zoom out key. This provides continuity with the volume up/volume down key pairing, and has been added to the final keypad design.

In most cases users were able to clearly identify the function of the navigation keys, and stated that the triangular shape of the four navigation keys and the grouping of the keys around the central, circular select key helped to identify their function. Visual users expected the up and down navigation keys to provide up and down navigation capability when images were presented in a grid.

Final Design

Test Results Applied to Final Design

The final keypad design takes into account various factors that prioritize but are not limited to the user testing results. Other considerations include keypad design research, accessibility standards and requirements, the constraints of the existing kiosk and museum exhibit designs, manufacturing considerations as well as the application of IDRC knowledge and experience in accessible design.

The following design modifications were made in the final keypad design:

- slightly larger keys
- larger key symbols on all keys
- simplified key symbols (back key, screen reader key, volume controls)
- modified volume control symbols (“+” and “-“ combined with speaker icon)
- addition of a second zoom key (to provide separate zoom in key and zoom out key) with larger magnifying glass icons and the addition of “+” and “-” inside the magnifying glass
- significantly larger screen reader on/off key to allow for tactile identification of key symbol
- modified back key symbol (straight arrow rather than circular)
- addition of inverted colour values for navigation keys
- the addition of a tactile frame (or surface depression) around the navigation keys
- proposed removal of the back key (with recommendation to afford back key function with the interface design instead)
- symbols on keys outlined rather than in-filled for improved tactile grip

Final Design Notes

Physical Design

- provide ridges around the perimeter of all keys for ease of tactile mapping and improved key-surface grip (0.5mm high)

- screen reader on/off key toggle (recommend that screen reader key remains depressed while screen reader is on, push again to release and turn screen reader off). This will provide a clue for turning the screen reader off.
- provide illumination of active keys (e.g. if there are cases where the up/down navigation keys are inactive, illuminate only the left/right navigation keys)
- provide a tactile frame or a surface depression around the navigation keys (~0.5mm high)
- key height minimum of 5mm, recommended 7mm
- key material (matte surface best for reduced glare but non-slip)
- mechanical and auditory (click) feedback when keys are pressed
- high contrast between keys and key symbols as well as between keys and kiosk surface
- inverted colour values for navigation keys and navigation key background

Interaction Design

- home key should provide an “are you sure?” prompt
- up/left and down/right navigation key pairing where necessary (in keeping with typical screen reader navigation pattern of left to right and top to bottom)
- up/down navigation keys to provide up/down directional navigation where appropriate (e.g. images in a grid, vertical timelines, etc.)
- zoom in and zoom out keys should allow for a minimum of 3 levels of zoom
- up and down navigation should be possible when visually implied (e.g. in a grid of images or a vertical list of items)
- keys should be activated only when pressed down for sufficient time, in order to avoid accidental key presses (e.g. in the manner of the caps-lock key on the Mac keyboard)
- museum interactives should be semantically structured for ease of navigation (<http://webaim.org/techniques/semanticstructure/>)

Is a Back Key Necessary?

The need for a key that would allow the user to return to the previously viewed page or layer will depend on the interaction design. It is our recommendation that the interactives be designed in such a way as to allow the user to easily undo the last function or return to the last viewed page or layer without the need for a back key.

Final Design Drawings

Please see the proposed keypad designs in figures 5 and 6. A direct comparison of the prototype keypad and the final design is shown in figure 7. The keypad dimensions and layout on the kiosk are shown in figures 8 and 9.

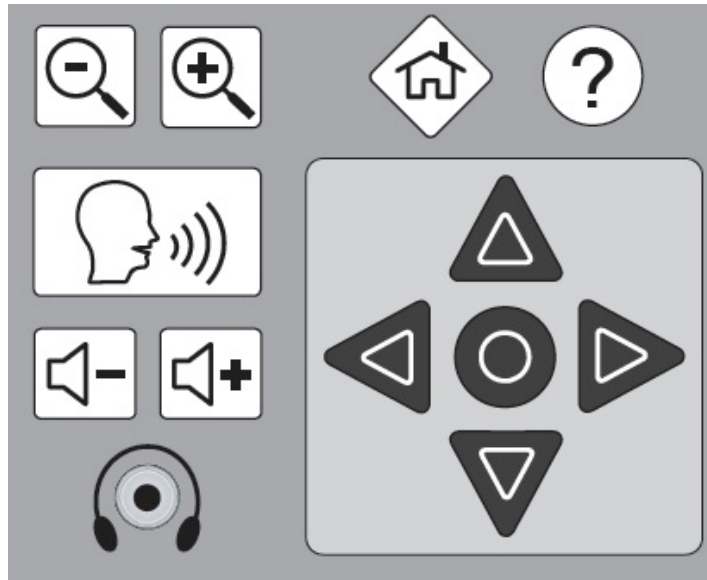


Figure 5. Final keypad design (without a back key).

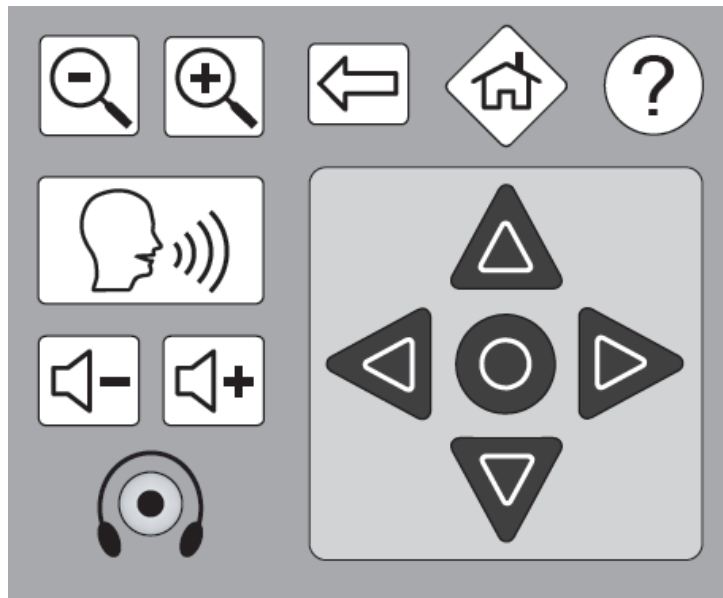


Figure 6. Final keypad design (with a back key).

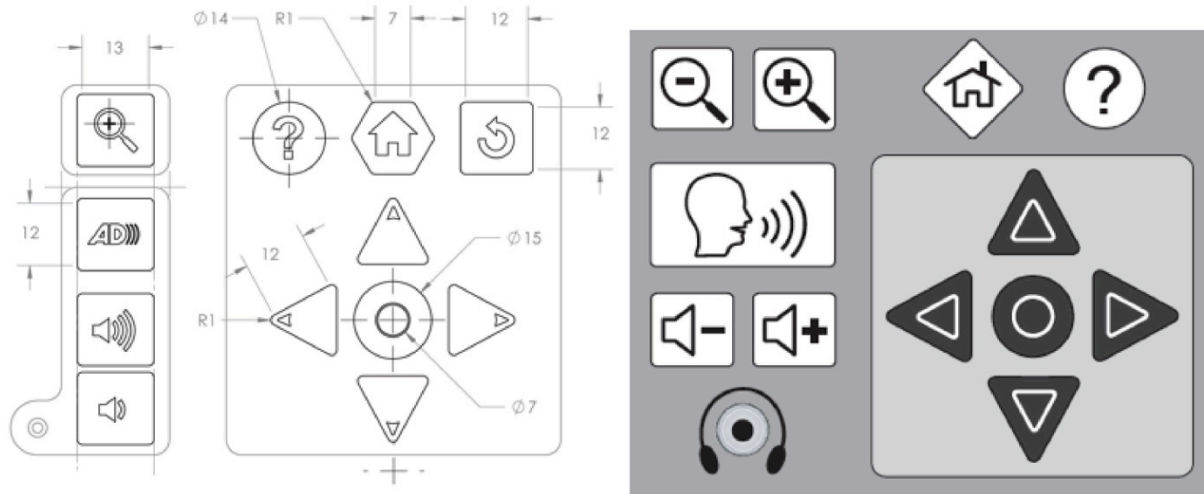


Figure 7. Comparison of tested prototype keypad to final keypad design.

DRAWING: CMHR KEYPAD DIMENSIONS

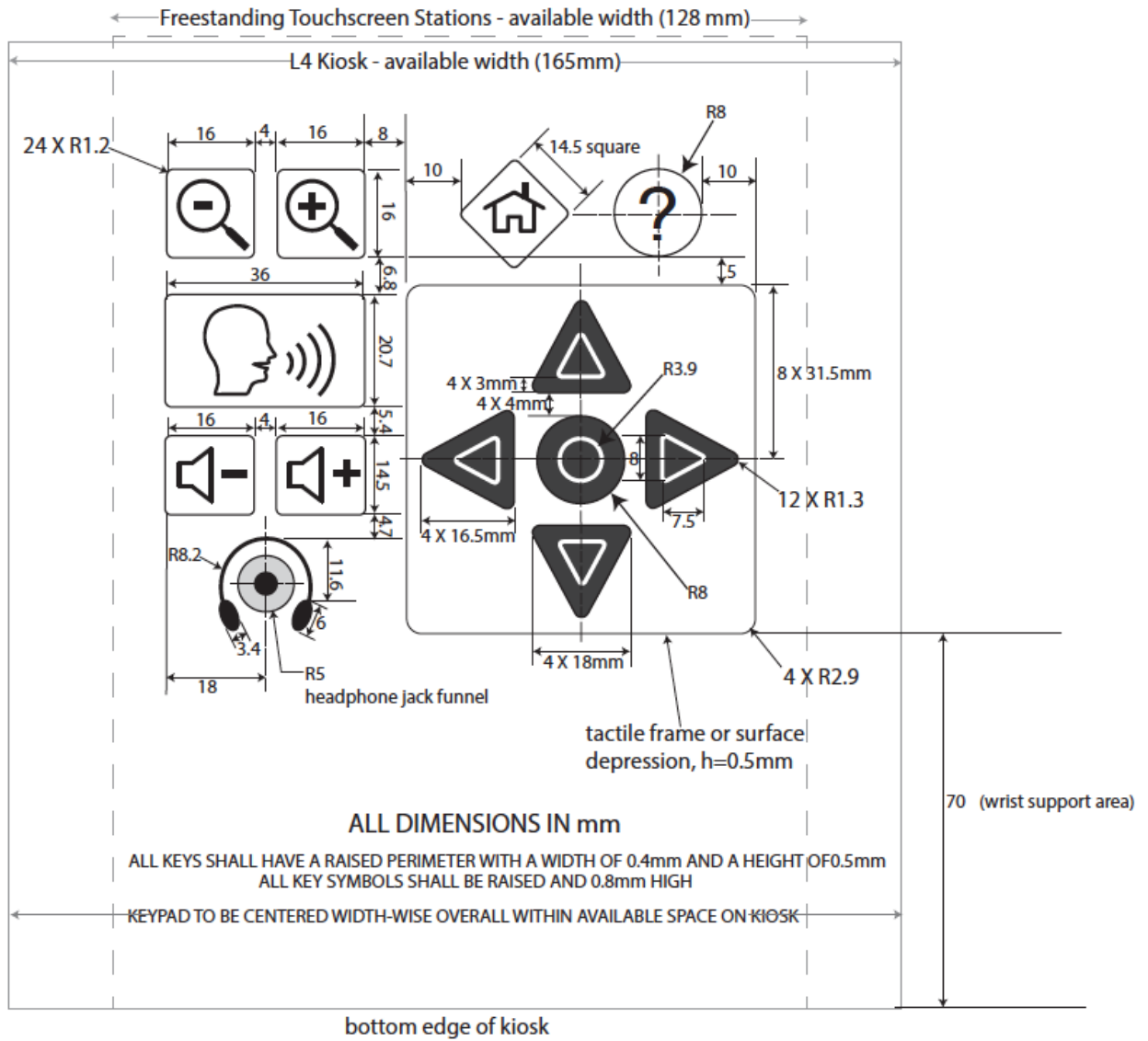


Figure 8. Final keypad dimensions and layout on the kiosk (keypad without a back key).

DRAWING: CMHR KEYPAD WITH BACK KEY DIMENSIONS

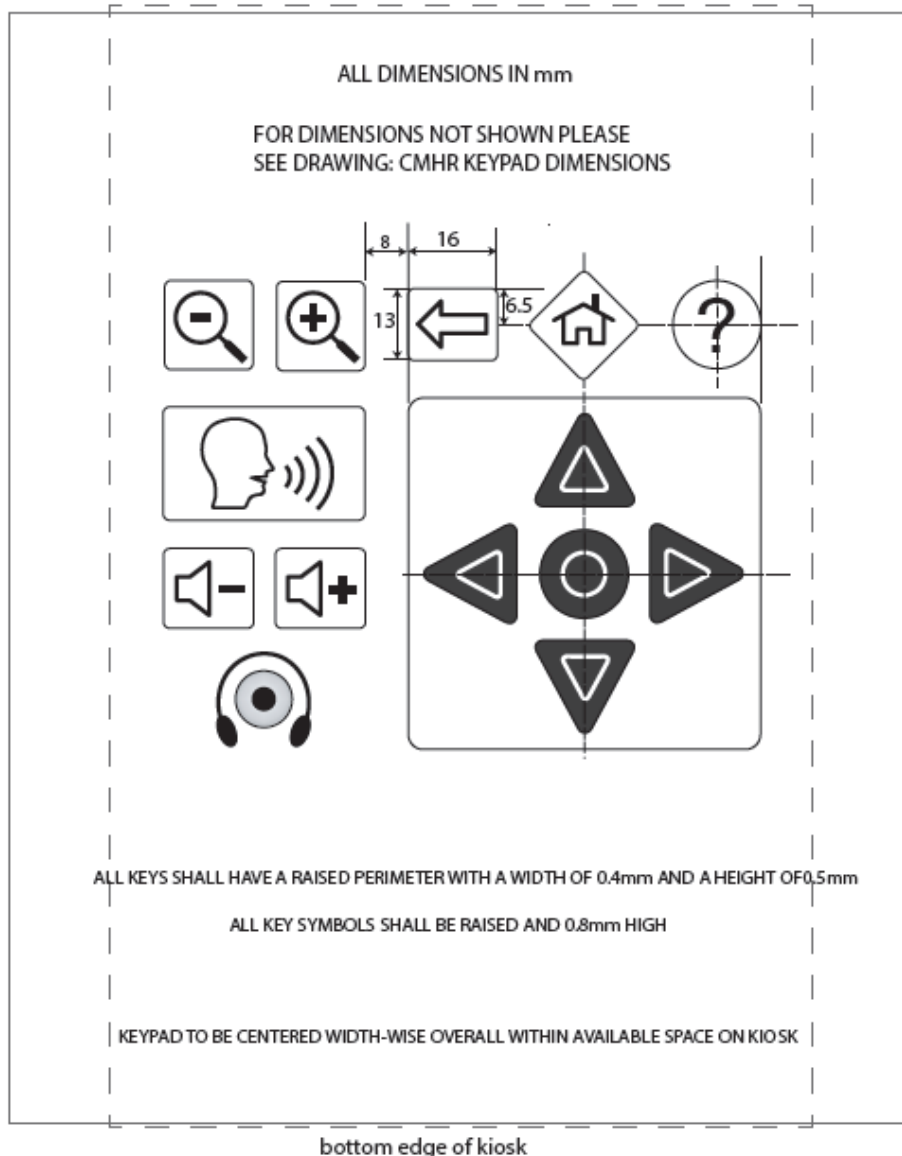


Figure 9. Final keypad dimensions and layout on the kiosk (keypad with a back key).

Appendix A

Summary of Design Considerations

Overall Keypad Design

- include a wrist rest/support to increase stability and reduce
- “back” key function needs to be clearer – improve icon?
- keys could be activated only when pressed down for sufficient time, in order to ignore accidental key presses (e.g. caps lock key on mac OS)
- solution for left-handed users or users who cannot reach the keypad (e.g. wheelchair too large to roll under kiosk)?
 - e.g. a detachable, hand-held device like the [3G Off-Table Handtrack wire mouse](#)
 - e.g. place keypad in middle-bottom below touch-screen

Key Design

- concave key surface for non-slip*
- well-defined upper key edges for improved tactile identification
- texture on some keys for tactile identification
- key material (matte surface best for reduced glare but non-slip*)
- shape of key can match function where appropriate (e.g. arrow-shaped keys)
- a [keyguard](#) could be included to increase accuracy of key selection
- internal key illumination – could brighten upon engagement
- sufficient distance between the keys (no less than half a key width)*
- sufficient height of keys (>5mm)*
- minimum size of keys (>12mm in any dimension)*
- larger keys better (but not too large as to be unidentifiable as a key)*
- embossed/(engraved?) symbols on keys for tactile feedback
- e.g. volume slider with embossed audio icon along with +/- embossed symbols indicating volume limits at each end
- contrasting colour/shade between keys and kiosk base (illumination will help) as well as contrast between key icon/text and key material*
- size of characters on keys >7.5mm with 1mm between character and edge of key*
- sans serif font for key text; lowercase letter height should be > ½ upper case height*
- function keys should be labeled with the full function names in the national or preferred language, or by well-known symbols*

Keypad Layout

- physical separation of keypad groups*:
 - navigation keys (forward, back, select)
 - home
 - help
 - skip back
 - audio keys (volume, headphone jack, audio description on/off)
- put headphone jack in center of headphone icon?
- arrange keys to line up with resting finger positions where appropriate

Audio

- vertical (volume) slider easier to use than horizontal, and up/down direction more obviously reflects logic of increase/decrease in volume
- audio feedback upon key selection or “snap” key for user-confirmation*
- audio description/screen reader icon improvement (could use a speech bubble?)
- have audio description turn on when the headphones are plugged in? (eliminates need for AD on/off switch, but implies that AD will be through headphones only)

*Source: [Characteristics of telephone keypads...requirements of elderly and disabled people \(European Telecommunications Standards Institute\)](#)

Appendix B

Keypad Design and Accessibility References

- [European Telecommunications Standards Institute - Characteristics of telephone keypads ... requirements of elderly and disabled people](#)
- [W3C Working Group - Keyboard Accessible Understanding Guideline 2.1](#)
- [Wisco Systems Telephone Accessibility](#)
- [508 Refresh report](#)
- [List of John Gill publications for accessible keypads and user interfaces](#)
- [US Dept of Education - Rehabilitation Engineering Research Centers](#)
- [Just Ask: Integrating Accessibility Throughout Design \(online book\)](#)
- [An Accessibility Review of the Verizon Haven Cell Phone \(see keypad section\)](#)
- [Making ICT Accessible \(tiresias.org\)](#)
- ["A Special Phone" iPhone app demo \(youtube video\)](#)
- [Configuring an Accessible Keyboard \(GNOME Library\)](#)
- [Ten Innovative Keyboards \(Webupon\)](#)
- [Information for Designers of Public Access Terminals](#)
- [The Markets for the Adaptation of Self-Service Terminals to be Accessible by People with Disabilities](#)
- [Section 508 Blog How to Tell if a Keyboard is Accessible](#)
- [Overview of Twenty First Century Communications and Video Accessibility Act](#)

Appendix C

Gap Analysis

Physical Interaction with Kiosk

- non-adjustable kiosk height will limit access of many users of different heights and in differently-sized wheelchairs
- inability to connect to kiosk with remote, personal device means that individual user's pre-set, personal preferences are unexploited
 - users will need to a) physically access kiosk in order to set preferences and b) repeat preference-setting routine at every kiosk
 - limits ability to adapt to individual's needs (a key component of accessibility)
- headphone requirement for listening to audio describe (vs. local speakers) means that user will have to plug in headset at every kiosk

Physical Interaction with Keypad

- keypad may be difficult for users with limited mobility to comfortably reach
- keypad requires a level of manual dexterity which some users with disabilities do not have
- keypad as sole alternative to touch-screen (vs. personal device or other solution) may limit overall enjoyment/experience of exhibit
- fixed, right-handed keypad limits use by left-handed users and those who cannot physically reach the kiosk
- keypad is easy to locate but due to immediate prominence may be confused for sole kiosk interaction
- use of keypad may be tiresome for extended periods; increasing wrist-rest area may provide one solution
- vertically-oriented keypads on wall-kiosks are awkward to use and will be tiresome for extended periods of use
- fixed keypad button controls limit the level of interactivity with changing kiosk content (eg. content requiring up and down controls in addition to right and left)

Touch-screen Interface

- on-screen interactables for different levels of navigation are often presented in the same row (e.g. language selection, timeline, view toggles and next/previous buttons) – separating these levels into functional rows will simplify interaction
- nuanced audio description would enrich user experience e.g. for map/globe visual a whirling sound upon swiping, splashing over water bodies, voice over countries
- use of colour-coding as sole identifier for different classes/levels of information will limit cognition of those who are colour-blind; include also a variety of shapes

gesture diptych

- tactile floor markings to indicate where to stand, audio instructions, alternatives for blind users, alternative for users with limited mobility would improve the interaction here
 - possible solution: mobile touchscreen as an alternative for some users, they would still get the experience of flipping through a book through swiping gestures

group table

- keypad is distant from kiosk content and appears to limit users to only the side content – provide a keypad at each individual station

debate table

- provide alternative to touch screen or audio instructions indicating which side of the screen is yes, and which side is no

Graphic Standard

- ability to set preferences on the touch-screen (font size, contrast, brightness,)
 - these could be portable preferences (on a token or other hand-held device)

Appendix D

User Testing Protocol

Methodology

Session Structure

The testing session was composed of two parts:

- Undirected "Observational" Testing
- Directed "Keypad Functionality" Testing
Expected duration: 60min

Testing formats

Kiosk exhibit formats for testing:

- single kiosk (insight stations)

Materials

- Interface mock-ups as provided by CMHR were used for testing. A highly simplified interactive was created based on the Mass Atrocities screen shots provided by CMHR.
- Prototype keys, constructed using 3D printing
- Rubber dome keypad base
- Heavy card stock for keypad casing

- Intellikeys programmable keyboard
- Computer monitor
- Screen-reader audio (Chrome browser with Apple Voice Over)
- Height-adjustable table
- Video camera
- Laptop for note-taking

Test Participants

The testing was performed with 4 external users and 3 IDRC users, as well as informal testing with paper prototypes at various stages within the IDRC.

1. Protocol introduction

General things to keep in mind for the test

- Probe the user on expectations, frustrations, and general thoughts.
- Avoid influencing the user's decision-making and deflect questions to gain further insight into the user's thoughts (e.g., "What does this do?", "What do you think it does?")
- Don't offer help; let the user attempt to perform the tasks themselves. If they ask for help, reply with probing questions such as:
 - "What do you think you should do?"
 - "What do you think that means/would do?"
- Reassure the user that we are not testing the user--we are testing the application, and there are no wrong answers.
- Ask the user to think aloud whenever possible.

Greeting script

Hi [participant's name]. I'm [your title] with the Fluid Project. The Fluid Project is a project aiming to build more inclusive, usable web experiences for everyone. Today we are looking at ways to help tweak and customize your experience of interacting with a museum-based, touch-screen kiosk and associated keypad.

This is a test of our designs; we are not testing you. If you find something difficult or unintuitive to use, chances are that others will as well. This test of the design is simply a means of evaluating our work and to discover any issues we need to address.

The study is composed of three parts: we'll start with an undirected, observational test where you can explore the keypad without any functional interaction with an interface. The second part is a keypad functionality test where the keypad will be connected to a simplified interface. After each section we'll ask you a few questions about your experience, and then end the testing period with a demographics questionnaire.

The study will take about 60 minutes, and you can stop at any time during the study for any reason. We will answer any questions you have now and at the end of the study.

Do you have any questions before we start?

First we'll need you to read over and sign this consent form.

2. User testing

Context

Before the test begins the user will be provided with information about the context of the keypad as well as a representative screen-shot of a kiosk interface.

The context description will include the following:

- that the goal of the keypad is to provide alternative input controls for touch-screen kiosks that will be installed in the Canadian Museum of Human Rights
- that the kiosks are an integral part of the interactive exhibits in the museum which present information about various aspects of human rights in Canada and beyond
- that keypads will be installed on the right-hand, bottom side of touch-screen kiosks which are designed at a set height and angle
- that interaction with both the keypad and the touch-screen will be possible in the museum, but for the purposes of our testing there will be no touch screen functionality
- that the keypad for testing is a prototype only, such that
 - the final key material will be different (but will likely be made of hard plastic with a smoother surface)
 - the force required and physical/audio response to pressing the keys may be different in the final product
 - the keys in the production keypad will likely be illuminated (either at all times or to indicate active keys)
 - the size, height and shape of the keys will be the same (dependent on the results of this testing)
 - the layout of the keys will be the same (dependent on the results of this testing)
 - the current screen-reader content is for testing purposes only, and in many cases is non-specific

a) Undirected "Observational" Testing

Test focus: The goal of this phase of the testing is to determine whether the function of each key in the keypad is clear to the user, as well as to determine if the design of the keys or layout of the keypad introduces any concerns or problems for the user. This phase of testing will allow us to observe the initial reaction of the user upon engaging with the keypad for the first time.

Introduction

Let the user know that the goal of this phase of the testing is to allow them to explore the keypad in order to determine if the function of each of the keys is clear, and to get any feedback they may have about the design of the keys and the keypad layout.

Let the user know that during this phase of testing the keypad will not be functional (that is, pressing the keys will not activate any response), but that the user is free to press the keys as desired.

Test

First, the user will be encouraged to observe the keypad, in both a visual and/or tactile manner, without any specific guidance. The user will be encouraged to verbalize any observations or questions that come up and these will be recorded.

Next, the user will be asked to name the function of each of the keys as best they can (if they haven't already). If they are uncertain of any of the functions, they will be asked to take a best guess, and this uncertainty will be recorded.

After the observational period is over, the user will be asked to provide any further feedback or observations about the keypad that they might have.

b) Directed "Keypad Functionality" Testing

Test focus: Basic functionality of the keypad.

Introduction

In order to isolate keypad functionality testing from issues related to the graphic interface structure of the museum interactives (which is outside the scope of this project), we will limit this phase of the testing to interaction with a highly simplified navigational interface based loosely on the interface mockups provided by the museum.

Test

Inform the user that the interface is a very simplified version of what will be seen in the museum, and is only for the purposes of testing keypad functionality. Navigable/selectable items will be highlighted with focus-state boxes - these do not represent the final design (design of focus state TBD). Furthermore, many buttons, though focusable, are not currently active; selecting these buttons will result in no action (we'll let you know what these are). Inform the user that this audio content is for the purposes of testing only and will be different in the final product.

Testing will proceed as per the following:

- open wireframe home page and let the user know that only the English language content is available at this time
- ask the user to complete the following tasks:
- Task 1:
 - a) Find the video and information related to Mass Atrocities story #4

- b) Now choose a different story to explore
 - c) Go back to Welcome/first page
- Task 2:
 - a) Navigate to the Geography view page
 - b) Go to the Stories view page
 - c) Go back to Geography view page
- Task 3:
 - a) Turn on the screen reader
 - b) Increase the volume
 - c) Decrease the volume
 - d) Turn off the screen reader
- Task 4:
 - a) Zoom in on the page
 - b) Return to original zoom level

Post-Test Questions

At this time the user will be asked a series of post-test questions and the answers should be recorded (audio recording or note-taking).

Post-test questions will include the following (if the user has not already answered them in their feedback):

- How would you describe your overall experience and comfort in using the keypad?
- Were you at any point confused about what each key does?
- The following are specific questions about the key and keypad design:
 - Do you have any thoughts about the grouping of the keys? Would you group them differently?
 - Is the shape of the key helpful in distinguishing the function of that key?
 - Are the raised symbols on the keys helpful in distinguishing the function?
 - How do you feel about the size of the keys?
 - How do you feel about the distance between each key?
 - If you need additional instructions on how to use the exhibit, what would you do?
- Are there any functions you wished to perform that you couldn't? (that didn't appear to be available to you through the keypad?)
- Would you add a key or take away a key and if so which key?
- Do you have any other concerns or observations about the design of the keys or the layout of the keypad?
- What do you like about the keypad?
- Although the design of the interface is not in the scope of our work, we may be able to provide some input into the final design. Do you have any ideas or feedback about the interface design or navigation features?
- If you could design an alternative input device for the kiosks (keypad or not), what would it be?

3. Post-test demographics questionnaire

1. If you use any custom devices to use computers (even glasses), list them here: _____

2. In general, what is your comfort level with technology?

Very comfortable

Comfortable

Uncomfortable

Finishing Up

Ask the user if he/she has any questions, thank the user for participating, and give an honorarium if we have one.

Appendix E

User Testing Results - Detailed

Trends

- icon used for screen reader on/off key is not clear
 - Visually identified as a captions button
 - Tactile cue is unclear - should use a more accepted tactile convention (possibly a speaker with sound waves)
 - Volume controls could be up/down arrows or +/- symbols grouped together with the screen reader on/off key
- buttons could be a little bigger and more spaced out
- symbols/icons on the keys should be bigger and/or better defined/easier to identify
- labeling keys with braille and raised print would help identify the key functions
- function of the single zoom button is unclear - suggest having a pair of keys: zoom in key and zoom out key.
- back button is visually and tactilely unclear - use conventional straight back arrow instead of circular arrow (confused with refresh key)
- home key symbol feels like an arrow
- navigation keys and select key functions were clearly understood
- up/down navigation keys were expected to navigate up and down when a visual grid was presented

User 1

Button design: Size, spacing, labels, etc.

- user found the raised symbols on the keys difficult to identify
 - recognised a circle shape on the zoom key and an "S-like" shape on the info key (question mark)
 - in general did not find the shapes of the keys or the symbols useful in identifying key function
- pressed the "?" button because it had an intriguing S shape.

- found the home and back keys confusing
- finds the positioning of the keys more useful in understanding their function (is familiar with a numerical keypad layout).
- thought that the key sizes and spacing were good
- when asked if she would add any keys to the keypad she stated she would add the 4 and 6 keys
- suggested that we add a key that would allow the screen reader to read back letters or words, as well as to adjust voice rate.
- longer keys with braille on the surface would be helpful. Braille labels adjacent to the keys would not be as effective as braille directly on keys.
- user wishes for better audio feedback when pressing the keys.

Tactile Identification

- user guessed that the keypad was based on a numerical keypad, such that the top row of help/home/undo keys were 1/2/3, and wondered why the 4 and 6 key were missing
- user guessed that the column of keys on the left side of the keypad must be function keys
- after trial and error in using the keypad the user stated that she felt the shape of the up/down/left/right navigation keys made their function clear
- after an initial encounter, understands that the middle button is for select.
- user referred to the select key as the "8" key

Screen Reader

- When asked to turn on the screen reader:
 - pressed all the keys until she found the screen reader on/off key.
 - then wanted to turn up the volume but couldn't identify a key that would allow her to do that
 - stated that she is feeling for a key with a "V" letter (for volume) or braille
 - stated that key textures matter a lot

Zoom

- Was not tested

General

- when asked to describe overall experience and comfort level with the keypad, the user stated that it was pretty good, and better than other keypad studies she'd been involved with
- user rated comfort level with technology a 2 (where 1=very comfortable, 2=comfortable and 3=uncomfortable)
- uses screen reader when on computer at home but no other custom devices

User 2

Button design: Size, spacing, labels, etc.

- user likes simplicity of the keypad
- key spacing is good - no changes needed there.
- user would change keypad to have two zoom keys, in and out, and would place them on the right-hand side of the keypad.

- this would have the added benefit of aesthetic balance.
 - having a single zoom button by itself in the corner makes it seem more like a utility (i.e. search).
- user would change the undo/back key symbol to a back pointing arrow and would put it on a square key in order to avoid confusion with back navigation key
- make the buttons a little bigger, especially the navigation buttons.

Visual Identification

- visually identified zoom key as a search key
- visually identified undo key as a refresh key
- thought audio key might be a captions key, but wasn't sure
- visually identified the intended functions of the home key, help key, volume controls and navigation keys
- user would have selected the undo/back key to go back to last page if he had recognised it as such (used navigation and select keys instead to navigate back to last page)
- when asked to turn on the screen reader user selected the intended key, but said it was only through process of elimination

Software Experience

- lack of initial focus confusing - didn't know where to start
- expected up and down arrows to move focus up and down

Zoom

- when asked to zoom, used the "refresh" key because thought the arrow was for zoom.
- eventually tried the magnifying glass to zoom in and out

Screen Reader

- when asked to turn on the screen reader, found the key by process of elimination - did not expect the "captions" button to be used for this purpose.

Alternate keyboard

- when shown alternate keyboard design #1, thought that round speech bubble still indicated captions.
- when shown alternate keypad design #1 (which includes a back/undo key and a skip forward key), suggested that if you provide the user with a back/undo key, there should also be a forward key (like a web browser back and forward)
- when asked about an alternate symbol/icon for screen reader on/off key, suggested a speaker symbol, with up/down arrow keys below it for volume up/down
- does not think forward/back arrow keys would be confused with navigation keys, especially if the back/forward keys are square
- prefers layout of alternate keypad #1
- thinks that alternate keypad #2 (with zoom and volume modes) would be too confusing

General

- when asked to describe overall experience and comfort level with the keypad, the user stated that it was pretty good, but that there were 3 keys which he found difficult to identify
- user rated comfort level with technology a 1 (where 1=very comfortable, 2=comfortable and 3=uncomfortable)
- uses keyboard-only input with personal computer on a regular basis

User 3

Button design: Size, spacing etc.

- would put a little more space between navigation key group and upper row of keys
- noticed later in the test that there was a larger gap between the zoom key and the audio key group
 - thought that the space between the zoom key and the audio on/off key should be the minimum key spacing everywhere on the keypad
- would make the keys a little larger in general, except for the navigation keys which are a good size
- felt in general that the symbols on the keys are too small and too detailed to be identifiable
- likes the texture and concavity of the navigation arrow keys - texture helps prevent slippage
 - flat, smooth keys (like the Apple keyboard) are hard to use because they are slippery
- thought the key groupings were logical, but might put the home key first in the top row, followed by the back/undo key, then the help key.
 - would put the help button last because it won't be used right away, home key first because it is the beginning
- the shapes of the keys didn't help the user personally, but she appreciated the fact they were different shapes. Said that it may help others even if it didn't help her.

Labels and Braille

- suggested that text and Braille labels beside the keys would be good, in addition to larger raised symbols on the keys
 - user remarked that braille grade 2 is more common
 - raised print is also good since not all non-sighted users are braille literate.
 - navigation keys do not need labels because their function is clear; could maybe label the whole cluster as "Navigation"
- could have audio instructions telling you where each key is located

Tactile Identification

- thought the zoom key was a Q at first but eventually identified it as a magnifying glass and thought it would have a zooming function
 - wasn't sure at first if pressing the zoom key again would zoom it back out
- identified the question mark and understood that it would be some kind of help key

- back/undo key was not clear at first (said it felt like a water droplet)
 - later, when asked to navigate to a previous page, the user stated that "there must be a back key" and eventually identified the back key as a "circular arrow"
- home key was not clear (thought it might be a left arrow)
 - when asked to go back to the first page of the interface, used the back button to go back step by step
- screen reader on/off key was not clear (said it feels like a fish)
- volume key functions were not clear
- immediately identified the 4 triangular keys as navigation keys and the center key as an "OK" button (identified the central circle as "O for OK")
 - understood that these navigational keys were for "moving around on the page"
- in general, when exploring the keypad, user is looking for audio and tactile clues to help give direction

Screen Reader

- user was able to enable the screen reader after some trial and error and process of elimination
 - user already understood that some of the keys were navigation, other keys felt like arrows, so that left the keys with unknown shapes.
- suggested that "voice" or "speech" would be good text labels for the screen reader on/off button
- suggested that a "bucket on its side with brackets" might be used as a symbol for the screen reader on/off button
 - otherwise could not suggest an alternate symbol for screen reader on/off button

Zoom

- thought the zoom button might bring up a menu with zoom levels to choose from
- wasn't sure if the zoom key was pressed a second time if it would zoom back out or not
- user knew that this was the zoom button because it was the only button left to press
- thought "Mag" could be used as text label; later decided that "zoom" would be better
- thought having two zoom keys (in and out) would be better, especially because it would match the up/down volume key pairing

Volume

- found the volume control buttons through process of elimination - knew roughly what the other keys were, so the remaining keys were likely volume.
 - thought that the up volume key felt like some kind of arrow
- suggested up and down arrows for volume key labels, with a text label ("VOL") between them or beside them

- user suggests that volume arrows would not be confused with navigation keys since the navigation cluster has well defined function and is spatially different
 - suggested that if the up and down volume keys were square this would also distinguish them from the triangular navigational keys
- when asked, thought that + and - might be OK for up and down volume symbols too
- the speaker symbols on the volume control keys were hard to decipher due to their small size and lack of context.

Navigation

- when asked about why she used mainly the left/right navigation keys and not the up/down navigation keys user stated that she expected the links would go across the page, and that either the left/right or up/down keys would do the same thing.
- user did start using the up/down keys when the left/right keys didn't seem to be working.
- "when I surf the web at home I use either the tab key to go from link to link or the up and down arrow keys if I want to listen to a line of text/links"

Back

- thought that the back/undo key should be labeled with a back arrow

Home

- when it was pointed out that there was one key left to identify, user identified the home key symbol (understood it was a house) and thought that it would function like a home key to take you back to first page.
- stated that "usually when there is a back key there is also a home key, like on a web browser"
- reiterated that the home symbol is unclear, and likely needs to be bigger

Voting Machine

- user described her experience with accessible voting machines
 - these have an audio prompt asking which language to choose, as well a simple keypad.
 - when asked, user wasn't clear on how the interaction was initiated - suggested that maybe there was a sensor that detected her presence (which started the audio), or if the attendant started the session for her.

General

- when asked to describe overall experience and comfort level with the keypad, the user stated that it was a little hard to use, but she appreciated the tactile features, found the screen reader helpful, and the navigation keys were easy to identify; it could be simpler.
- user rated comfort with technology a 2 (where 1=very comfortable, 2=comfortable and 3=uncomfortable)
- uses ergonomic keyboard (with concave keys) and screen reader when on computer at home
- noted that self-check-outs in grocery stores sense your presence and just start talking to you

- felt that it would be necessary to have someone in the museum tell you what is available at the kiosks/how they work in order to have a good experience

User 4

Button design: Size, spacing etc.

- did not find that the key groupings helped to identify the key functions
- found the square keys more helpful in identifying the functions
- user stated that symbols were not helpful.
- user found volume, zoom, and screen reader keys easier to push
 - Observer hypothesis: the square keys are easier to push than the arrow keys - so by comparison the left side keys are easier.
 - Observer hypothesis: Also due to their shape, size, and proximity to the user, they are easier than the smaller triangle keys and the square keys which are further away (thus requiring more force to push with stick).

Sizes:

- found the size of the keys to be OK, but thought that they could be a little bigger
- user would generally prefer a larger keyboard
- test administrator observation: arrow keys are oddly shaped and hard to press using a stick.

Spacing:

- thought that the distance between the keys could be a bit bigger for both visual identification as well as ease of use

Labels & Cues:

- user had difficulty seeing the small labels on the keys and asked to have the keypad held closer
- stated that the symbols on the keys should be more defined
- when asked if he would prefer text labels he said yes
- user would prefer to have an audible/tactile click when the keys are pressed

Visual Identification

- identified the volume down key as a number sign
- thought the volume up key might be a memory key
- thought the home key might be an up arrow
- identified the question mark and stated that he would press this key to get information
- stated that he expected that the triangular navigational keys would "work a cursor"
- stated that the central select key would be used "to click on"
- stated that the zoom key symbol "looks like an eyeglass" and he expected it would be used to enlarge text (and added that this feature would be useful to him)
- when asked what he thought the key on the upper right of the keypad might be for (back/undo key) he stated that he had no idea

Functional Identification

- through trial and error, user identified the screen reader on/off key as well as the zoom key
- when asked to zoom back out, user tried the screen reader key, volume keys, select key, then the zoom key
- when asked to turn the screen reader back on the user found it again through trial and error
- when asked to turn the volume up, user tried pressing the home key twice (earlier identified as an up arrow), then tried pressing the up cursor keys.
 - user then proceeded to tap randomly on keys until the volume was increased
 - stated that they did not expect the speaker button to do what it did.

General

- when asked to describe overall experience and comfort level with the keypad, the user gave it a 6/10, where 10 would be very good/comfortable
- user rated comfort with technology a 2 (where 1=very comfortable, 2=comfortable and 3=uncomfortable)
- uses sticky keys, screen reader and mechanical keyboard when on computer at home

IDRC User 1

Button design: Size, spacing, labels, etc.

- a square undo button caused user to think that it could be related to the other square keys on the keypad (i.e. zoom, audio and volume controls), could this be a good thing?
- did not use the back button during testing
- confused as to why "search" button is grouped with audio buttons.

Function Identification

- identified the zoom key as a search key, the audio on/off key as a Captions key, undo key as a refresh key
- undo key should go back in hierarchy rather than in history
- undo key not that useful for sighted users
- suggested to put undo key on the interface (focusable) rather than on keypad

Software Experience

- navigating through horizontal time bar would be better achieved with L/R navigation keys rather than up/down
- would recommend voice commands or joy stick as alternative inputs to the keypad
- suggested to have audio descriptions of all selectable options when landing on a page (e.g. "press the back button to return to X page, press the Home key to return to first page, press the Info key to get more information about this exhibit)
- focus state on a whole box indicates you might get more info by selecting it (rather than just focusing on Close button)

- Original zoom functionality (press zoom key once, then use up and down navigation keys to zoom in and out) was very confusing - no visual feedback. No idea what is happening.

IDRC User 2

- Stories/Geography buttons could be more of a toggle and should only appear on each menu page (i.e. on Stories menu page you can switch to Geography menu and vice versa)
- home/reset button could be placed in a separate space from the keypad, because all users will want access to a Reset key if they arrive at the kiosk and it is not at the start
- zoom button could be a toggle that stays depressed while zoom is active
- having modes (zoom mode and/or volume mode) would be confusing
- activating zoom could open a pop-up instructional window; this box could be focusable such that you would just navigate your way out of it and it would disappear

IDRC User 3

Button design: Size, spacing, labels, etc.

- volume controls could be one rocking toggle key (+/- on each end)
- would like to see text labels on the keypad itself; this would help especially for the screen reader on/off key

Function Identification

- initially thinks the select key is for centering, but after some thinking, user states that he thinks it is to play and pause media if focused.
- also initially thinks the arrow keys control media, and select key is to stop/play, then thinks that the cursor keys can be used for many different things
- shapes and sizes of keypad are good
- suggests to put volume up and down on a teeter-totter / rocker switch.

Software Experience

- pairing of up/right and down/left navigation keys to forward/back navigation functions is confusing
 - user expects to be able to navigate up and down through the items on the page as well as left and right and finds it frustrating that he can't
- lack of focus on initial page is confusing - was looking for some indication on where to start, but no cursor or hint.

Zoom

- looking at the button itself, user guesses that the zoom button would be stepped and cycle back to initial setting; pressing zoom will zoom in repeatedly and the cycle back to default.
- looking at the keys, it's not immediately clear how the zoom button will work.
- when asked to zoom in, user thinks zoom key will make the video full screen.

- also thinks the on screen graphics +/- indicated whether the zoom function will work or not.
- wonders if zoom will be a window that zooms and then you navigate using cursor keys like Google maps.
- when asked to return magnification to default, user thinks pressing "Home" will accomplish this.

Screen Reader Button

- suggested that the screen reader key icon could be a play/pause button - this would allow pausing of media and screen-reader narration
- the same toggle key could be used for play/pause as well as zoom in/zoom out
- when identifying the keys, user thought that the screen reader on/off key would provide extra dialog options
- it isn't clear what this key does
- the icon looks more like a tooltip / information note button - not for sound.