

User Experience Design Assessment 1

Concept:

I will be designing interactive information panels for museums and art galleries that will provide facts, historical context, and any related graphics/videos provided. These panels will work to replace current static panels, and allow visitors to work through each exhibit at their own pace no matter their cultural or technical background. These interfaces are large, free standing panels designed so the user can approach, interact with, and leave whenever they want to.

All screens will have clear buttons for navigation, menus, calling assistance, and a reset button that will enable easy return to the main page (with default settings). Each button will either be physical, or integrated into a touchscreen window, alongside any written information or multimedia content. There will also be a progress bar to communicate state of the system to the user.

These features will be modelled on a 'direct manipulation' system (Shneiderman, 1983)¹ and aligns with the core principles outlined in 'Interaction design : Beyond human-computer interaction' (Sharp, Rogers and Preece 2019)²; i.e.:

- '*Continuous representation of the objects and actions of interest'*
- '*Rapid reversible incremental actions with immediate feedback about the object of interest'*
- '*Physical actions and button pressing instead of issuing commands with complex syntax'*

An accessibility menu will provide options like chosen language, colour-blind mode, and spoken descriptions, to empower users via inclusive design (Rogers and Marsden, 2013)³. An embedded AI assistant will answer any queries about the exhibit or system with the help button available for human assistance, if needed.

All explicit affordances will be emphasized using ordering and high contrast colours to allow the user to shift attention between the exhibit and interface. This approach aims to modernize the visitor experience, providing immersive, educational, and accessible engagement for all visitors.

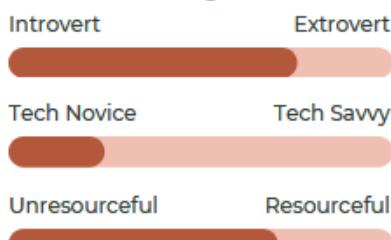
Requirements:



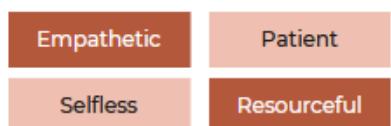
About:

Name: Diego Riley
Age: 44
Work: Carer
Family: Married With 2 children
Nationality: British
Languages: English

Personality:



Traits:



QUOTE

"Inclusivity is key for our family's quality time."

BIOGRAPHY

Diego was previously an author, but now works as a primary carer for his elderly mother after she fell blind 4 years ago. As his mother is so reliant on him, he struggles to find time for his wife and two kids aged 8 and 12.

Despite the challenges, Diego's mother is still able to navigate environments independently, which gives him some relief knowing she can manage on her own to some extent.

Diego's background as an author has instilled in him a deep appreciation for storytelling and education. He understands the value of immersive experiences that engage both the mind and the senses. However, finding such experiences that accommodate his mother's needs while also being meaningful for his children can be a challenging task.

FRUSTRATIONS

- Often finds himself torn between caring for his mother and spending quality time with his family.
- Struggles to find accessible activities that accommodate his mother's visual impairment.
- Feels he can't enjoy personal hobbies or quality time with his family due to caregiving demands

GOALS

Diego's primary goal is to provide the best possible care for his mother while also being present for his wife and children. He wants to create meaningful memories with his family and ensure that his children have enriching experiences despite the challenges they face as a family.

TASTES AND HOBBIEST



Scenario 1:

Diego is planning to visit a local museum with his mother and children on a weekend afternoon. He has chosen a museum as, when searching online, he saw that it had various accessibility options, including help with visual impairment, which would be perfect for his mother. Diego booked tickets but couldn't hire a tour guide as they were fully booked.

When they arrive at the museum, Diego asks a member of staff what accessibility options they have for his mother. The staff member tells Diego about the new interactive displays the museum has recently installed. She explains how he can enable **spoken descriptions** for his mother to have the page content read automatically, and how each display features **tactile buttons with braille** to aid her independent navigation.

Diego thanks the staff member and leads his family to the nearest display where he talks his mother through how to use the device and lets her try it for herself. The family continues to explore the exhibits, **reading through the slides and watching video demonstrations** at their own pace.

As they continue through the museum, Diego uses the navigation buttons on the interactive panels to move between different sections of the exhibit. He encourages his children to ask the **AI assistant** questions about the items, and they take turns interacting with the panel to learn more about the cultural significance and historical context behind each piece. At one point, Diego's mother expresses interest in a particular painting but struggles to hear the audio description due to ambient noise in the museum. Diego quickly locates the **volume control** form within the **clearly labelled accessibility menu** and adjusts it to a higher level, ensuring that his mother can hear the description clearly.

After exploring a bit together, they realise they only have time to visit one more area. Diego's mum wants to go the ocean life exhibit while his children want to see the dinosaurs in the prehistoric area. Diego's mum says that she feels confident enough to go explore the exhibit on her own, and that she can always press the **help button** on the display if she needs help. Diego thinks about this for a second, but says that if she feels comfortable going by herself, they can all meet up by the exit when they're done. She agrees, and they each go to the respective areas of the museum.

As they explore their respective exhibits, Diego feels relieved that he can focus on spending quality time on his children without distraction. They take photos and discuss their favourite discoveries, eagerly anticipating their reunion at the museum's exit.

When they finish their exhibit, they head to the exit where they wait for a little while before Diego's mother appears. When asked about her experience exploring on her own, she expresses happiness at regaining her independence and allowing Diego to spend quality time with his children.

As they leave the museum, Diego's children eagerly discuss their favourite parts of the visit, already planning their next museum adventure. Diego smiles, feeling a sense of satisfaction knowing that they've created lasting memories as a family.



About:

Name: Sophia Chen
Age: 27
Work: Museum Educator
Family: Lives with partner
Nationality: British
Languages: English, Chinese

Personality:



Traits:



QUOTE

"Let's create unforgettable experiences for everyone."

BIOGRAPHY

Sophia Chen's passion for art and education has been a guiding force throughout her life. Growing up in a culturally rich environment, Sophia developed a deep appreciation for the arts from a young age.

Before joining the museum staff, Sophia worked as an educator in various community arts programs, where she honed her skills in engaging diverse audiences and fostering a love for art in people of all ages. Her experience working with children, seniors, and individuals with disabilities has shaped her approach to accessibility and inclusivity in museum education.

FRUSTRATIONS

- Establishing new exhibitions requires considerable time and effort.
- Developing standardized tour plans accessible to all staff members presents a challenge in maintaining consistency.
- A large portion of the museum budget is being spent on signage for temporary exhibits.

GOALS

Sophia prioritizes her own professional development by seeking out opportunities for training, networking, and skill-building in order to provide the best possible museum experience for visitors. She understands that by continuously evolving and adapting to new technologies, she can help ensure that the museum can provide the best possible experience for everyone.

TASTES AND HOBBIESTS



Scenario 2:

Sophia has been tasked with setting up the new interactive displays for one of the museum's exhibits. She has been given a USB stick containing the information slides she needs to **upload onto each display**, as well as any **videos and voiceovers for spoken descriptions**.

Sophia takes the USB stick and approaches one of the displays. She inserts it into the **USB port** located under the device and presses on the **settings button** situated on the touch screen display. From there, she selects '**change content**' and enters the **password** provided by the museum. The screen illuminates with a file selection screen, displaying the data stored on the inserted USB stick. She selects the correct file and confirms her selection. The screen flashes a loading bar before returning to the first slide of the exhibit. She briefly uses the **navigation buttons** to advance the slideshow and check that all the pages are present and that any videos and graphics load. She also verifies that both the **spoken descriptions** are correct and that the **language settings** display correctly.

Before Sophia leaves, she removes the USB and presses the central '**home button**' to return the display to the first slide with default language and accessibility settings. She continues to repeat these steps for the rest of the information panels in the exhibit, ensuring each one displays the correct information.

As the day progresses and the museum opens, Sophia walks around the exhibits speaking and helping any visitors with questions about the exhibits or the systems. She occasionally receives a **notification from her tablet** indicating that someone in her area has requested help from one of the interfaces. When this happens, she approaches the people at the display to assist them with their query. Before she leaves, she ensures to turn off the help button so that it won't be **highlighted on her tablet display**.

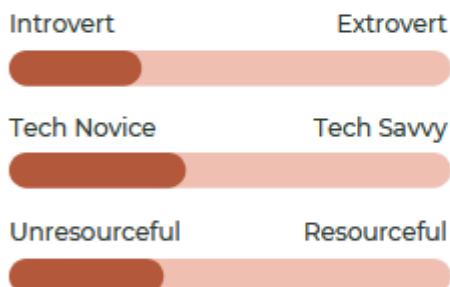
After the day is over and the museum closes, she walks around **switching off** each information panel before the cleaners wipe them down. She leaves the museum feeling satisfied by the amount of people she saw enjoying the experience she created for them.



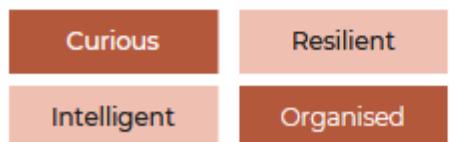
About:

Name: Anish Kumar
Age: 61
Work: Retired
Family: Lives with wife
Nationality: Indian
Languages: Punjabi, Hindi, Urdu

Personality:



Traits:



QUOTE

"Exploring culture is like embarking on a journey without end."

BIOGRAPHY

Anish Kumar recently retired from a successful career in banking, where he worked diligently to provide for his family and secure their future.

With his children now grown and living independently, Anish finds himself eager to embark on a new chapter in life. Inspired by his love of history and culture, Anish has decided to pursue his lifelong dream of learning English and exploring the rich culture of European countries.

Anish has chosen to travel to England in order to get a better grasp of the language as well as explore the arts and heritage.

FRUSTRATIONS

- Very difficult to appreciate exhibits due to some of the language used being quite advanced.
- Feeling self-conscious when asking questions, especially during a tour, due to his poor English.
- Feeling rushed through popular exhibits as he struggles to read signs before the crowd moves him along.

GOALS

Anish's primary goal is to become proficient in English, allowing him to communicate effectively and confidently in his travels and interactions with people in many countries. He also hopes to deepen his understanding of different cultures and histories, enriching his retirement with meaningful experiences and connections.

TASTES AND HOBBIES



Requirements:

Functional Requirements:

- **Physical Interface:**
 - Physical navigation buttons for progressing through the information screens.
 - Touch screen interface.
 - A clearly marked help button for requesting a staff member.
 - A clearly marked help button to reset the state of the system.
- **Information Screen:**
 - A screen showing Written information about the exhibit.
 - Able to display text, pictures, and videos.
 - Touchscreen icons for opening the accessibility and language menus and AI assistant sidebar.
- **Accessibility Menu**
 - Options for colour-blind/high-contrast mode, spoken descriptions (and volume control).
- **Language Menu**
 - Allow the user to change the system language from a range of options (*for use by people such as Anish*)
- **AI Assistant Sidebar**
 - Accept and answer queries from the user about the exhibit and system (*allows users to explore the subject deeper than a static panel would allow. Perfect for cases such as Diego's children*)
 - Only replies with responses relevant to the exhibit and the question.
- **Settings Menu:**
 - Only accessible to staff after inputting a password (*for use by museum staff such as Sophia*)
 - Options to view system version, upload new exhibit slides, videos, and spoken descriptions, and power off the system.

User Characteristics:

The device's user base will be a diverse selection from many backgrounds, each with unique abilities, preference, cultural and educational backgrounds (*e.g. Anish*). Additionally, the system must accommodate for all impairments and disabilities (*e.g. Diego's mother*).

Usability Requirements:

The system must be **easy to use** with **very high learnability**. Since most visitors typically only visit a museum once, the **memorability of the interface is not a top priority**. However, this is not a concern given the simplicity of the design.

This is especially important in cases such as Diego's mother where she must be able to navigate the system independently without sight.

User Experience Requirements:

- **Physical Interface:**
 - Include a help button that users can press to call a staff member for assistance if they prefer human interaction or if the AI assistant cannot address their query.
 - Physical navigation buttons have braille lettering to make the system accessible to those with vision impairments. (*such as Diego's mum*)
 - Include a 'reset to start' button that sends the user back to the first page with default settings. This could also happen if the system is left untouched for a period of time.
 - Braille lettering and markings around the touchscreen to indicate the location of accessibility features.
 - Distinct 'beep' when accessibility menu opened or feature toggled.
- **Information Screen:**
 - A Progress bar to give visual feedback for interactions and provide a clear representation of the current state of the system.
 - All explicit affordances will be emphasized using unique colours and symbols to allow the user to shift attention between the exhibit and interface without additional effort of recalling the system.
 - Ensure the language menu, accessibility menu, AI assistant, and help buttons are clearly visible and accessible from any screen within the interface.
 - Video content is displayed with subtitles and closed captions to make the system more accessible to those with hearing impairments.
- **Accessibility Menu:**
 - Ensure that the accessibility menu is easy to access and use for all visitors, regardless of their abilities.
- **Language Menu:**
 - Clear icons representing each available language (Flags) as well as its name written in the respective language.
- **AI Assistant Sidebar:**
 - Assistant only responds with information relevant to the exhibit or system.
 - Allow the user to input their queries with ease
 - Always maintain a polite and respectful tone

Data Requirements:

Type: Written information about each exhibit.

Accuracy: High Accuracy. Cannot display incorrect information about an exhibit (especially for the AI assistant).

Amount: Depends on exhibit size. Most likely reasonably small, as to not overwhelm the visitor.

Persistence: Very long term as historical facts do not tend to change.

Environmental Requirements:

Physical Environment:

- Indoor use in public space.
- Does not need to be weather resistant.
- Must be rugged as to withstand frequent physical contact from adults and children.
- Must be both dust and splashproof to protect the electrical components and allow for easier cleaning.

Social Environment:

- Shared space among visitors (and possible sharing of displays during busy times or tours)
- No privacy requirements as all interfaces display the same information.
- Security requirements are required to protect against unauthorised access or tampering with the system.

Organizational Environment:

- Support for system readily available with very quick response times.
- Majority inexperienced first time users with members of staff needing basic training.

Technical Environment:

- Connection to local network required to alert staff to requests from user.
- Run on embedded hardware.
- Very low required specifications as the system is not very demanding.

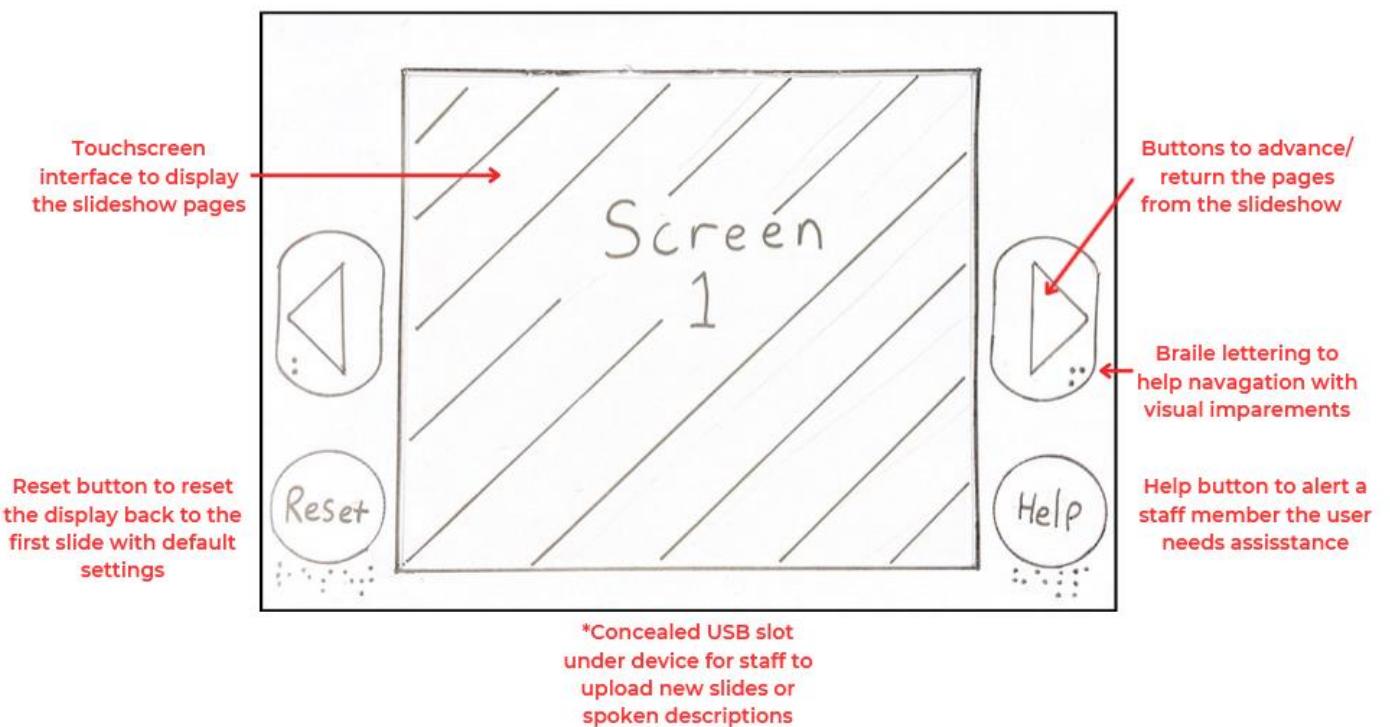
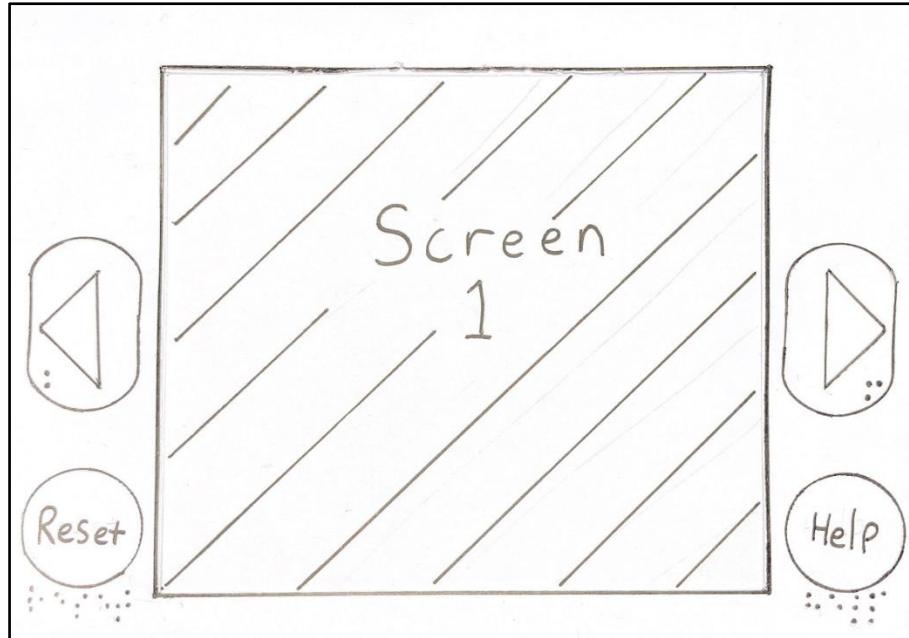
Lo-Fi Prototypes and Storyboards:

For my initial prototype, I chose to create lo-fi mock-ups for various page types and interactive menus. The elements I chose to prototype include:

- Physical Interface
- Main Information Screen
- Video Player
- AI Sidebar
- Accessibility Menu
- Language Menu
- Locked Settings Menu
- Unlocked Settings Menu

After creating many sketches for each design iteration, I arrived at a collection of designs that I was happy to trial. These designs are annotated below:

Physical Interface



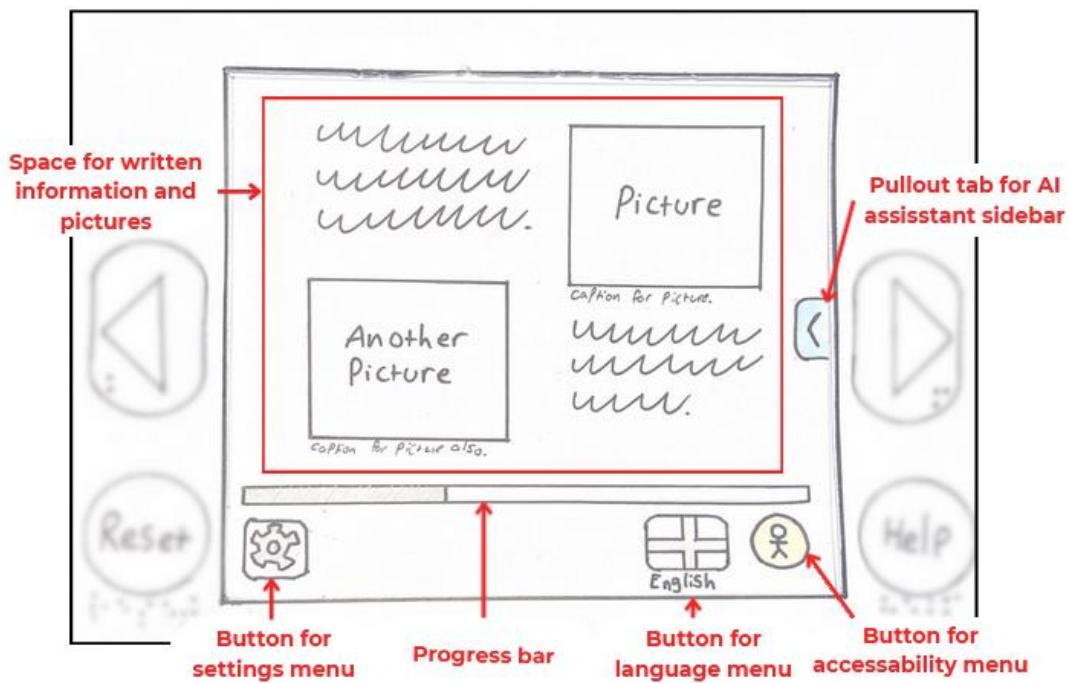
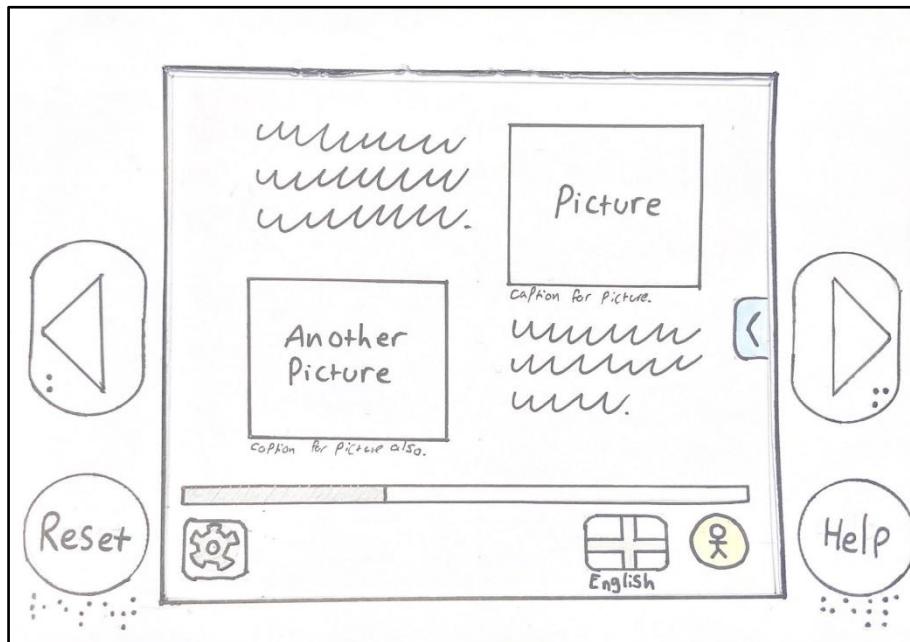
The physical interface is a very important part of the design as it handles all interactions between the system and user. For this reason, I decided to make it a paper border so I could get a better idea of the system's appearance while the user is interacting with it.

This design meets all the functional requirements of the system. The buttons are obvious in their functionality with a minimal design which satisfies the usability requirements. The help button produces a distinct beeping noise to alert the user that help has been called.

Concealing the USB slot was a deliberate choice, positioned discreetly under the device to be found only when necessary. This approach discourages tampering from the public, but ensures easy accessibility for users who are aware of its location while maintaining an uncluttered interface.

The all physical buttons are tactile to provide assurance to the user that the button was pressed.

Information Screen

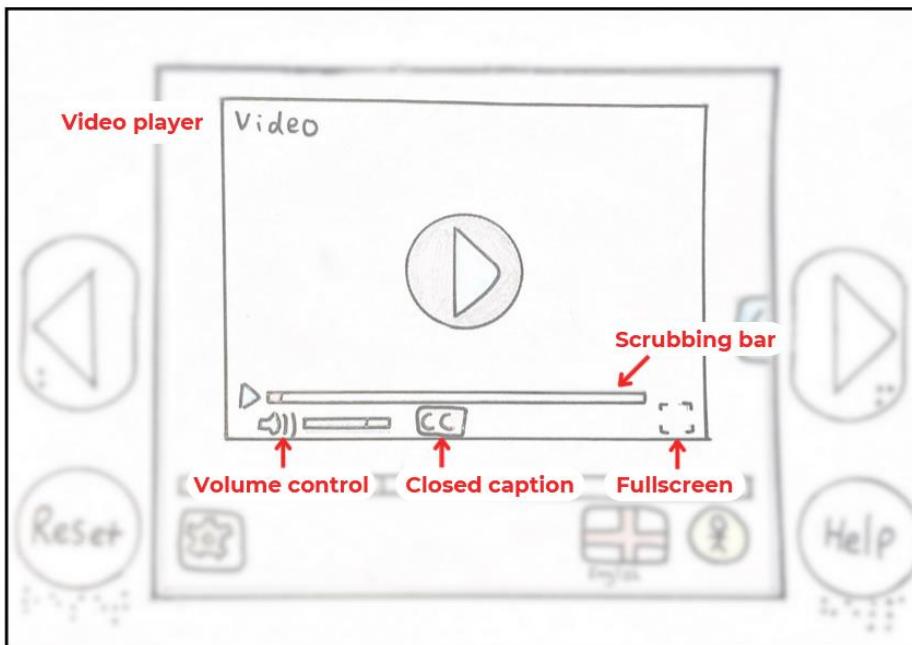
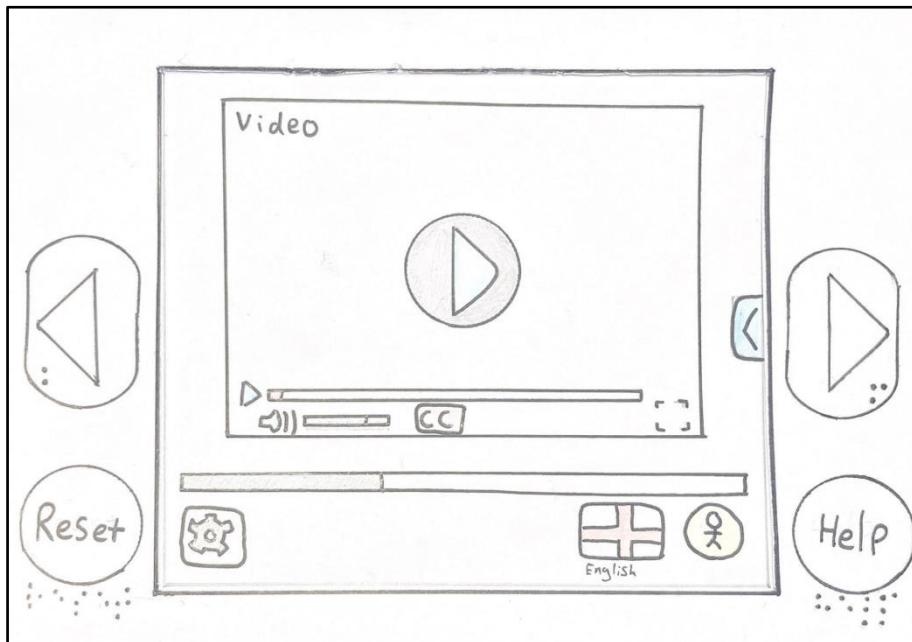


The information screen is the primary interface the user will see while interacting with the system, so the design must not contain any information that is irrelevant or rarely needed, and must have a minimal and uncluttered aesthetic with the important affordances obvious only when needed; as mentioned by Sharp, Rogers and Preece (2019)⁴. For this reason, I chose to use non-intrusive yet distinctive colours and shapes in the design of the buttons (*the colours are a lot more vivid in person).

The layout of the icons on the screen play a vital role in the usability of the system as there needs to be one for each possible action the user can perform, while not bombarding the user with too many options. I chose to group the buttons by physical characteristics and functionality (Principle of similarity) and use common, well understood symbols. This approach helps to computationally offload the user and allow them to process the available information more efficiently, therefore enhancing user experience. These buttons are visible no matter the state of the system as to reduce the user's memory load.

The progress bar is used to clearly display the system status; one of the user experience requirements of the system.

Video Player



The video player is very similar to the information screen, but it is tailored for multimedia content. It features an embedded video player to showcase educational graphics or exhibit-related demonstrations.

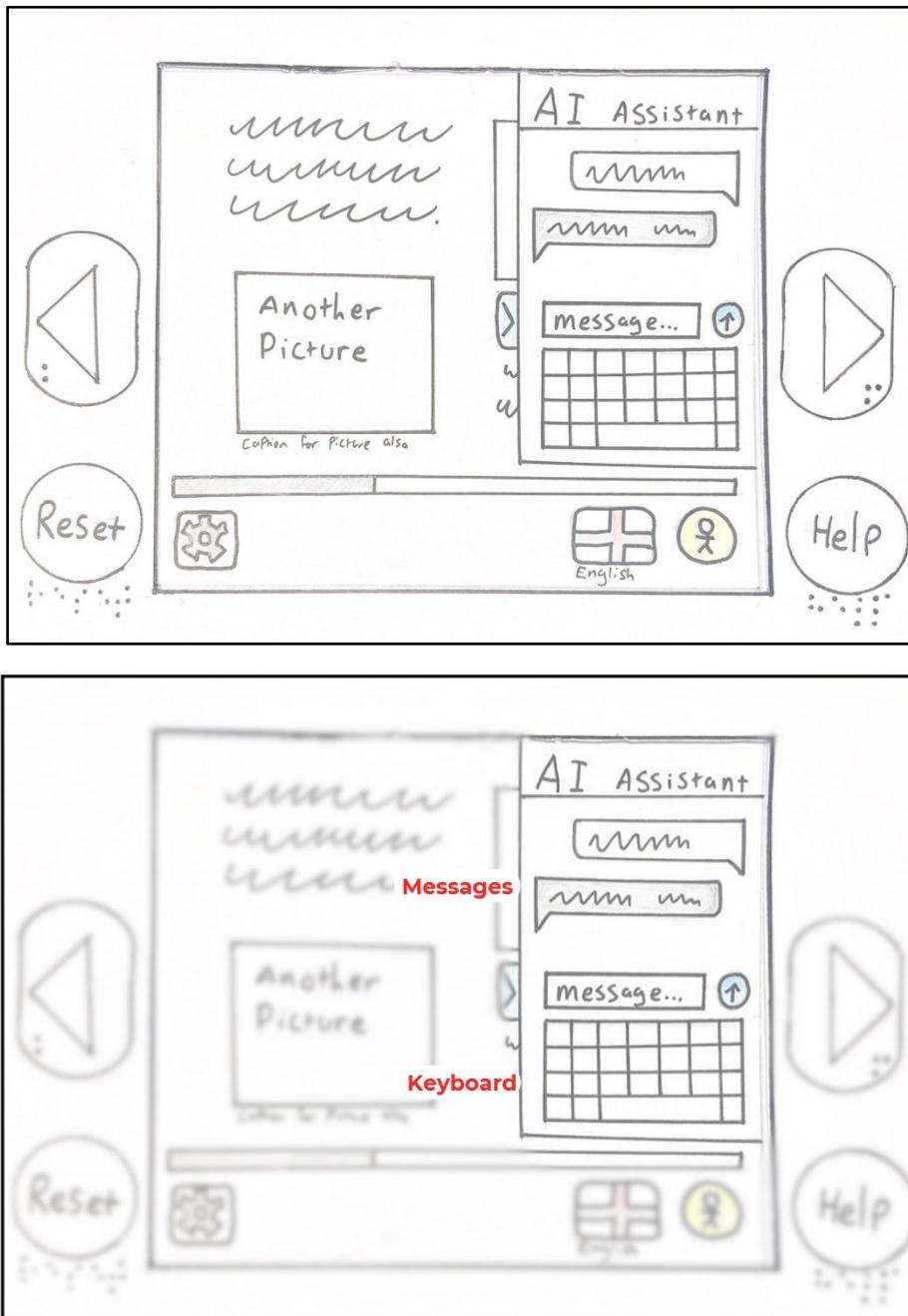
Key components of the video player include a pause/play button, scrubbing bar for navigation, adjustable volume slider, and buttons for closed captions and full screen mode.

Additionally, users can easily mute the video by pressing the speaker icon on the volume control. The closed captions button functions similarly to the one in the accessibility menu, providing subtitles and closed captions to aid users with hearing difficulties in understanding the video's context.

The video player design maintains consistency with the overall system aesthetic, adhering to a minimalistic approach with grouped icons for improved recognition.

Centralizing all relevant features within the same screen location encourages user interaction and facilitates learning. Featuring cliches from common interfaces help create a match between the system and real world which helps recognition.

AI Assistant Sidebar



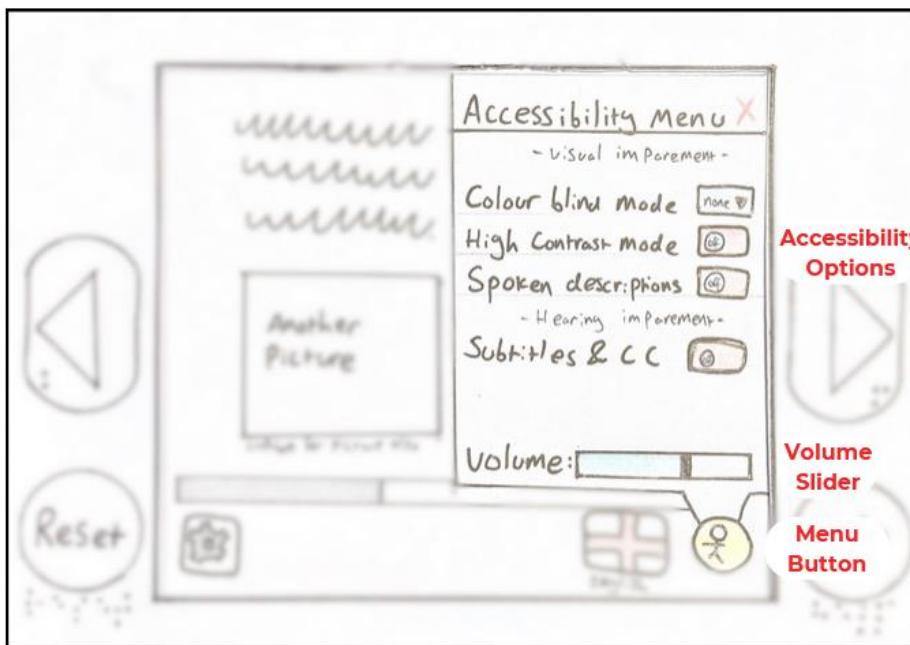
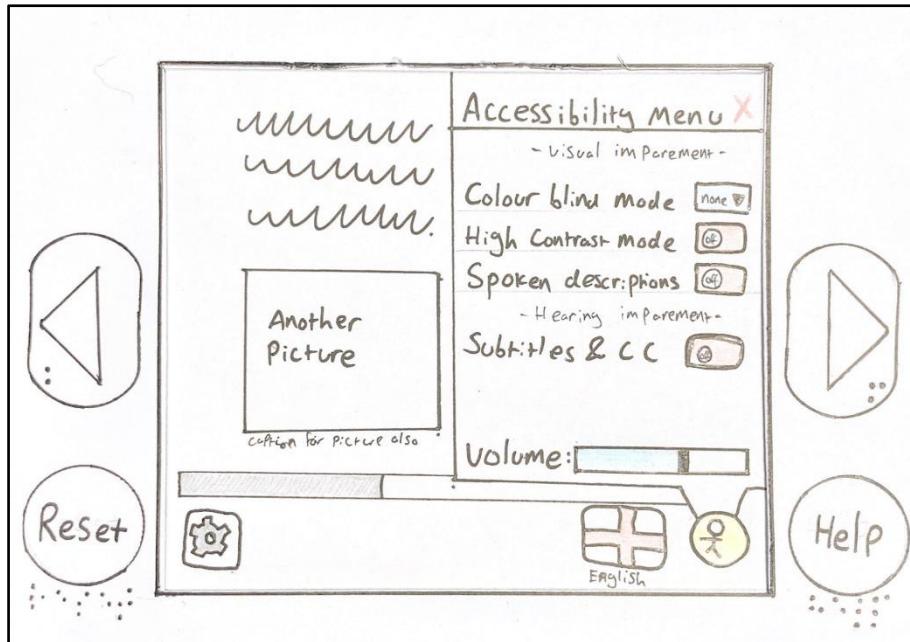
The AI Assistant sidebar features a simple and intuitive interface, similar to most instant messaging apps. Upon pressing the tab located on the right side of the screen, the sidebar slides out, revealing components such as a keyboard, message bar, send button, and a history of previous interactions.

The user will use the keyboard to input inquiries about the exhibit or system, and the AI will respond with an appropriate response. The AI will only respond to queries relevant to the museum and politely decline to answer otherwise. The AI will answer with a polite and respectful tone to ensure a positive user experience.

The sidebar's design aims to be as inviting to encourage user engagement and curiosity about the exhibit. I have tried to do this by making the keyboard a prominent feature and displaying previously asked questions from other users to make the user curious about the exhibit.

According to the data requirements the AI needs to respond with high accuracy as to not display the wrong information about an exhibit. The AI's response must also not be too long as to not overwhelm the user with too much information.

Accessibility Menu



The accessibility menu opens as a popup after the user presses on the bright accessibility symbol in the bottom right of the screen. This button is grouped with the physical help and language menu buttons to allow the user to easily distinguish where to look when they need help.

The menu contains several options that can be switched on and off by pressing the clearly marked switches, which immediately update the display accordingly and provide feedback for the user to interpret and act upon.

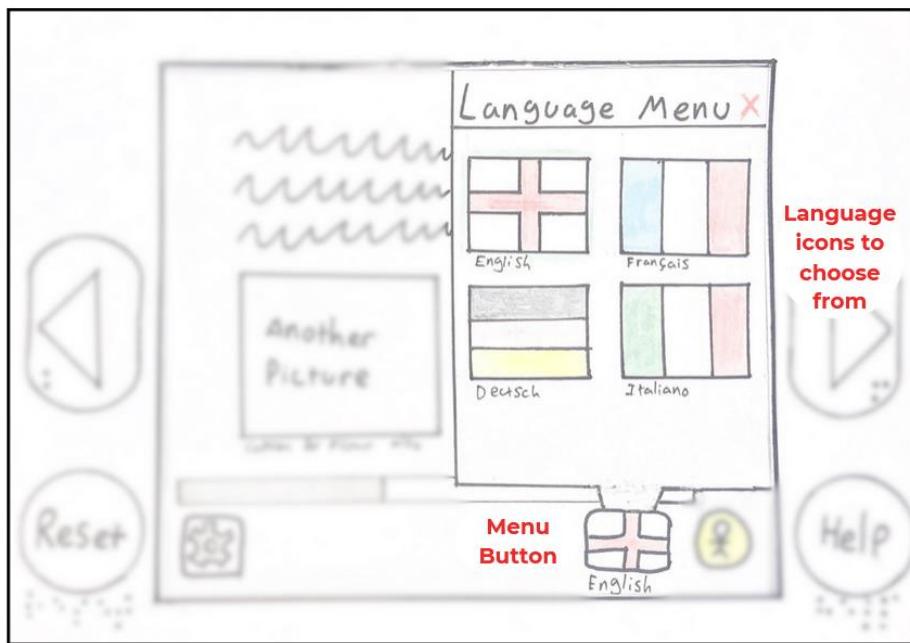
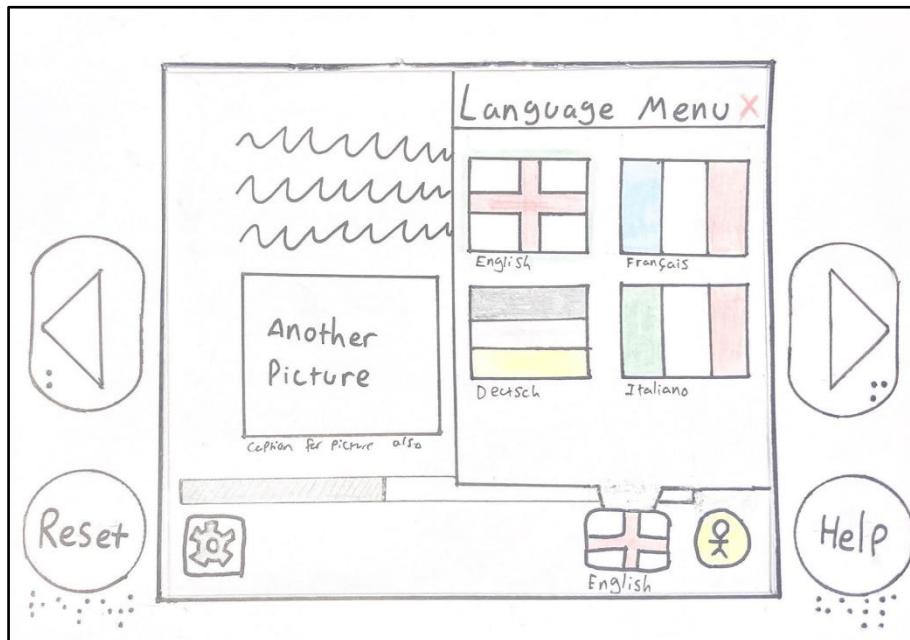
The spoken descriptions switch says aloud 'spoken descriptions enabled/disabled' when toggled on/off respectively.

The colour blind mode settings features a drop down menu where the user can select a filter depending on the type of colour blindness they have.

The Volume slider changes the volume of the Spoken descriptions and system sounds (e.g. beeping noise).

To close the menu, the user can either press on the button again, the red 'X', or anywhere else on the screen. This interface enhances user experience with seamless interaction.

Language Menu

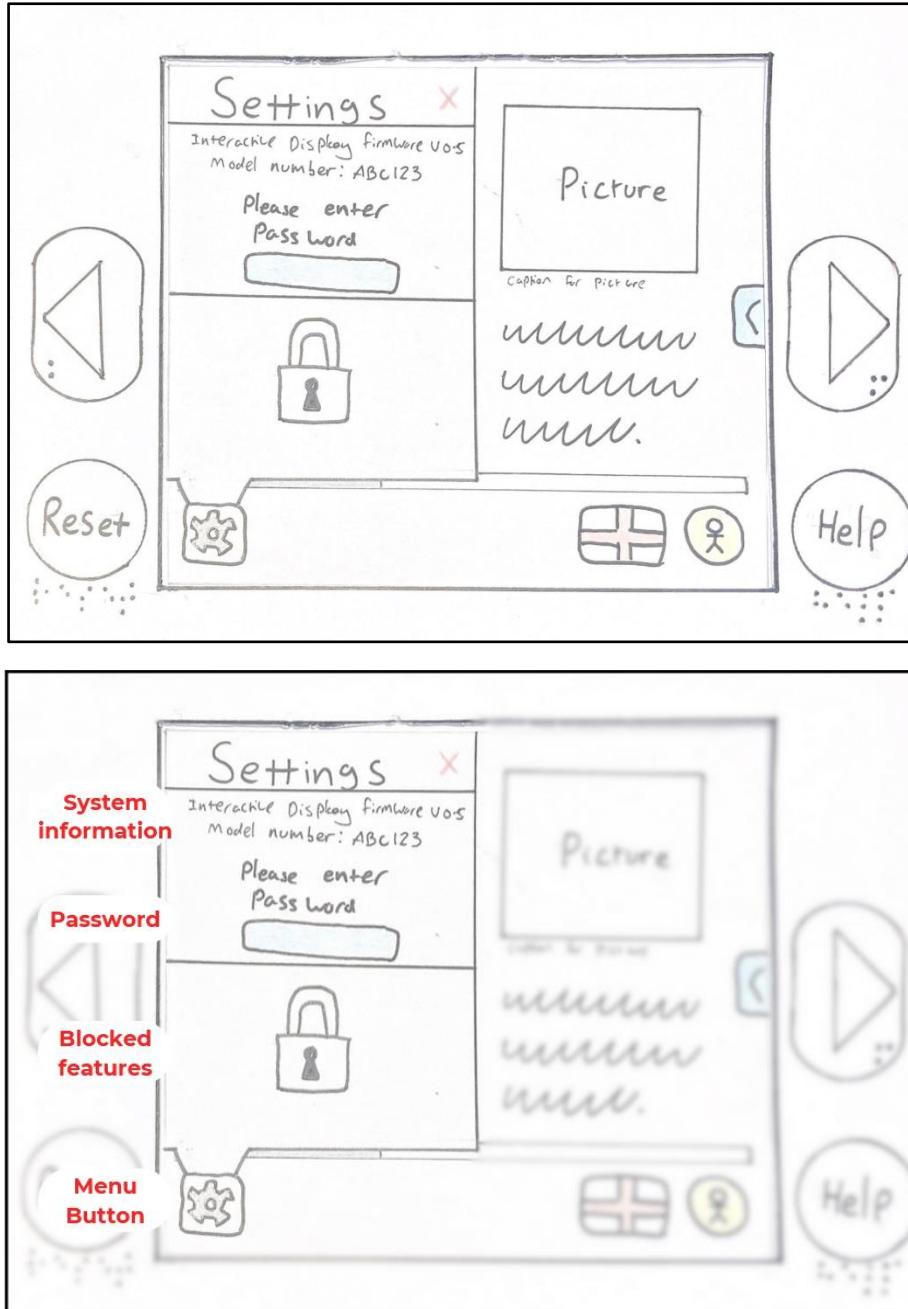


The language menu enables users to customize the system's default language to one of the supported options provided by the museum or gallery. These language choices are flexible and dependent on the language options included with the slideshow files uploaded by the museum. Additionally, auto-generated translations will be available for commonly spoken regional languages, ensuring broader accessibility and usability.

The Design for the language menu is very human centred by using easy to recognise symbols (flags) to help with recognition. The flags have the name of the language written underneath it and will have a green outline when selected to ensure that there is no confusion while using the system. After selecting the desired language, the system will update with the new language immediately providing positive feedback to the user. The

Similarly to the accessibility menu, the user can either press on the button again, the red 'x', or anywhere else on the screen.

Locked Settings Menu



The locked settings menu appears as a popup like the other menus in this system. The popup appears when the user presses on the cog button, which is a widely recognised metaphor for settings. The popup contains system information such as the model number and firmware version as well as a text box for inputting a password.

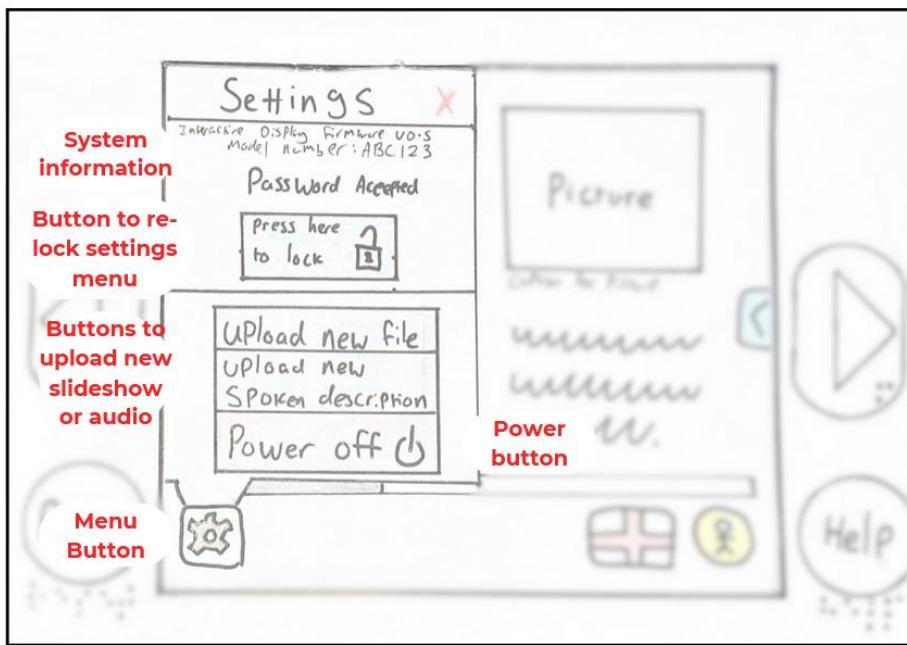
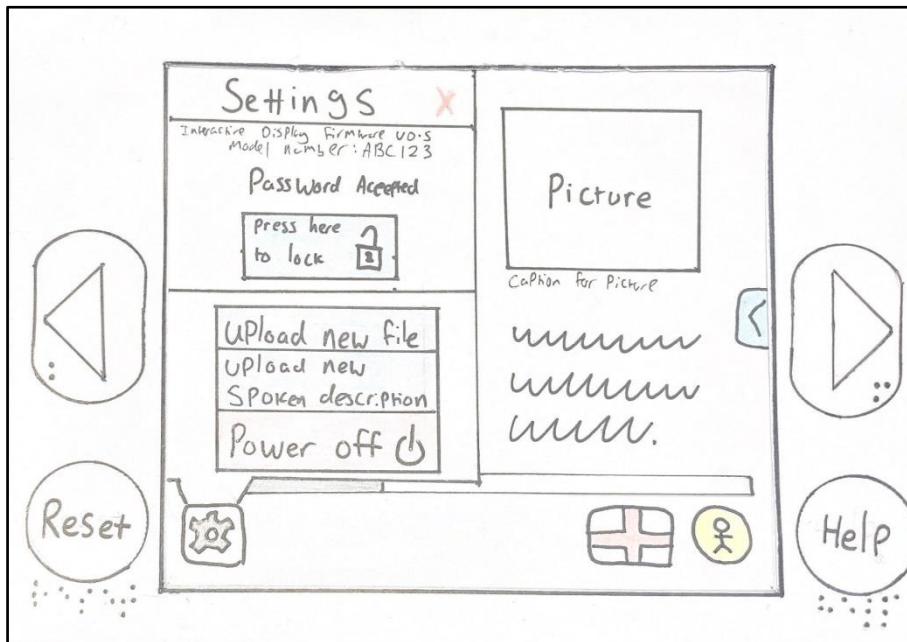
The settings button is positioned by itself in the left corner of the screen separated from the other menus the user can access. It also features lighter, less noticeable colours. This is done deliberately as to discourage the user from interacting with it, but to still be visible to anyone looking for it.

The password can be input via a concealed onscreen keyboard that only becomes visible after the user presses on the lock icon. This approach relies on the principle of closure, where an inexperienced user would believe the system to be complete and that they couldn't input a password, to discourage the user from interacting with this feature.

If the user inputs an incorrect password, red text will appear alerting the user that unauthorised access is not allowed. This negative feedback and refusal is to discourage users using parts of the system that they shouldn't.

If a correct password is provided, the unlocked settings menu will be displayed instead of the locked one. If the user is unable to provide a password, they can close the menu in the same way as the others.

Unlocked Settings Menu



The unlocked settings menu only gets shown after the user successfully inputs a password in the locked settings menu. From this menu you can upload new slideshow and spoken description files. After a file has been selected, a loading bar will appear in the centre of the screen to provide a visual indication of how much longer before the system will be updated with the new file.

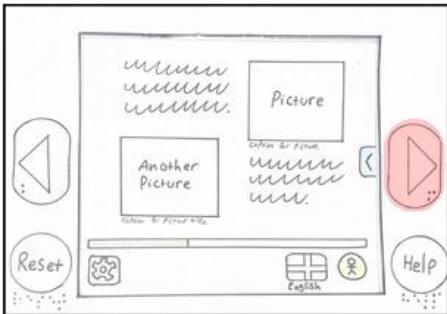
Once the user has uploaded new files, they can either lock the settings menu so that is requires a password to access once more, or power off the system.

If an invalid file is selected, the system will alert the user that the file could not be loaded and to select an appropriate file.

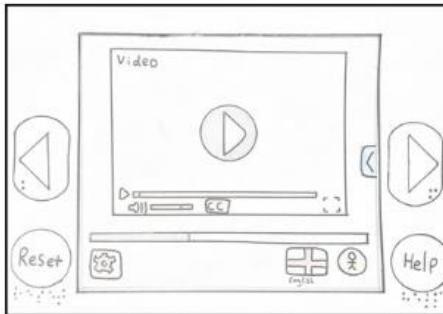
Once the correct password has been entered, the user has 5 minutes before the password is required again. This conforms to the security requirements outlined in the environmental requirements section.

Storyboards

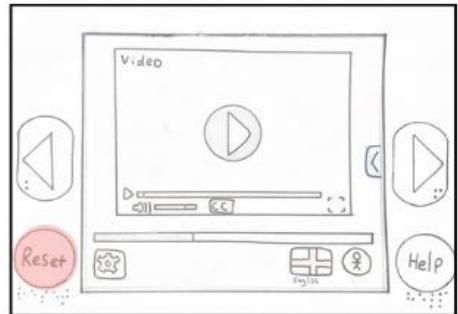
User interacting with the system interface:



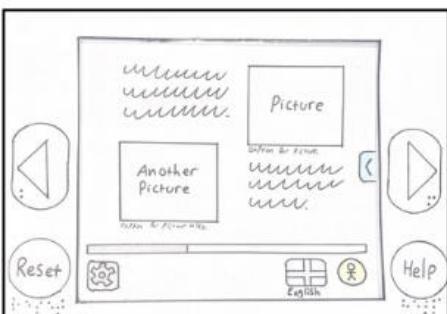
The display is on the first page of the exhibit. The user presses on the right arrow button.



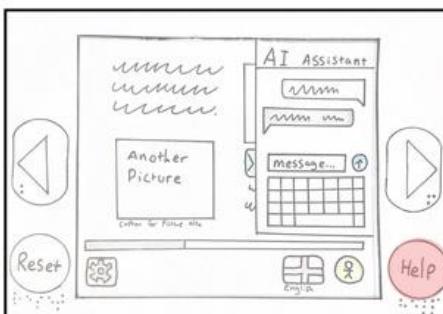
The interface advances to the second page of the exhibit.



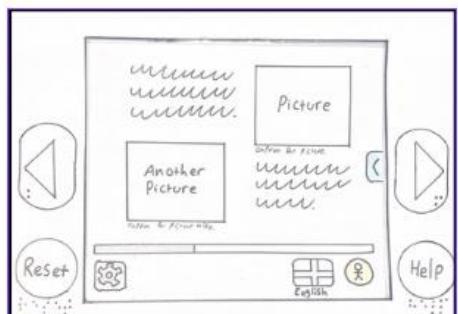
The user presses the 'reset' button.



The interface resets back to the first slide in the slideshow with default settings.



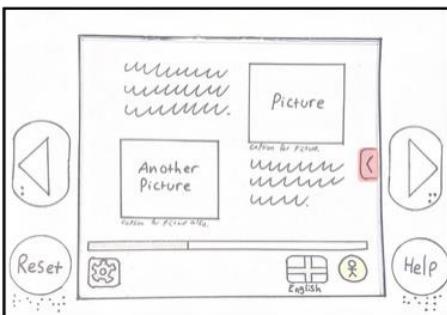
The user accidentally opens the AI sidebar and doesn't know how to close it, so presses the 'help' button for assistance



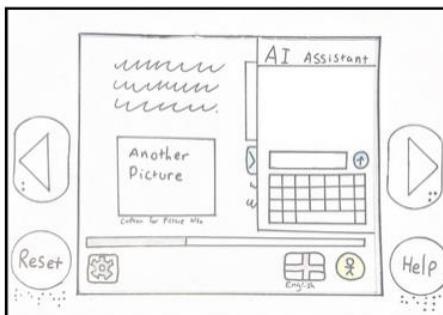
A member of staff was alerted that the user needed help and approached them to help with their problem.

This storyboard shows a scenario a user might find themselves in when first learning the system interface. It demonstrates how the physical interface can be used to navigate the system and gives an example of how the help button might be used.

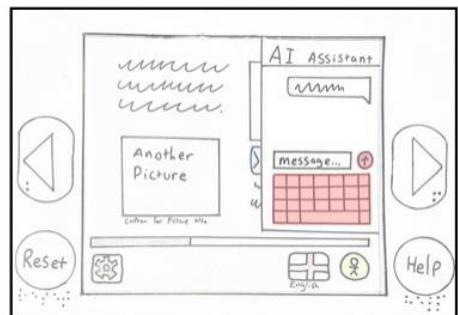
User tests AI assistant



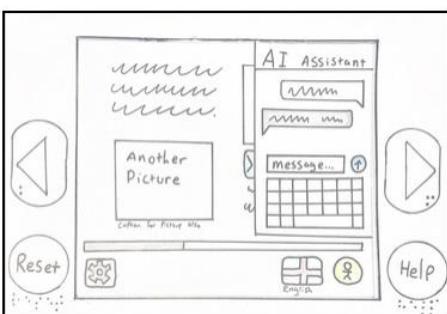
The user has a question, so decides to try out the AI assistant by tapping the tab to access the menu.



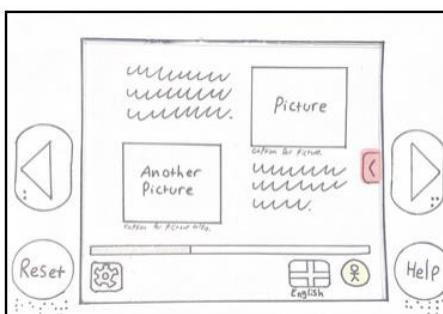
Inside the tab, there's a keyboard, a text bar, and a history of past messages from both the user and the AI.



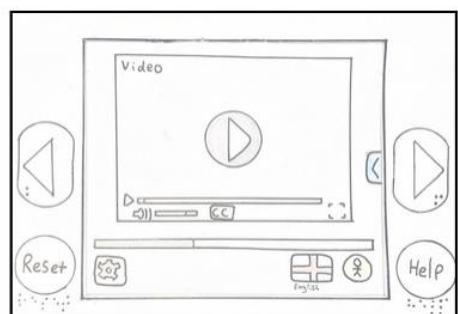
The user inputs their question via the keyboard and then taps the send button next to the text bar.



The AI acknowledges the message and provides a relevant response relevant to the user's question.



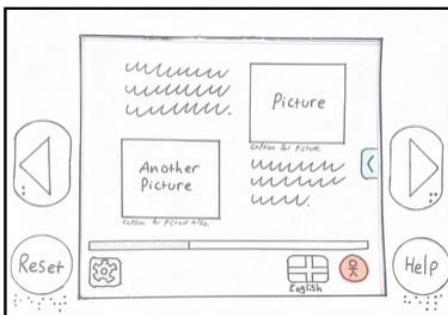
The user is satisfied with the response and presses the tab to close the sidebar.



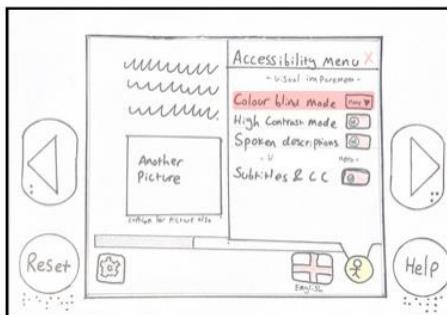
The sidebar closes and the user is able to carry on with the slideshow.

In this storyboard, a user tries the AI assistant to enhance their experience.

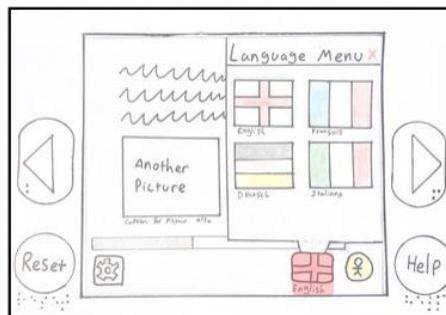
Colourblind user changes accessibility and language settings:



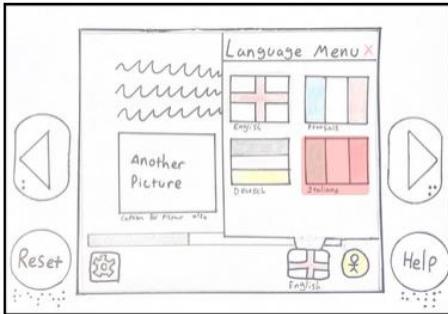
Struggling to read the text due to colorblindness, the user opens the accessibility menu to view their available options.



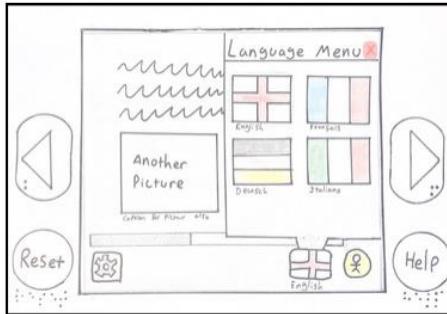
The user finds the colorblind selector and chooses the mode relevant to their condition.



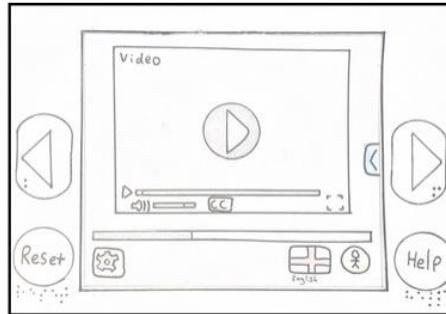
The user thinks the experience might be more enjoyable in their native language, so they open the language menu by pressing on the flag icon at the bottom of the screen



The user chooses their language from the available options by tapping on the relevant icon.



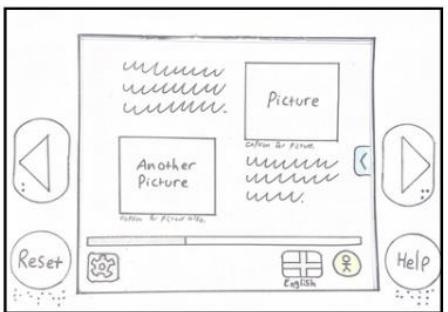
The user closes the menu by tapping on the X in the top corner of the window.



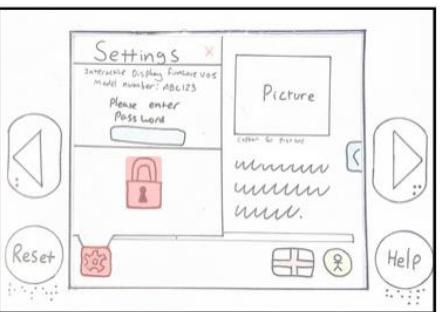
Satisfied, the user can continue with the slideshow using their selected options.

This storyboard shows how quickly a user can set up the system to accommodate their needs.

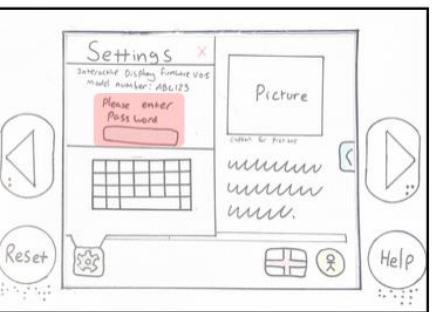
Staff member uploads new slideshow file:



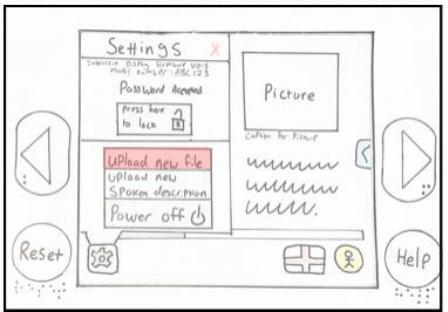
A staff member has been tasked with updating the displays with the appropriate slideshow for the upcoming exhibit. They have been given a USB containing the new slideshow.



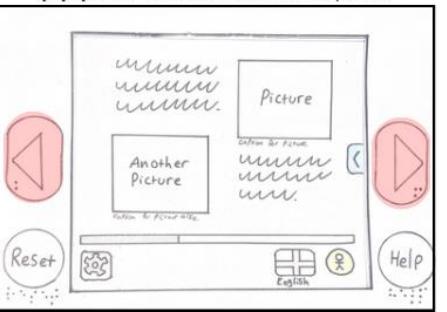
They open the settings menu by pressing on the button in the bottom left of the screen and then the lock icon in the popup menu to reveal the on-screen keyboard.



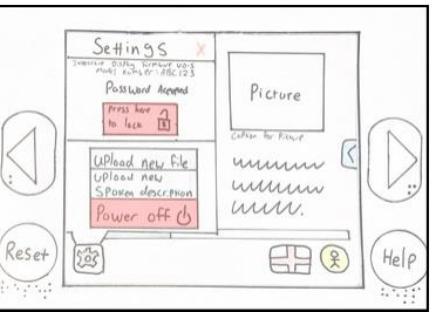
They tap the password field and use the on-screen keyboard to input the password provided by the museum.



Once the correct password is entered, the staff member can proceed to press the "upload new file" button and select the appropriate file from the inserted USB drive.



Once the file is selected, the staff member can verify that the upload is successful and ensure that the file is displaying correctly by scrolling through the slides.



If they are satisfied, they can either press the lock button to restrict access to the settings menu or power down the system.

This storyboard shows a scenario where a museum staff member uses the settings menu to upload a new slideshow file onto the machine. This shows how the system has good efficiency of use.

Requirements Check:

I believe that my prototype satisfies all current requirements very well, although during its creation there were a few features that I thought could be added in the next design iteration. Some of these extra requirements include:

- System could feature more braille lettering to help locate touchscreen elements
- The settings menu could include display options (contrast, brightness, etc.)
- Each device could have a unique ID
- Use of the AI assistant should be encouraged more

On the other hand, I feel that the system incorporates features beyond the initially defined requirements. Examples of this include using information hiding to make the settings menu more abstract and deter users or creating a safer system by requiring a password after more than 5 minutes with the settings menu open.

Evaluation and iterative design:

Heuristic Evaluation

Visibility of System Status:

All points of interaction between the user and the system provide immediate feedback. This includes the tactile click from physical buttons, audible cues from accessibility menu elements, or a visual indication such as a popup opening. This continuous communication works to enhance the user experience by confirming actions and ensuring users are aware of their interactions with the system.

The progress bar clearly displays the system status and allows the user to get an idea for how close they are to their goal (viewing the whole exhibit)

All explicit affordances have been emphasized using ordering and high contrast colours to make them immediately available when needed by the user. Affordances are also chunked together by characteristics and functionality (Principle of similarity) to improve the ease of learning and help with information processing.

Match Between the System and the Real World:

The system matches well to the real world due to how customizable it is. This includes options for the user to change the system language, enable colour blind filters, toggle subtitles, etc. The system icons also match common tropes and metaphors. This approach helps to computationally offload the user and allow them to process the available information more efficiently.

With the buttons being clear in their functionality, the system naturally has very good mapping between the user's mental model and system image.

User Control and Freedom:

As the system aims to model a direct manipulation system as closely as possible (Shneiderman, 1983)¹, users have a great degree of control over its behaviour. Throughout the design process, I've remained mindful of the core principles outlined in 'Interaction Design: Beyond Human-Computer Interaction' (Sharp, Rogers, and Preece, 2019). Here are some elements that demonstrate this approach:

- Immediate feedback for all affordances.
- All menus have a clearly marked 'close' button and can also be closed by tapping outside the menu.
- All affordances are represented via clearly buttons, sliders, switches, etc.
- Changes easily reverted in one action

I chose not to include an undo/redo button, as it would only work to complicate the user interface and decrease the learnability of the system. The design's straightforwardness and good mapping also allow for the user to easily revert any accidental changes without additional complexity; especially with the addition of a system reset button.

Consistency and Standards:

I believe that this system maintains consistency not only in its design, but also to conventions seen in similar systems. This is done through use of common symbols (e.g. Accessibility, settings, flags, arrows, etc.) and actions (typing on keyboard, toggling switches, dragging sliders, etc.) which provide the user with a sense of familiarity and reduce cognitive load. This is very important due to '*Jakob's law*'⁵ which states that user will spend most of their time using digital products other than yours.

Error Prevention:

This system is simple and low risk enough where there doesn't need to be much error prevention. I believe that, in most cases, presenting confirmation requests would only disrupt the user's thought process and cause frustration.

The only mistake I could think of is a staff member leaving the system unlocked, which is handled in most cases by the automatic system lock after 5 minutes.

Any slips (e.g. accidentally opening a menu, changing system language, advancing the slideshow) are easily reversible within one action, and it would be more hassle for the user to confirm each action than to resolve each slip.

Recognition Rather Than Recall:

The system relies almost fully on recognition for the user to discern functionality from the interface. This is due to the use of common metaphors used to represent actions. An example of this is when using the language menu and all options are expressed using a flag (standard symbol) and the name of the language (removes the need to recall where the flag represents).

Another example of how this criterion is met is how all system popups avoid concealing the menu buttons at the bottom of the screen, therefore keeping menu buttons visible and easily accessible. However, there's room for improvement by not concealing the AI sidebar while menus are open; but this is not critical as users typically close menus after use.

The only time recall is favoured over recognition is when navigating the settings menu, as it is reserved for experienced users of the system only and actively discourages unauthorised users from using it.

Flexibility and Efficiency of Use:

The system intentionally enables users to customize their experience through the accessibility and language menus. This enhances user satisfaction, as it allows them to tailor the system to their preferences and needs.

The touchscreen interface does not allow gestures such as swiping or pinching, as these could very easily be done by mistake especially with children using the system.

The interface also does not allow for any shortcuts as the system is simple and intuitive enough to navigate efficiently without them.

Aesthetic and Minimalist Design:

I think this system has a very consistent minimalist design due to the positioning and colour scheme. The menu buttons are positioned around the outside of the touchscreen out of the way of where the user's eyes would be looking. This takes advantage of the figure ground principle where the written information and videos dominate the user's focus as they are central to the page. This could be further improved in future models by **making UI buttons smaller and less intrusive** on the page contents.

The primary colours of the physical system and menus will be a shade of grey which will not distract or confuse the user while navigating the interface.

Help Users Recognize, Diagnose, and Recover from Errors:

The system will display an error message when the user selects an invalid file from the settings menu, prompting them to choose an appropriate file. Additionally, if the user inputs an incorrect password into the settings menu, a message will tell them their password is incorrect and to contact the system administrator if forgotten.

In most cases, the system does not provide error messages, as its primary goal is to provide information and assistance without dealing with actions complex enough to cause errors.

Help and Documentation:

The interface does not provide any documentation as it is still only being prototyped. This is due to change in future iterations of the system.

The system provides help to the user via the AI assistant and the physical help button can be pressed if the user cannot resolve the issue on their own.

Feedback:

When gathering feedback for this prototype, I asked 5 people of various ages and technical backgrounds. I first gave them some background knowledge on the system (e.g. Concept, physical interface, concealed keyboard in settings) and then tasked them with completing various actions using the prototype. These actions are as follows:

- 1) How would you go about advancing through the slideshow?
 - a) How would you go back to a previous slide?
 - b) Can set the volume of the video to max and enable subtitles?
 - c) Another person has just finished using the interface. How would you reset the system for you to use?
- 2) Can you change the system language to German?
- 3) Can you enable spoken descriptions and apply a colourblind filter?
- 4) Given the password is 'Tutankhamun123', can you:
 - a) Give me the firmware version number
 - b) Upload a new slideshow
 - c) Power off the system

Question no.	Person 1	Person 2	Person 3	Person 4	Person 5
1.a	✓	✓	✓	✓	✓
1.b	✓	✓	✓	✓	✓
1.c	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓
4.a	✓	✗	✓	✓	✓
4.b	✓	✗	✓	✓	✓
4.c	✓	✗	✓	✓	✓

This result is very positive, and I am very happy that the majority of people were able to use the system without issue.

I asked what they thought of my prototype. I broke down their opinions using six targeted questions aimed at identifying areas for improvement. These questions are as follows:

- *What do you like about this system?*
- *What do you not like about this system?*
- *Did you find the system easy to learn?*
- *Was there anything you felt was unintuitive?*
- *Would you use this system?*
- *What changes would you suggest for this system?*

Here is a summary of the answers I received:

What do you like about this system?

The answers I received for these questions emphasized the systems clarity and ease of use. This includes both aesthetics and functionality as well as one person saying, '*it's a better design than ones I've used before*'.

This is a very positive response and I'm happy that the system's design was a success. This gave me a very good idea of what parts of the design are a success.

What do you not like about this system?

The main answer I got for this question was about how the system **feels very squished with the icons and buttons taking up too much space on the screen**. This is largely due to the side of the paper I used to make the models being too small, but I agree with this statement, and even brought it up in my heuristic evaluation of the system. This could be improved by making the UI buttons smaller and less intrusive on the main contents of the page.

I also received a few comments about **the AI assistant feeling obsolete especially considering how tucked away it is**. I disagree with the AI being obsolete, but I think that in future designs the AI could be better integrated into the interface. This problem is mentioned

I think this is very good feedback, and I will keep it in mind during future design iterations.

Did you find the system easy to learn?

There was an overwhelming 'yes' to this question. One participant said that this was due to the system being '*very transparent with the actions you can perform*'.

This is very good to hear as it was one of my initial requirements for the system. It also matches my conclusion in the heuristic evaluation of the system where I spoke about the ordering and high contrast colours contributing to the usability.

Was there anything you felt was unintuitive?

The only answer to this was how it felt awkward to reveal the keyboard in the settings menu. I think this is a good response as the settings menu was intentionally meant to deter inexperienced users from using that part of the system. I spoke about this in the 'Recognition Rather than Recall' section of my heuristic evaluation, and I'm glad that my opinion is verified by reviewers of the system.

Would you use this system?

The answer to this question was also an overwhelming yes. This gives me a very good indication that the system concept and current model are both on the right path.

What changes would you suggest for this system?

I received a wide variety of answers for this question. Some of these changes include:

- More braille to indicate locations of touchscreen elements
- Options to change system brightness
- Make physical buttons, icons, and the progress bar smaller
- Remove AI assistant / Better integrate the AI Assistant
- Add a change password button in the settings menu
- Add a device ID to distinguish between them
- Make the system more colourful other than just white

New Requirements:

Between hearing user feedback and completing a heuristic evaluation for the system, I have extracted a list of requirements that should be added onto the current model:

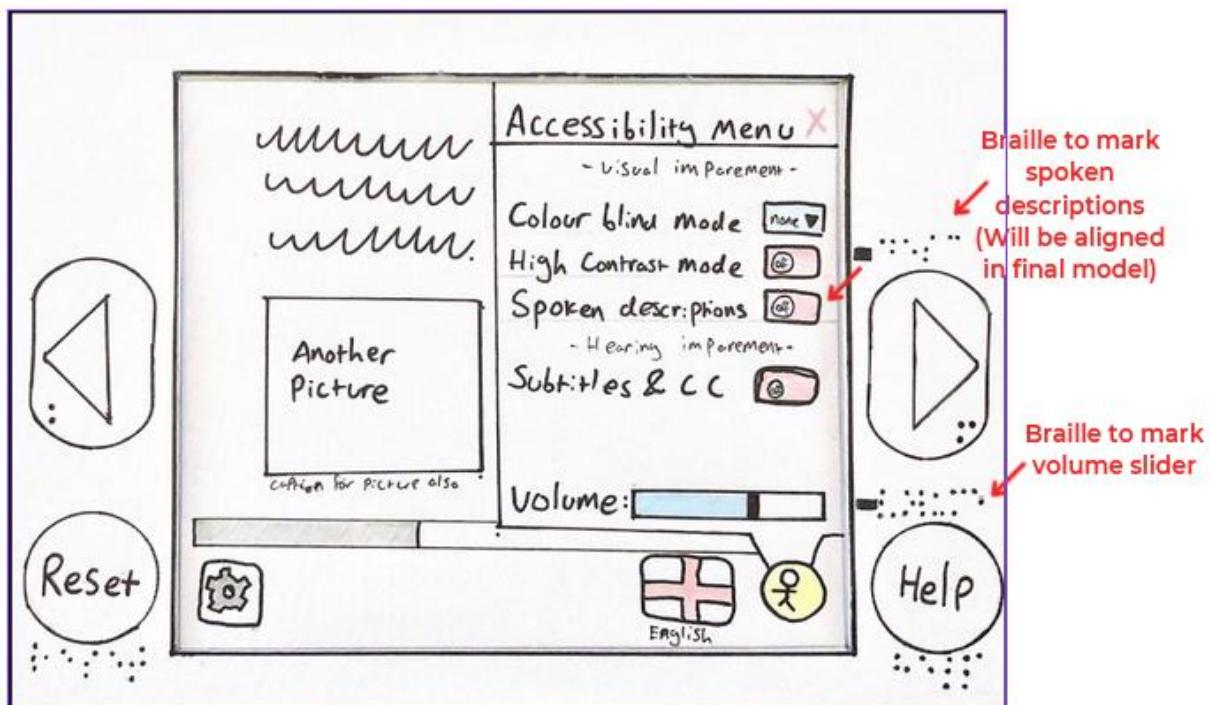
- Clearly indicate touchscreen elements using braille markings for better accessibility
- Encourage use of the AI assistant
- Be able to change the system's display settings (brightness / contrast)
- Allow the system password to be changed
- Provide a unique device ID to distinguish between devices
- Keep the UI elements small and to the edges (Leaving until final prototype)
- Use colours other than white for things other than the information screen

From here I should be able to update my designs to meet these new requirements.

Iterative Design:

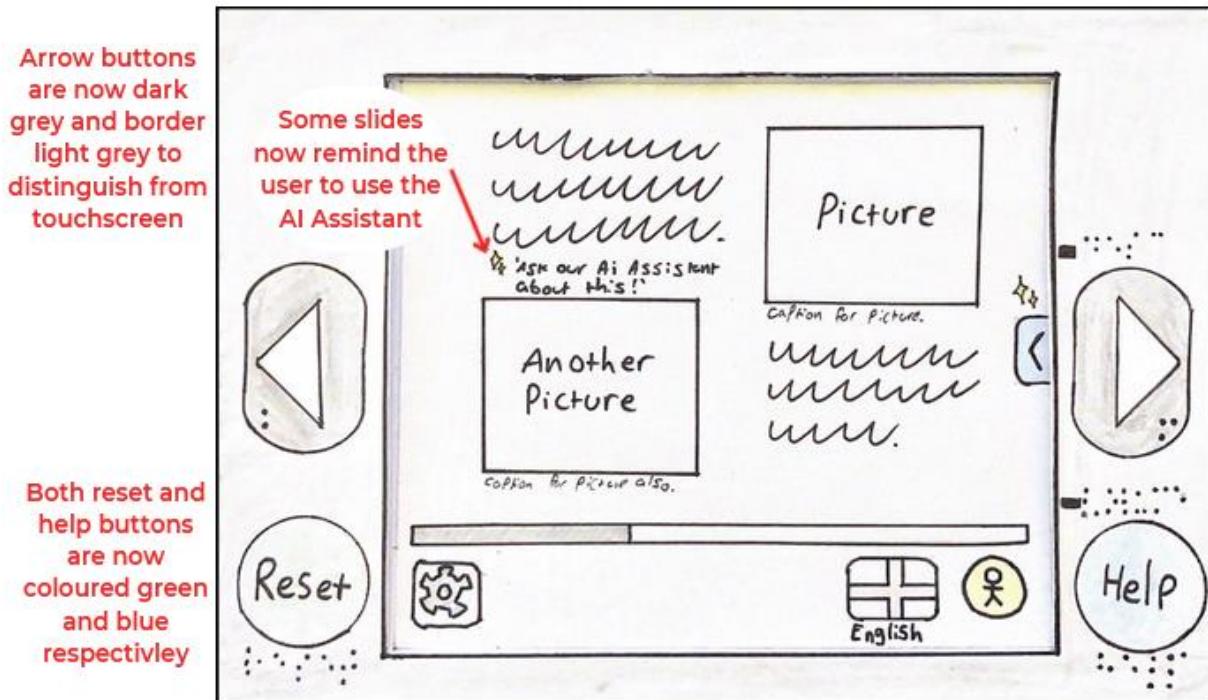
Second iteration:

Clearly indicate touchscreen elements using braille markings for better accessibility:



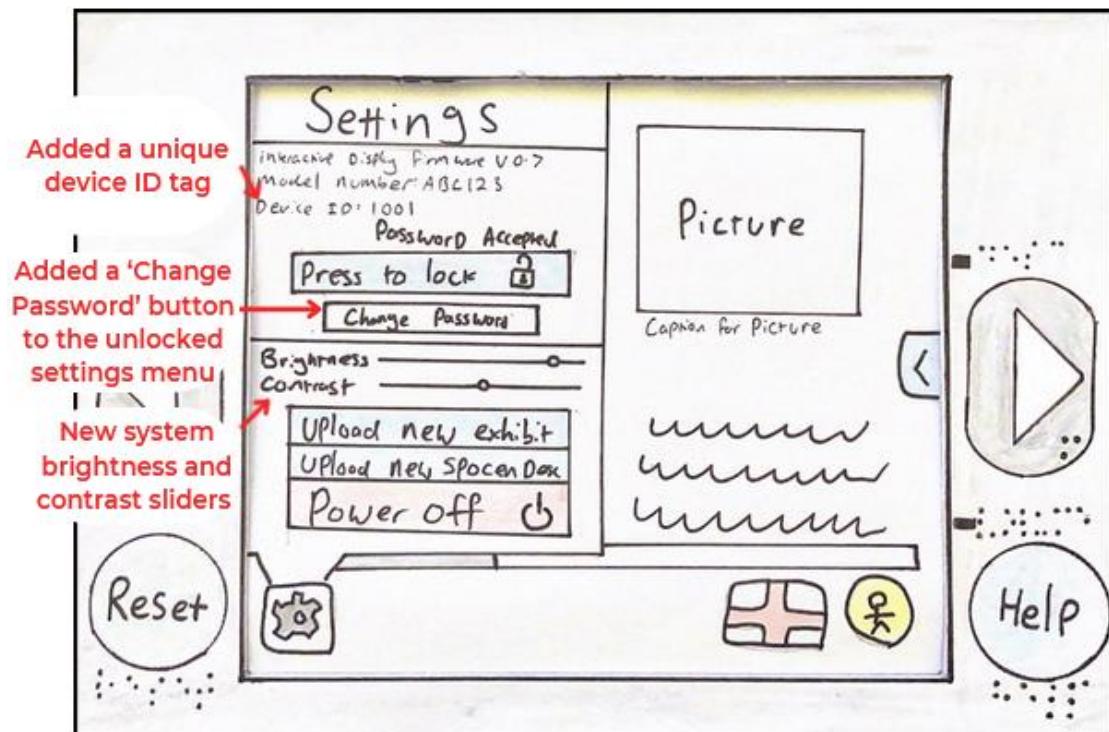
This new design adds braille marking to help people with visual impairments locate touchscreen buttons. The marking for spoken descriptions will be shifted to align with the correct button in the final version.

Encourage use of the AI assistant / Use colours other than white for things other than the information screen:



In this design I have added colour to the border and physical buttons to differentiate them from the touchscreen. I have also added small messages around information blocks to encourage the user to use the AI Assistant.

Be able to change the system's display settings (brightness / contrast) / Allow the system password to be changed / Provide a unique device ID to distinguish between devices:



I have added a unique device ID, change password button, and system display sliders. This covers a lot of suggestions from the review.

I presented the updated system to the reviewers to gather their opinions. I asked the same questions as before, with some slight modifications for comparison to the previous version. Their responses were as follows:

What do you like about this new system?

All the responses for this question either referenced the new colours of the system interface, or the new element reminding the user to try out the AI assistant. I am glad to see that these changes were received positively.

What do you not like about this new system?

Only one reviewer provided feedback for this question by suggesting that there was **not enough diversity in the language selection**. I agree with this, and more language options will be available in the next design. This is a purely visual change to represent what the system could look like, as the variety of languages available is dependant on what the museum uploads.

Did you find this system easier to learn?

The consensus for this question was that the system was now a bit easier to learn due to the clearer colours and the AI sidebar being highlighted.

Is there anything you still feel is unintuitive?

None of the 5 reviewers could think of anything for this question which is very good.

Would you use this system over the one previous?

All 5 reviewers said yes to this question, which is great because it shows that these designs are on the right track.

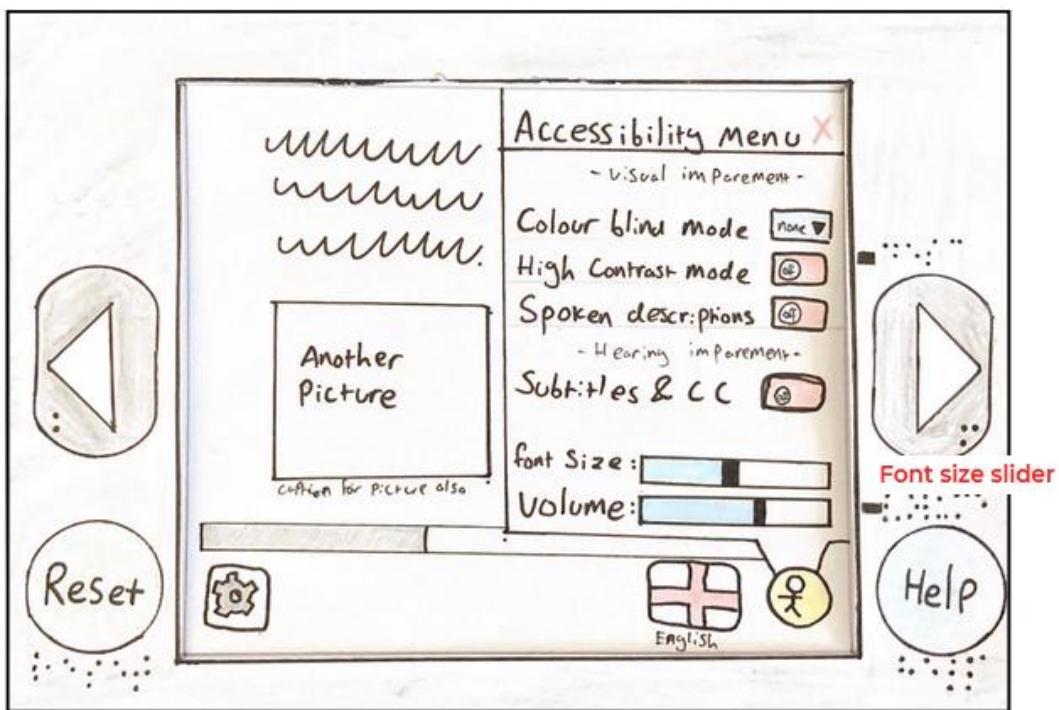
What further changes would you suggest for this system?

There were still a few things that could be improved that have been added to the working requirements:

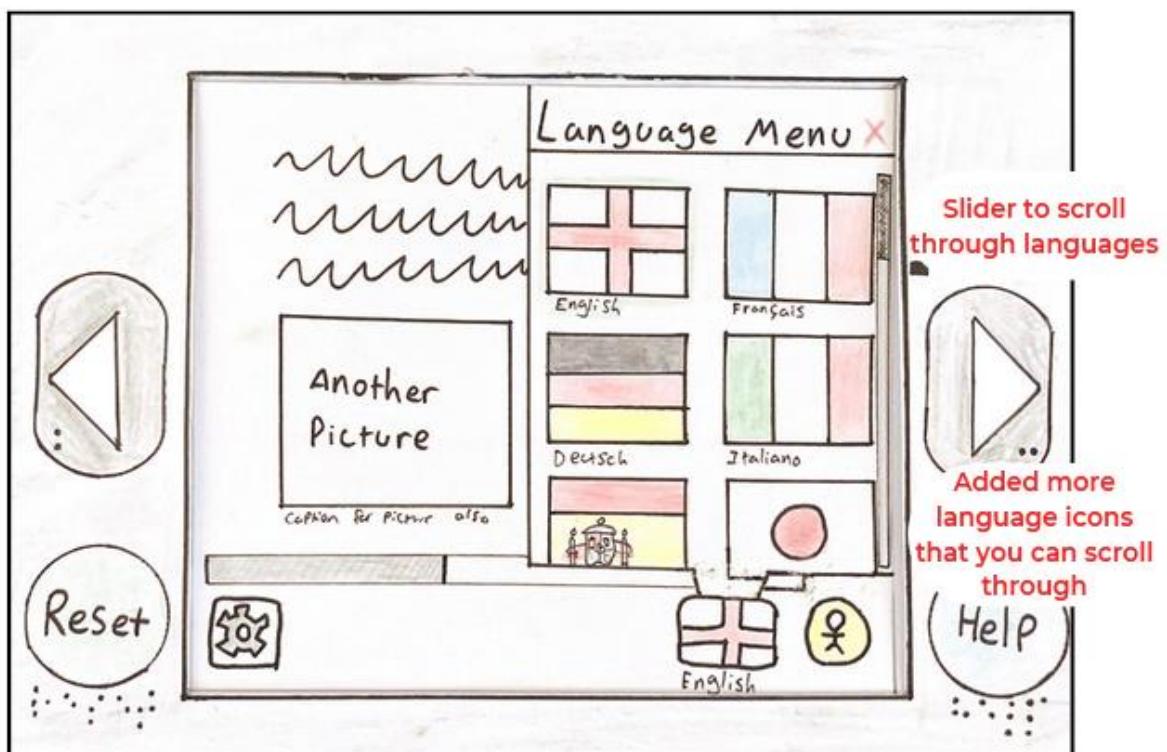
- Diversity in language selection
- Allow the user to change the font size of the system
- Allow the user to enable filters for dyslexia
- Allow the user to set the default language setting for the device (Will add in final design)

I will work to improve on these aspects in the next design iteration.

Third iteration:



In this design I added a font size slider to adjust the don't size of the system. I will likely move this into the visual impairments section in the final prototype. I will also add a range of filters for dyslexia, but there was not enough room to add it in this model.



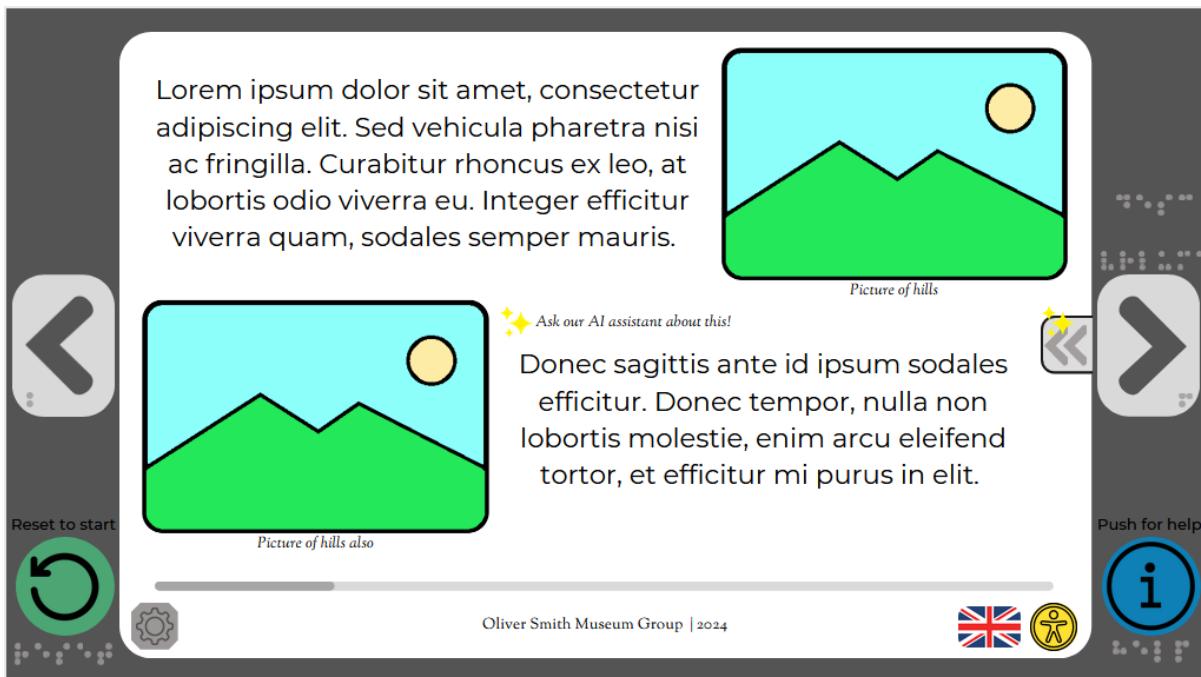
In this design I added a slider to scroll through the available languages. This allows the user to have a much wider range of options.

I will add filters for dyslexia and a default language selector in the final version as there was not enough room on the paper models.

Final Prototype:

Following the updated designs, I'm confident that the system is ready to proceed to its final stage of prototyping with a digital model. I used an online tool to create these designs, building upon the paper models and ensuring to incorporate the new requirements identified during the heuristic evaluation and user testing. Here are the current models:

Main Screen

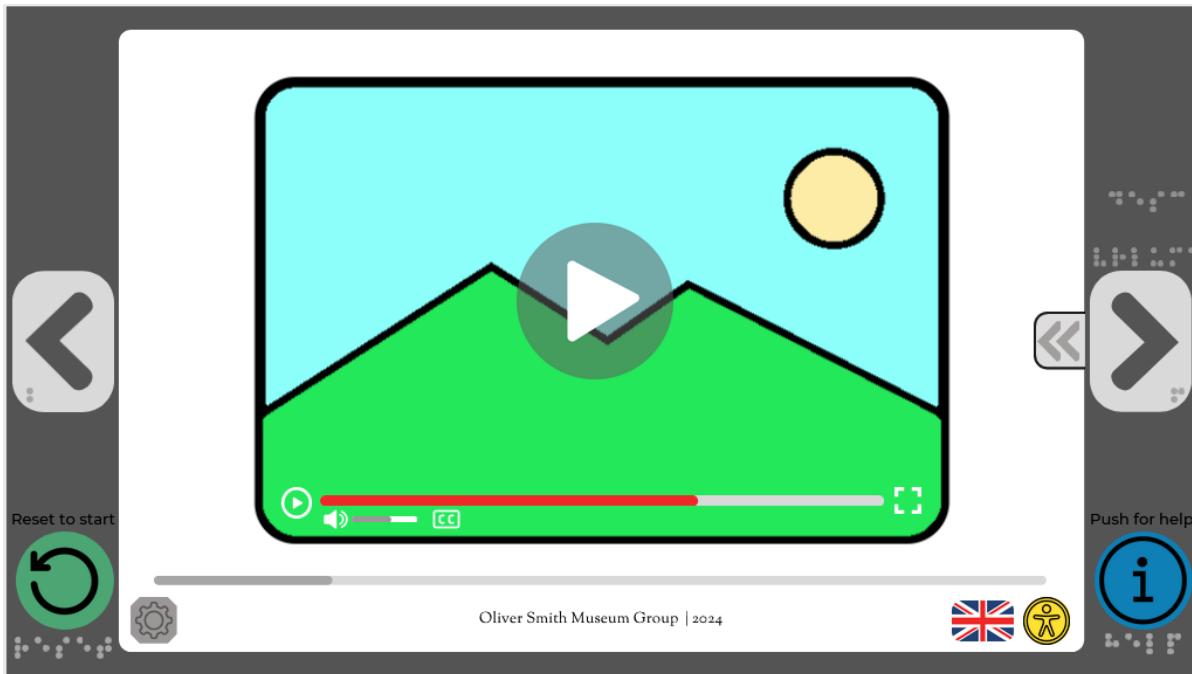


This is the main screen that the users will interact with. It shows both the physical and touchscreen interfaces in one. You can see the navigation, reset, and help buttons around the border. These enhancements ensure consistency with the rest of the system, further enhancing user familiarity and usability. The reset and help buttons have been given a written description to avoid confusion and as a form of error prevention.

This design keeps all the important elements included in the paper models, including all menu icons, progress bar, and the AI sparkle.

As this screen serves as the central interface for user interaction, following the principles of minimalism and clarity outlined by Sharp, Rogers, and Preece (2019)³ is paramount. Building upon the paper versions, menu buttons have been improved by reducing their size and positioning them closer to the screen's edge, addressing the requirement highlighted in the heuristic evaluation. This adjustment makes the screen appear uncluttered while ensuring that important affordances remain readily accessible when needed.

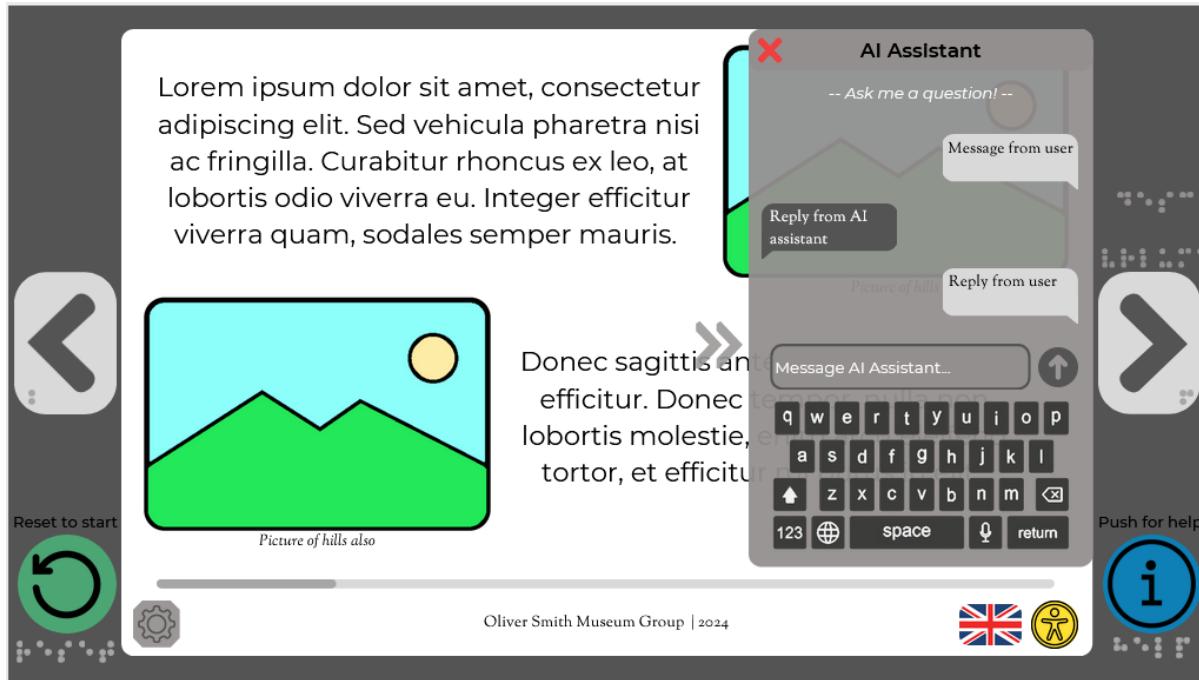
Video Player:



The video player is modelled directly from the paper version. It includes a pause/play button, scrubbing bar for navigation, adjustable volume slider, and buttons for closed captions and full screen mode.

The video player design maintains consistency with the overall system aesthetic, adhering to a minimalistic approach with grouped icons for improved recognition.

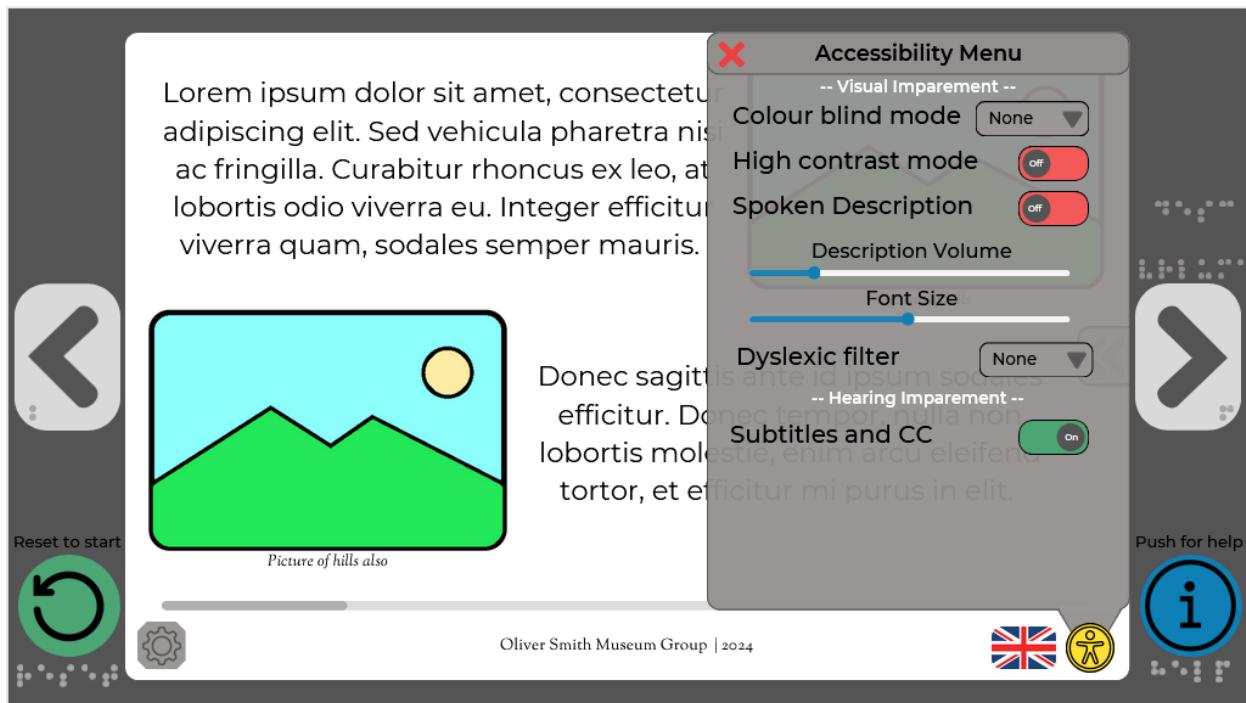
AI Assistant Sidebar:



The AI Assistant sidebar has also been modelled directly from the lo-fi prototype. It features key components such as a keyboard, message bar, send button, and a history of previous interactions.

The user can input inquiries via keyboard, and the AI will respond appropriately, only addressing museum-related queries. The AI maintains a polite tone for a positive user experience. The sidebar design promotes engagement and curiosity by featuring the keyboard prominently and displaying previous user questions about the exhibit.

Accessibility Menu:



This is the accessibility menu. It allows the user to customize the system to their personal requirements. Most of the design is modelled from the paper prototype, but also includes the addition of a drop down menu for a dyslexic filter. This meets requirements derived from the user feedback, and works to empower users via inclusive design (Rogers and Marsden, 2013)³ as mentioned in the concept for this project.

The spoken descriptions switch says aloud 'spoken descriptions enabled/disabled' when toggled on/off respectively.

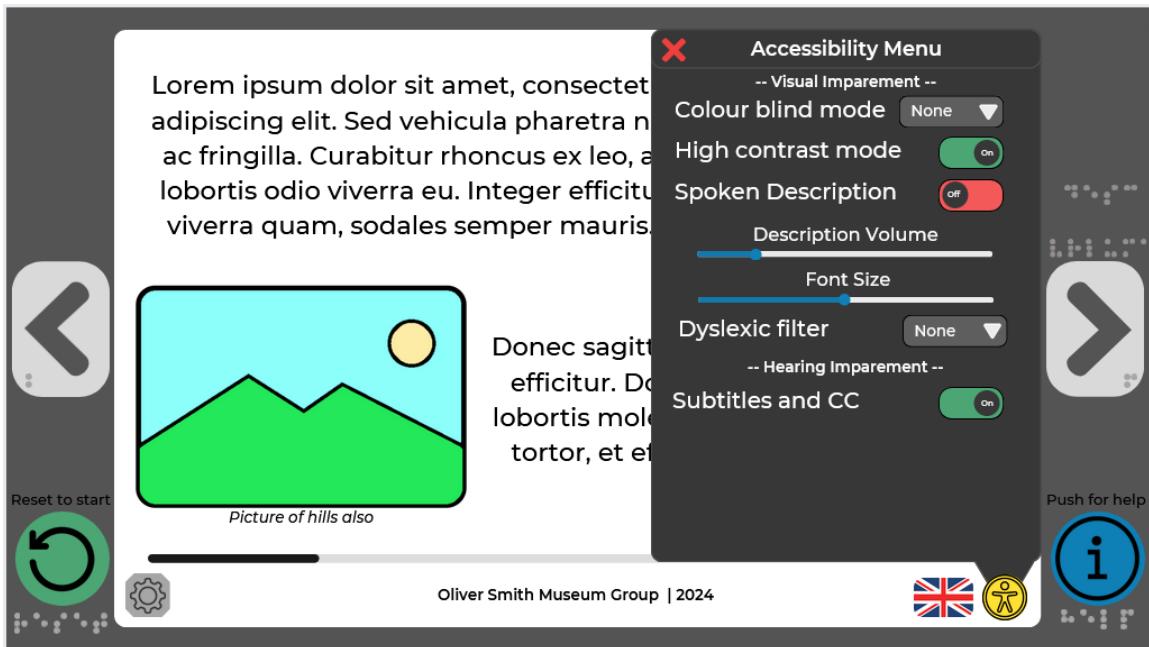
The colour blind and dyslexic filter features a drop down menu where the user can select a filter depending on the type of colour blindness they have.

The Volume slider changes the volume of the Spoken descriptions and system sounds (e.g. beeping noise).

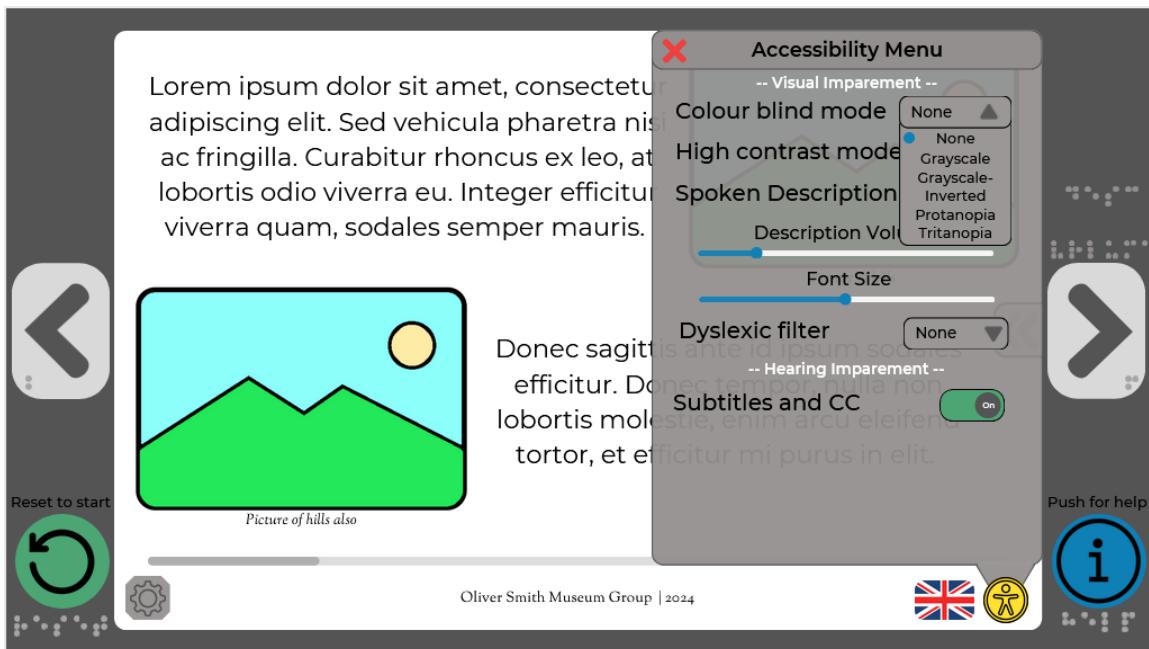
To close the menu, the user can either press on the button again, the red 'x', or anywhere else on the screen. This interface enhances user experience with seamless interaction.

It is important to note the braille lettering indicating the location of both the spoken description switch and volume slider. This works to allow individuals with visual impairments to navigate the system independently.

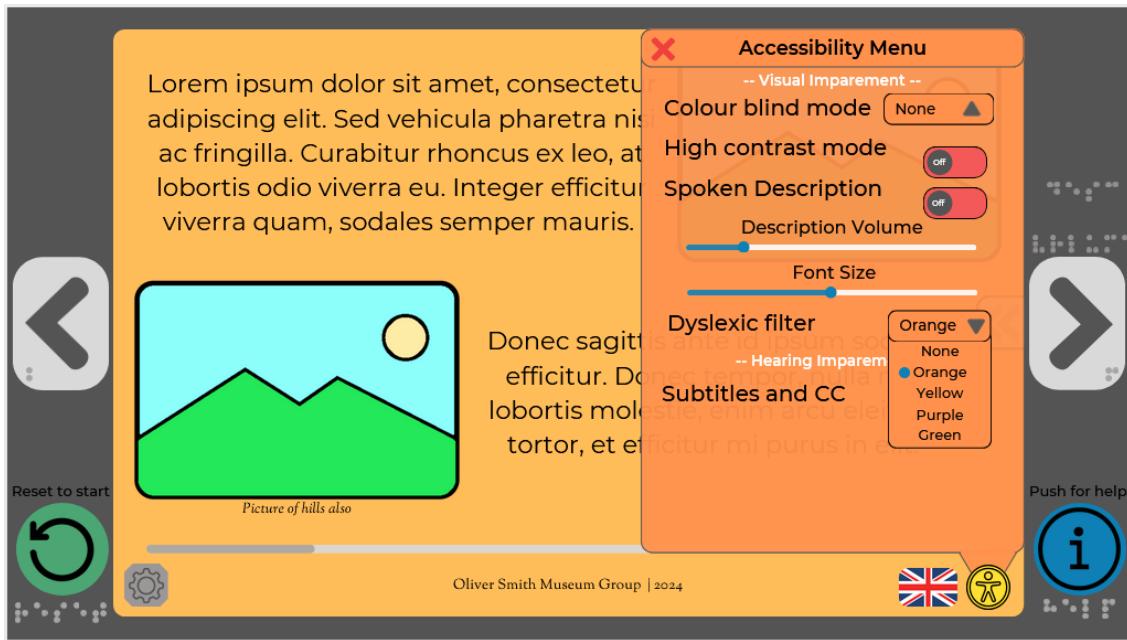
Accessibility Menu options:



This image demonstrates what they system might look like if the user enables the high contrast mode.

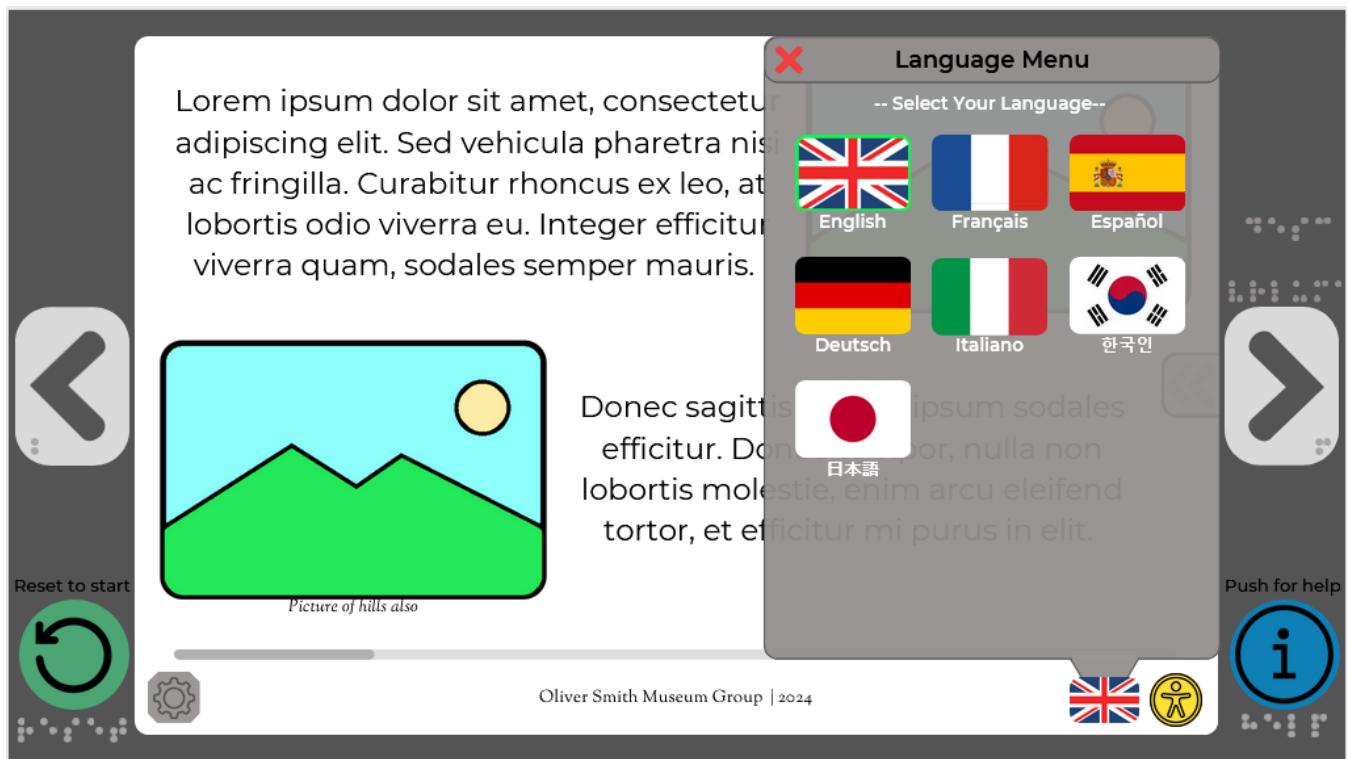


This image demonstrates what options the user might have for colour blind mode



This image demonstrates what a dyslexic filter might look like when enabled from the accessibility menu.

Language Menu:



The language menu is very similar to the lo-fi prototype with a few minor changes. I have chosen to remove the scroll bar as the screen is a lot larger now and is able to fit a lot more icons into the menu. The scroll bar would still become available if the museum was to upload too many language options to fit in the menu popup.

When a language is selected, it will change the icon at the bottom of the screen accordingly, and highlight the selected language in green.

Locked Settings Menu:

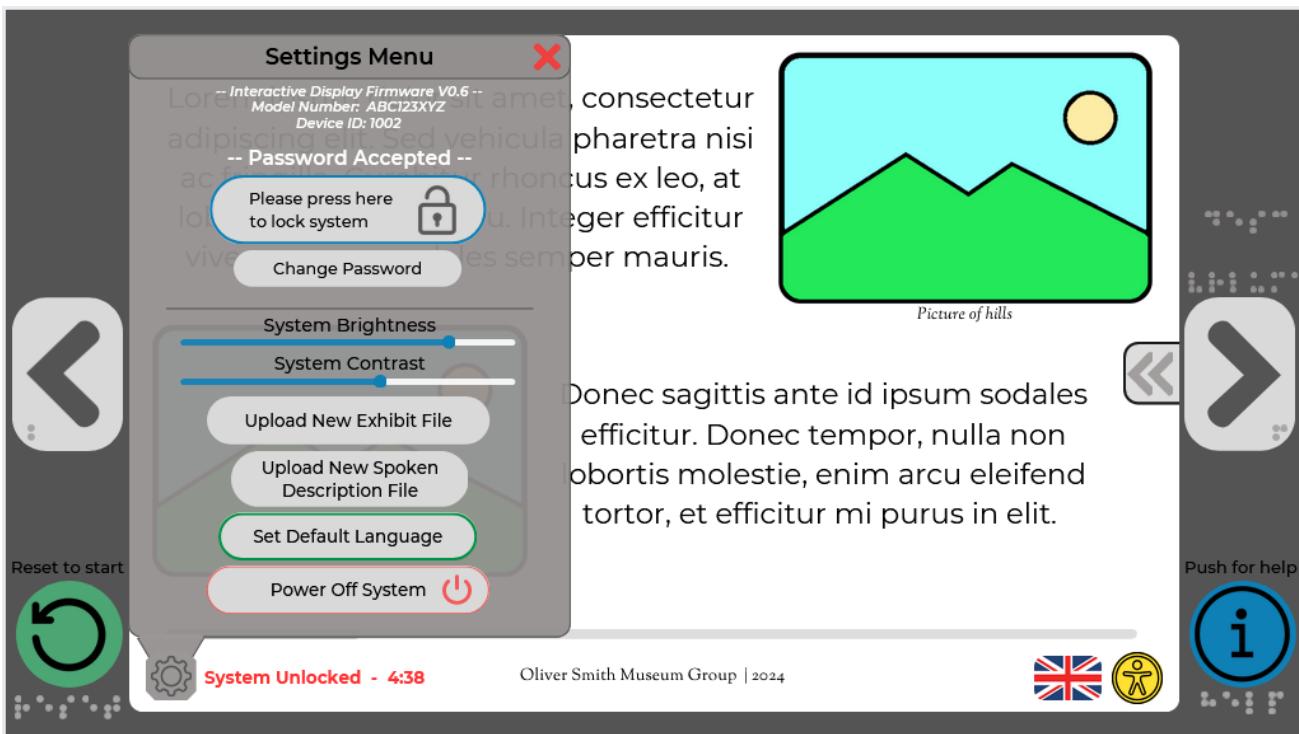


This screen has been modelled directly from the paper prototype. When the user presses on the lock icon it will reveal a keyboard for the password to be entered.



Once the password has been entered, it will unlock the settings menu for 5 minutes before it needs to be entered again. This is for security reasons spoken about in the heuristic evaluation of the system.

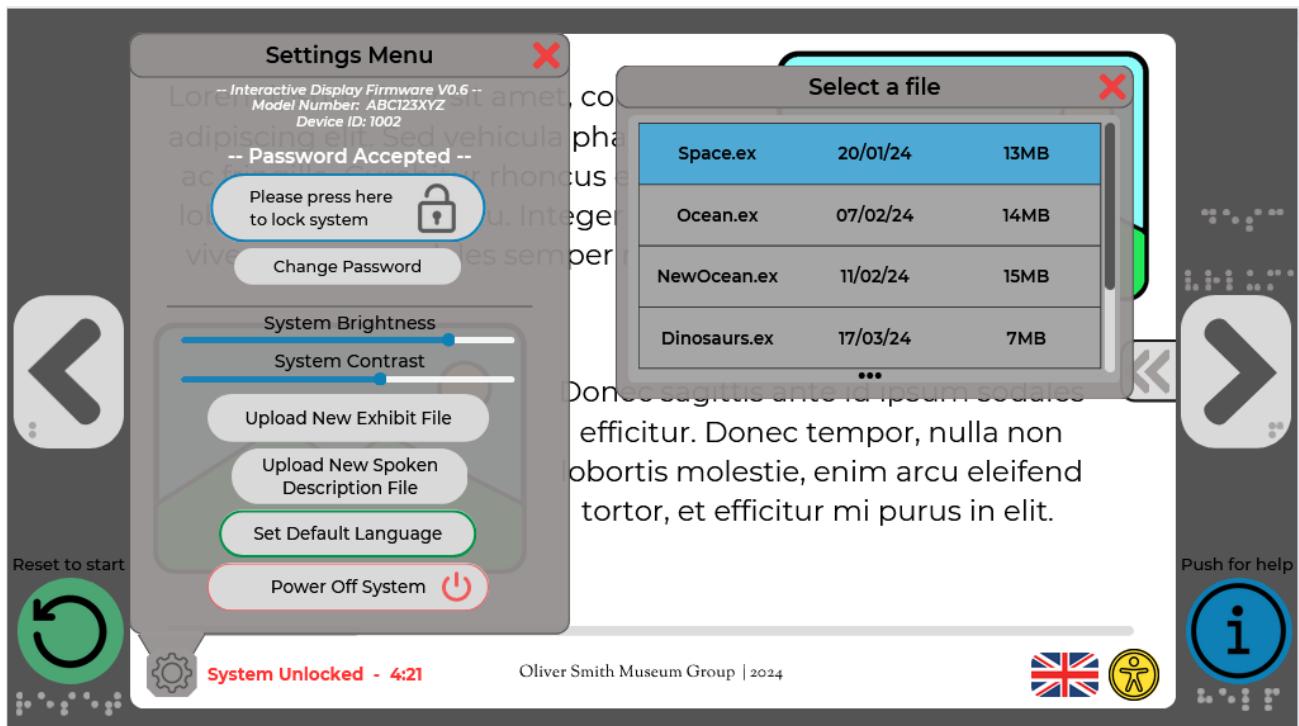
Unlocked Settings Menu:



This is the unlocked settings menu will remain unlocked for 5 minutes after the correct password is entered. The remaining time is shown at the bottom of the screen beside the settings button.

The menu allows the user to change the system password, brightness, contrast, default language or upload new exhibits or spoken descriptions. When the user is finished, they can either lock the menu or power off the system.

The firmware version, model number, and device ID can all be retrieved from the top of the menu.



When the user chooses to upload a new exhibit or spoken description, a file selection window appears displaying the available files on the inserted USB. These files can be scrolled through and selected by tapping on them.

User Experience Evaluation:

The design of the interface does not contain any information that is irrelevant or rarely needed, and have a minimal and uncluttered aesthetic with the important affordances obvious only when needed. This is essential to pass the aesthetic and minimalist design heuristic as mentioned by Sharp, Rogers and Preece (2019)⁴.

The interface has been designed to maximize customizability, ensuring that users from diverse backgrounds and with varying needs or impairments can navigate the system effortlessly. It has done this using both an accessibility and language menu offering a wide range of options that can be toggled in series. This inclusive design approach empowers all users, regardless of their background, to interact with the system effectively (Rogers and Marsden, 2013)³.

The layout of icons on the screen is crucial for the usability of the system, ensuring that each possible action has a corresponding icon without overwhelming the user with too many options. I've applied the principle of similarity by grouping buttons based on physical characteristics and functionality, using common and well-understood symbols. This approach helps to computationally offload the user, allowing for more efficient processing of available information and ultimately enhancing the user experience.

I have made extensive efforts to ensure that the system state is accurately and fully represented through various means, including the use of progress bars, use of transparent popup boxes over Fullscreen menus, and immediate feedback after user input. This continuous representation of the system ensures that users are always aware of available actions and their outcomes, ultimately increasing the useability of the system.

Because of this system's simplicity in design, it has a very strong mapping between the conceptual model and the actual system image. This is very important when it comes to providing a positive user experience as it allows the user to clearly define a path of actions to accomplish their goals. This is also a key concept endorsed by Sharp, Rogers and Preece (2019)⁶, where they state, 'if the system image does not make the designer's model clear to the users, it is likely that they will end up with an incorrect understanding of the system'.

This high ease of learning is perfect for this system because, as mentioned in the useability requirements, the system user is likely only ever going to interact with the system once. This allows the system to be adopted by a museum or gallery with the staff only needing very little training.

Final Testing

To finalize this design, I chose to run one final round of user testing on the digital designs. I did this by asking the same 5 reviewers as before these questions:

- *Does this digital model improve upon the paper prototype?*
- *Could you see yourself using this system?*
- *Is there anything you think could be improved?*

Here is a summary of the answers I received:

Does this digital model improve upon the paper prototype?

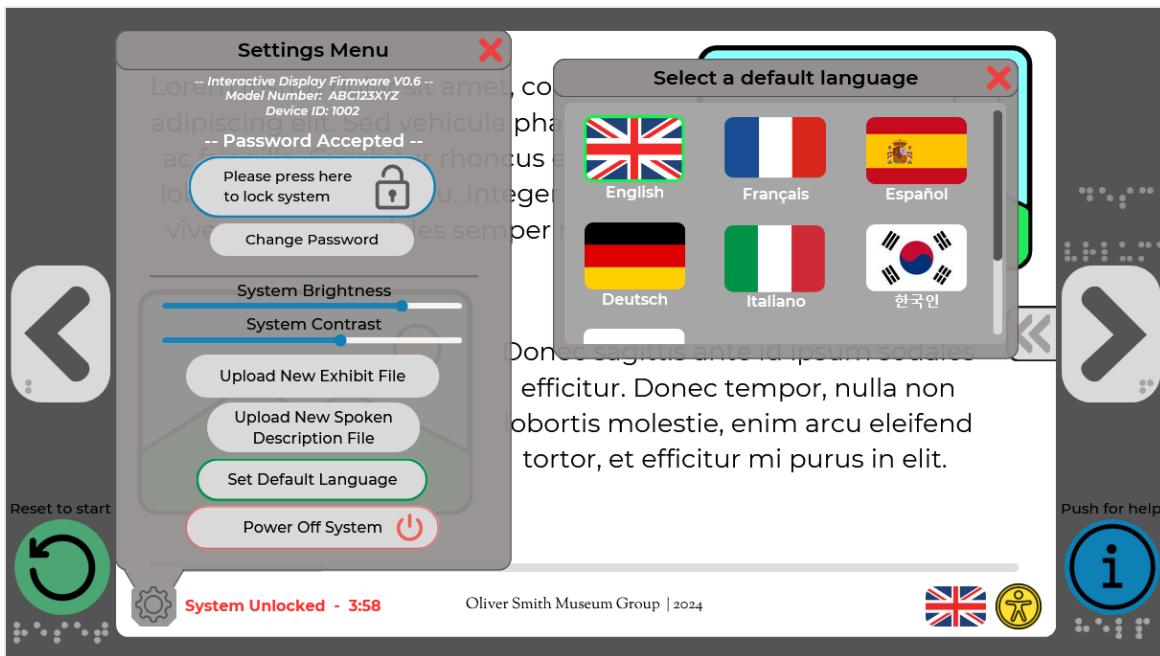
There was a definite yes for this question with all 5 reviews saying they prefer the digital model over the paper prototype.

Could you see yourself using this system?

There was also a resounding yes for this question with all users saying they would love to use this system. This is very nice to hear as I have put a lot of effort into these designs.

Is there anything you think could be improved?

There was only one critique from this question with the other 4 reviewers saying that the system is very good as it is. This one suggestion was that I should show what the 'select default language' menu should look like. I have created a design for this below:



Final Evaluation:

This final prototype fulfils all initial requirements as well as additional ones identified after the heuristic evaluation and review. As this proposed system is functionally complete, it is ready to be developed into a functional system.

I believe that during the development of this system, I followed the concept closely and delivered a product that matches its description very well. This includes the concept of 'direct manipulation' being achieved by conforming to the core principles outlined in 'Interaction design : Beyond human-computer interaction' (Sharp, Rogers and Preece 2019)²; i.e.:

- *'Continuous representation of the objects and actions of interest'*

The slideshow is always present even when the user opens a menu. This works to reduce memory load and increase the usability of the product.

- *'Rapid reversible incremental actions with immediate feedback about the object of interest'*

The feedback provided to the user is usually given as the effect taking place immediately and allowing the user to preview the change before committing to any changes and closing the menu. All menu options are easily reversible, usually being represented using a switch or slider which allows the user to modify system settings and receive feedback immediately.

- *'Physical actions and button pressing instead of issuing commands with complex syntax'*

All affordances are represented using unique colours and common symbols allowing the user to recognise immediately what they need to press to complete their desired task.

During the development of this system, I felt that a few things could have been improved upon. Firstly, I should have chosen to make the lo-fi prototypes on a large piece of paper as to get a better feel for the scale of the final design. I also think that involving more than 5 reviewers could have provided a more accurate representation of the design's quality and produced additional ideas for features.

Overall, I am very happy with what I have produced and feel that it matches my original concept perfectly.

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- 3a) **Rodgers Y., and Marsden, G.** (2013) Does He Take Sugar? Moving Beyond the Rhetoric of Compassion, Interactions.
- 3b) **Sharp, H., Rogers, Y. and Preece, J.** (2019). *Interaction design : Beyond human-computer interaction, Concrete Design*. 5th ed. pp.445-446
- 4) **Sharp, H., Rogers, Y. and Preece, J.** (2019). *Interaction design : Beyond human-computer interaction, Heuristic Evaluation*. 5th ed. pp.550-551
- 5) **Nielsen, J.** (2019). *Jakob's Law of Internet User Experience* (Video). [online] Nielsen Norman Group. Available at: <https://www.nngroup.com/videos/jakobs-law-internet-ux/>.
- 6) **Sharp, H., Rogers, Y. and Preece, J.** (2019). *Interaction design : Beyond human-computer interaction, Frameworks*. 5th ed. pp.92-94