Design principles analysis

Flexibility-usabilty tradeoff

In this app, we want to emphasize efficiency, which results in only a limited number of functionalities being built. Due to the limited functionalities, the app is very streamlined and usable for librarians, and focuses only on what is necessary for the users.

Consistency

Throughout the application, we use consistently shaped and colored buttons. The internal, aesthetic consistency increases recognition and communicates expectations for each button. We use external consistency with the rectangular shape of the book covers throughout the app, to mimic real-life shapes of most books.

Mental Model

By implementing a side-to-side scanning action when the user is looking through the books on a given shelf, we rely on the mental model of librarians physically going through books by shelf. When physically re-shelving books, librarians will go by shelf, and look through each one, left to right.

Performance load

Throughout the app, performance load is minimal for the user because each action of the re-shelving process is broken down into steps. Users are asked to complete smaller tasks to get them to re-shelving misplaced books, rather than walking them through the entire process all at once. They are also presented with options to "Save for Later" which allows them to complete each task at their own pace.

Wayfinding

The application uses navigational icons such as arrows alongside descriptive text to provide directional context for the user. This helps them wayfind and navigate to a given destination or action.

Hick's law

The options presented on each screen are minimal because the app only offers a few functionalities. Therefore, according to HIck's Law the amount of time it takes for a user to make decisions in our application would be small.

Picture Superiority Effect

We utilize the picture superiority effect by using images of book covers, rather than just the titles of the books. This allows librarians to more quickly visually identify and

remember a book on a shelf or cart.

Chunking
We practice chunking when dividing misplaced books shelf by shelf, rather than in one group to allow for an easier readout of the information the librarian needs.

Similarity
We employ the principle of similarity in our design when grouping our book cards into similar spaced rows using consistent spacing. This decision allows for the user to easily discern the shelf they are part of. Additionally, all book cards are shaped the same to further emphasize their relatedness.

Proximity
Proximity is an important part of this app on the main screen as shelf numbers appear directly above misplaced book rows. In positioning shelf information directly above these rows librarians will not need to guess where the books belong. Book cards that belong to the same shelf are also closer together and horizontally grouped to further emphasize their togetherness due to close proximity.

Alignment
By left-aligning shelf numbers with book card rows, the user is easier able to travel down the screen to find the shelf they are looking for than if the shelf designations had been center or right-aligned. This is a mental model prevalent in most western cultures, however, other cultures would need the alignment reversed.

Fitts's law
Observation of Fitt's Law is seen in certain versions of our app in the size and location of the scan shelf function button. Its large size and location near where the average person places their thumb when holding a phone allows for easy use of the app's most important function.

Visibility
Visibility is employed in the app in certain versions when screens alert the user that a misplaced book has been found. This allows users to get immediate visible feedback on their actions in the app.

Recognition over recall
Mental models used in our app such as card shape, button location, QR scanning, and screen tabs were used to allow librarians to not need to recall functionality but rather to recognize certain objects and their actions to make using the app far simpler.

Serial position effect
By placing the misplaced books that are closest to our users, we utilize the serial position effect. These books are the most relevant and likely to next be relocated by the user, thus maximizing recall of these books is important.

Signal-to-noise ratio
We take the concept of signal-to-noise ratio into consideration by ensuring that every design element serves a purpose. For instance, colors and shadows are only used in order to draw attention to important functions of Ledgar, rather than merely making elements "pretty". Information that is not critical uses minimal design in order to reduce noise.

Accessibility
Accessibility is considered in our design by ensuring important buttons are easily accessible at the bottom of the screen, and ensuring information is presented in both textual and iconic methods to improve perceptibility. Accessibility via simplicity is also utilized by providing clear prompting and tutorials for critical functions.

Control
The principle of control is utilized by providing both simple descriptions for books such as shelf number and title, as well as advanced information such as ISBN. Whether the user is new to being a librarian, or knows how to use more advanced library information, Ledgar will accommodate the user.

Errors
Error detection is a part of the app when users incorrectly scan a shelf. A screen appears letting the user know they have incorrectly scanned and now have the option to go back or type the shelf designation into a field.

Forgiveness
By providing the users a way (back button) to easily go back to the main dashboard page from the QR scanning screen allows for a degree of forgiveness. By employing the mental model of back buttons being at the top left of a screen, users will not feel as though they cannot reverse their actions and be far more comfortable using Ledgar.

Feedback
By providing the users confirmation of certain actions such as shelf QR code scanning, of successfully saving a book for later, we implement feedback, which provides feedback for their actions.

Aesthetic-usability effect

By designing an aesthetically pleasing application, we sway users into believing that our product is usable. This would increase the probability of our application getting used by librarians to complete re-shelving tasks.

Expectation effect

By setting the expectation that our application can re-shelve books more efficiently, users are more likely to believe so and find positive results.

Affordance

Building our application for mobile devices that are handheld and have cameras affords scanning and transportability as a user is going through the library. This increases efficiency of the system, because when presented with a QR code per shelf, a users knowledge and instinct is to scan it with a mobile camera.

Color

Ledgar's user experience takes into consideration the principle of color by utilizing color to bring the user's attention to important functions. For instance, the "scan shelf" button is brightly colored because it is the main function of the app, and the "relocate" button is vividly colored as this is the primary action you would take when viewing a misplaced book.

Highlighting

The technique of highlighting is used throughout Ledgar's user interface in order to draw the user's attention and convey meaning. For example, when a menu is active, the text and icon becomes colored and underlined, whereas inactive items are gray and not underlined. Additionally, uppercase text is used for labeling shelves, as this allows them to be differentiated from other information.

Legibility

A high degree of legibility is an extremely important part of this product due to the importance of differentiating similar titles of materials and their ISBN numbers. A light background with text ranging from dark gray to black to get contrast levels above 70% was decided upon to minimize human error brought about by misreading.

Iconic representation

Example icons are employed in Ledgar to allow for quicker visual scanning by users when semi-familiar or familiar with the app. Example icons were used largely because some actions, such as scanning shelves, are quite complex and do not have an effective way to be portrayed literally or similarly. Iconic representation is also used to reduce performance load and allow for a simpler display.

Design principles analysis

Flexibility-usabilty tradeoff

As the flexibility of a design increases, the usability and performance of the design decreases. As the simplicity of our design increases, the usability and performance of the design makes it easier to navigate. With its narrow focus, the user should be able to focus on its simple task of creating a training simulation.

Consistency

To improve the usability of the interface, a consistent set of fonts, colors, and buttons are used across the layout. When creating a new scenario, each submenu used for customization has a similar appearance for menus. Buttons whose actions take you to a new page are rounded, and menus with selection options are rectangular and the selected option becomes darker.

Mental Model

A common mental model for mobile application includes a small gear to represent the settings page and a small house button to go to the home page, as well as navigation bars that are accessible throughout the interface. To adhere to a new user's mental model of mobile applications, we included those standard home and settings buttons in a navigation bar located at the bottom of nearly every screen.

Performance load

In order to minimize the performance load, our app minimized the total number of screens and actions needed to accomplish the user's goal. By understanding the users context we were able to limit the amount of text and elements on each page to reduce the time it takes to complete the set up and begin the training.

Wayfinding

To improve navigation through our mobile application, we included a title at the top of every screen to help a user assess their current location within the app, buttons are clearly labeled to help a user determine their route, and a navigation bar is almost always at the bottom of the screen to help a user return home at any time.

Hick's law

We limited the number of options provided on the home, settings and scenario pages to decrease the time a user needs to make a decision and complete the training. This helps direct the users attention and encourages them to proceed in setting up their training session.

Chunking
To improve the user's ability to comprehend the information on each page, we grouped the information into various sections. There are separate pages for the user to create a new scenario versus viewing past scenarios. While creating a new scenario, the four areas of customization each get their own page: Training location, fire location, material burning, and structure type. When viewing the past scenarios, the user only views data for one scenario at a time and the data is divided into sections.

Similarity
Related elements within our interface were designed to look the same or similar in order to improve the perception of their relation. For example, the four sections of customization when creating a new scenario are all identical buttons, but they are a different style of button than the "Create New" and "start" buttons.

Proximity
In order to show the relationship between different options of the submenus, we put related items close to each other.

Alignment
In order to show the hierarchy of information on each screen, we aligned each element with features of identical importance. For example, the title of each screen is centered at the top of every page.

Fitts's law
We made the size of our targets as large as possible to improve usability. For example, we made interactive buttons like the back buttons larger. We also made the start button fairly large and close to the other buttons so that it would be easy to click once settings are finalized.

Visibility
By optimizing and refining the content placed on each page we can lead the user though the process and guide them through a series of steps. We only included the necessary information on the landing and home page to make the app accessible and easy to navigate.

Recognition over recall
All of our menus have lists that the user can choose from so that they simply have to recognize the features they want to customize rather than recall them. Furthermore, the "Past Scenarios" page provides a list so that the user can recognize the scenario they want to view instead of recalling the exact date of that scenario.

Picture superiority effect
The picture superiority effect doesn't really apply to our interface as there are no photographs in the interface itself.

Serial position effect
Things presented at the beginning and end of a sequence are more memorable than things presented in the middle, which is why our "Create New" button appears at the top of our home page and the "Past Scenarios" button appears at the bottom.

Signal-to-noise ratio
In order to optimize the signal-to-noise ratio, we included very little to no extraneous information anywhere within our app, and users looking for more information can look for it when they want it rather than be bombarded with information they don't need.

Accessibility
To optimize the accessibility of our interface, the colors used to convey information are high contrast and easy to read, the typeface is simple, and all text is easy to read.

Control
The level of user control should be related to the proficiency and experience of the user. The app is designed to be used by firefighters; they have the expertise knowledge and experience of what each section means: Training Location, Fire Location, Material Burning, and Structure Type.

Errors
To help the user avoid errors, we included back and cancel buttons throughout the interface. We also added a confirmation box when the user clicks the "start" button to start the simulation, as they can no longer alter the simulation when the trainees are doing the scenario.

Forgiveness
In order to ensure that the user is not heavily punished when an error is committed, our design allows some actions to be reversible. For example, there is an option to delete scenarios that were made accidentally. Furthermore, at any point, a user may exit the app or go to the home page, and the scenario will be saved as a draft.

Feedback
Options are darkened to give user feedback when they select them. The interactions are placed on each page to allow the user to feel engaged for a moment while selecting an option. This enhances the users experience within the app and improves the communication between the interface and the user.

Aesthetic-usability effect
Our design aesthetic looks simple and easy to use, therefore it is simple and easy to use. When problems are encountered, the design of the interface makes people more tolerant because it's aesthetically pleasing. Creating a positive emotional response to our interface is important to our design.

Expectation effect
In order to prevent any expectation effects from biasing the results of our usability testing, we made sure to use neutral language to describe our app as simple as possible to allow the firefighters to form their own opinions.

Affordance
In order to improve the usability of the interface, we designed our buttons to afford clicking but giving some of the buttons some dimension to emulate physical buttons. Additionally, our home button is a house icon, and the button for adding options is the symbol for addition, or "plus" sign.

Color
We modeled the aesthetic of our layouts after other firefighter apps by using a fairly neutral color palette with red to add a pop of color. We chose the red that is strongly associated with firefighters and firetrucks. Beyond the red and neutral color palette, we wanted the design to be simple in order to maximize functionality and legibility.

Highlighting
A technique for focusing attention on an area of text or image, we rounded the most important buttons while the rest stayed rectangular. Buttons such as "Create New" and selected buttons had reversed out text and a dark background to indicate they had been selected. We used a bold text to highlight the labels of each section.

Legibility
Since our app is used by firefighters who are out in the field daily, we needed to make sure our design was legible and easy to read. We use a minimal amount of text—used only with our buttons. We purposely picked a typeface that had high legibility and a low stroke contrast. We used a dark text on a light background for optimal legibility, avoiding patterns and textured backgrounds.

Iconic representation
Apples basic iOS icons are used in our design to improve recognition and recall, and also goes along with the mental model. The Home and Settings buttons are examples of resemblance and symbolic icons, respectively. Apple's symbols are known worldwide and share a common visual motif for optimal performance.

Design principles analysis

Flexibility-usabilty tradeoff
Our application has very few purposes making it very usable, but not very flexible. Since it's purpose is very clear, it is very easy to use and very self-explanatory. Overcomplicating it would take away its benefit of simplicity.

Consistency
We executed consistency in our designs by creating a color palette for each one. Choosing one or two colors and incorporating them throughout the pages is easier on the eyes and gives the app a brand. We also were consistent with our typefaces. We used the same typefaces for all body text and a different typeface for headings.

Mental Model
Our app's log in screen, back arrow, and home icon all follow a mental model. Most all applications on the market follow that usual design flow with those elements.

Performance load
The performance load of our application is pretty low. Its main features (finding and puting away library books) walk you through fairly thoughtless tasks and only takes a few button presses to complete. However, I would say that a little performance load is present because the app is does take some physical movement and searching to complete a task.

Wayfinding
Our application is the perfect example of wayfinding because its literal purpose is for the user to find their way to a shelf location. The app's AR provides an arrow on the screen pointing the user in the right direction and a writting directions at the bottom of the screen as well.

Hick's law
Our app follows Hick's law because, again, it has only two, very simple uses. The second page displays only two large buttons: "Look up" and "Put away". This simplicity makes the app very easy to navigate.

Picture Superiority Effect
When looking up a specific book, the search results page contains pictures of the book covers that correlate with the titles. This makes finding a book quicker because users are more likely to spot a cover they recognize than a word. Also, a results page filled from top to bottom with text only would be pretty disorienting to look through.

Chunking
Chunking is utilized on our search results and book overview pages. On the search results page, the book title, author, and cover are all placed closely together to distinguish that result from the next. Like the search results page, the book overview page chunks specific information such as summary or about the author in a way that makes it distinguishable from the rest of the information on the page.

Similarity
Similar content such as search results or information about a book look consistent with each other so the user knows those elements are related.

Proximity
Similar content is placed near each other so the user knows those elements are related. For example, the seach results are listed closely together so that if the first result is not what the user is looking for, their eyes will continue to travel down the page of similar results.

Alignment
Each of our pages is either left aligned or center aligned which makes it easy to read for the user.

Fitts's law
The distance to hit a target in our application is really confined because it is all contained within a smart phone screen. A user's thumb spans the distance of the entire screen.

Visibility and Progressive Disclosure
We use buttons and icons to increase visibility for users. A button is an obvious indicator that the user should press there. Information and possible actions are only revealed as the user progresses through the application.

Recognition over recall
When typing a word into the search bar on the search page, results will appear based off that search. A user could type the word "Potter" and Harry Potter books would pop up based off that word, so the user doesn't have to recall the whole title of a book.

Serial position effect
Our app makes use of the serial position effect by placing the most likely match for what the user is searching for at the top of the search results. We understand users are most likely to remember the first and last items in the list, so we want to use that top position for the book they are most likely to be searching for. We also place

the title and author of the book at the top of the book overview page, since these are arguably the most important pieces of information to remember, whereas the summary, recommendations, etc. are further down the list.

Signal-to-noise ratio

Our app design has a high signal-to-noise ratio. We have removed any unnecessary elements and minimized confusing or distracting design elements to make the main functional keypaths as clear and informative as possible.

Accessibility

We made our design accessible by using basic guidelines for accessibility. This includes using a color palette that is easy to read and understand even for people with different kinds of colorblindness, and using text that is easy to read for people of all ages. If this app were to be commercially developed, accessibility guidelines for coding would also be followed.

Control

Our app implements a fairly simple and eficient level of control for users of all proficiencies. Since our app may be used by long-time librarians and part-time volunteers alike, we wanted to make it easily learnable and accessible to as many skill-levels as possible.

Errors

Our design prevents erros by allowing users to confirm whether or not they are searching for the correct book after they scan an RFID tag, just in case the RFID tag has misregistered. This prevents users from losing time and searching for the wrong book.

Forgiveness

Our design incorporates the principle of forgiveness by allowing users to easily go back or return to home if they accidentally begin down the wrong keypath. The AR segments of our design also have a “cancel” button in the top left, so users can easily leave the screen if they are in the wrong place.

Feedback

Our app incorporates the design principle of feedback by giving the user visual feedback that something has happened. For example, when you have tapped on the search bar, a blinking cursor appears to signal that you may begin typing. When a button is tapped, the button may briefly change colors to signal it has registered the action. The user also receives important feedback after scanning an RFID tag, when the app pulls up the book it has found nearby showing that the user has successfully

scanned a tag.

Aesthetic-usability effect

We designed our app to be colorful, sleek, and aesthetically pleasing to give users the impression that the app is easier and more intuitive to use. Throughout the process we strove to make an app that was functional but also looked good.

Expectation effect

The expectation effect is present with how the user perceives the app. We purposely designed our app to be as simple as possible while still maintaining functionality, to give the user the expectation that the app would be uncomplicated and easy to use.

Affordance

The key affordance used in our design is seen with our buttons. Our buttons are colored and sized differently from other text elements to make it clear to the reader that they can be interacted with to move forward in the app.

Color

Our design features a simple monochromatic blue color palette. Varying tints or shades of blue are used to emphasize certain elements, such as buttons which can be interacted with. We've chosen to pair the blue with white icons, text, and background to create contrast as appropriate.

Highlighting

Our design uses uppercase type in a darker color to highlight certain pieces of information, such as book titles. This highlighting effect was used so users may easily scan through a list and pick out the most important piece of information, the title of the book they are searching for.

Legibility

Our final product design uses a clear sans serif typeface that is easy to read. Our design makes use of contrast and a fair type size to ensure maximum legibility for any user.

Iconic representation

Our app uses iconic representation in the form of arrow, home, and magnifying glass icons. The magnifying glass icon signals to the user that a search function is available. The arrow is positioned at the top left of the screen and represents the ability to go back a step. Finally, the home icon signals to the user a way to return to the "home screen" of the app.