CPSC 481: Introduction to Human-Computer Interaction

Final Portfolio for Makerspace Management System

<u>MKRS Union</u>

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Task Centered Design and Prototyping Grading Sheet

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Completeness of Project	Missing	Incomplete portions	Satisfactory
Original submission for the first assignment	☐	☐	☐
Part I, A2: Redesign writeup: Screens & redesign rationale (TA marks this)	☐	☐	☐
Part II, A2: Heuristic evaluation	☐	☐	☐
Part II, A2: Redesign rationale & final design critique	☐	☐	☐
Working end of term demo	☐	☐	☐
All team members completed all weekly 'Most Valuable Team Member' surveys to portfolio final due date	☐	☐	☐
Horizontal prototype	☐	☐	☐
Quality and completeness of the redesign rationale (TA marks	☐	☐	☐

this)

Screen snaps/final design rationale	Poor	Ok	Great
Fixes major flaws in horizontal prototype	□	□	□
Good rationale behind design	□	□	□
Design critique indicate major problems?	□	□	□
Design critique indicates how these problems may be solved.	□	□	□

Your Heuristic Evaluation (may or may not be required)	Poor	Ok	Great
Problems categorized by heuristics	□	□	□
Major problems detected	□	□	□
Severity ratings are reasonable	□	□	□
Main points of the evaluation are summarized	□	□	□
Sophistication and quality	□	□	□

Completed system	Poor	Ok	Great
Depth of interface shown	☐	☐	☐
Breadth of interface shown	☐	☐	☐
Non-interface aspects	☐	☐	☐

Graphical design	Poor	Ok	Great
Visual appearance	☐	☐	☐
Sensibility of layouts	☐	☐	☐

Evaluating the *project*	Poor	Ok	Great
Simple and natural dialog	☐	☐	☐
Speaks the users language	☐	☐	☐
Minimizes memory load	☐	☐	☐
Consistent	☐	☐	☐
Provides feedback	☐	☐	☐
Clearly marked exits	☐	☐	☐
Shortcuts for experts	☐	☐	☐
User error handling	☐	☐	☐
Provides relevant help	☐	☐	☐

Technical aspects	Major problems	Adequate
Robust/bulletproof	☐	☐

Final video figure and project demonstration	Unacceptable	Adequate	
Gave a good feel of system?	☐	☐	

Overall impression	Poor	Ok	Great
Final design	☐	☐	☐
Design evolution	☐	☐	☐
Portfolio	☐	☐	☐
Heuristic evaluation	☐	☐	☐
Implementation	☐	☐	☐
Final video figure	☐	☐	☐

Section 1: Identification and Requirements

Phase 0: Setting the stage

0.1 Background Environment

Many students at the University of Calgary frequently visit the Taylor Family Digital Library (TFDL) for a variety of reasons such as renting out books, studying, catching up with friends, and working on group projects. One of the less well-known services at TFDL is the makerspace located on the third floor. Via the makerspace, students and faculty can use a variety of tools and machines that they otherwise would not have access to, such as 3D printers, vinyl cutters, and CNC routers.

Though there is an existing webpage and a variety of online resources for the TFDL makerspace, they are difficult to navigate. For library staff, the current solution often forces them to create individual custom solutions for specific problems, such as the need for an online portion of the space orientation during COVID. The fact that these tasks are hosted across the web means that they are not easily integrated with the TFDL website, and makes it difficult for end users to find all the information and resources they need. For example, currently, there is no way to book equipment, one must show up and hope that the machines they want to use are vacant. Additionally, certain tasks such as signing up for classes or workshops, are rolled into the larger TFDL system even in cases where they are not a great fit. Finally, the space is poorly advertised and there is little opportunity to engage with other makers, which seems to users like a missed opportunity especially given the community-oriented nature of the space. Overall, there are a lot of missing features and gaps in the current offering which we hope our system will fill.

0.2 What the system will be used for and general expectations that the system should satisfy

Our aim is to create a management system to help makerspace users better navigate the process of learning about and using the space. This web application will allow both beginners and experienced veterans to book equipment, register for events where you learn or connect with the wider community of makers at TFDL. For library staff, the goal of the system is to help them

complete the parts of their job that are specific to the makerspace, and reduce their need to have domain-specific knowledge about how to run the space. In general, the system should function as a centralized online hub for both users and managers of the makerspace. It should reduce the need for makerspace-specific tasks to rely on outside solutions, but in scenarios where outside solutions do work well, the app should handle them gracefully and ensure they are easy to find and use within the context of the larger system.

0.3 System Constraints

There are a number of constraints to take into account when developing a system for the TFDL makerspace. First, the system should integrate well with the TFDL website. Whatever solution we develop needs to provide a seamless experience for users who discover the space via the TFDL, including scenarios where the TFDL advertises or promotes its makerspace offerings, and thus we want to avoid creating a system which requires users to download an external app or using any kind of specialized hard- or software. Additionally, the system needs to be easy for library staff and university IT personnel to maintain, and should introduce minimal complexity on top of their existing solutions. Together, these concerns led us to choose a web application as the best fit for the incoming makerspace management system.

Phase 1: Identification

1.1 Expected types of users

The expected type of users for this application are mainly expected to be students looking to use the makerspace and the tools in it for basic manufacturing or prototyping abilities for classes, startups, hobbies and so on. However, other users can include university faculty and staff. The typical users can range from being highly experienced to having little to no experience.

1.1.1 Inexperienced Makerspace Users

This category of users are interested in using the makerspace, but are not necessarily familiar with the tools and skills required. They can be either students or faculty. The inexperienced users are likely to benefit from things such as introductory workshops and full-service or guided experiences.

1.1.2 Experienced Makerspace Users

This category of users already has experience in the makerspace and likely has a specific set of knowledge and skills on particular machines. Again, these users could come from any part of the university community. They are self-sufficient and know what they want out of their experience at the space.

1.2 Work contexts

Students using the makerspace range both in experience level as well as intention for use of the space. From beginners to veterans with lots of experience using the various machinery offered in the workspace, a variety of students are there to work on both personal and school related projects. Typically, students use the space to take advantage of machinery that is not easily accessible outside of the workspace such as the 3D printers and the CNC Milling Machine.

Faculty members including students working in research positions are also users of the makerspace. Similar to that of regular students, faculty members typically use the space to take advantage of machinery that is not easily accessible outside of the workspace. However, the work setting may differ as most faculty members using the space are doing so for a set purpose and not for hobby. Most faculty are there to work on projects related to their research under the university or projects that will be used for teaching purposes such as projects for class demonstration.

1.3 Approach for getting background information

We developed our tasks using a variety of representatives. Some of our team members have used the makerspace before, so we used their opinions to validate our choices of these tasks. We have also asked friends who have experience in the makerspace community including a few who have used the TFDL makerspace in the past. In addition to that, we also emailed the staff of the makerspace in the TFDL in regards to how they run the space to get their thoughts as well. In creating each user and their task, we combined experiences from each of these sources.

1.4 Concrete tasks examples

Below are the tasks that we consider to be important for our management app.

1.4.1 Task 1: New User Going through Orientation

Joey wants to start using the makerspace. He goes to the TFDL webpage and reads the overview, and finds that there is a link to a safety orientation that all users must complete before they can use the space. He clicks the link and is taken to the TFDL's events calendar. He scrolls through the library's events, including lots that aren't related to the makerspace, and eventually finds a time slot that works with his schedule. He fills out the form on the TFDL website with his name and email, and registers for the class. Joey is sent a confirmation email to tell him that he has successfully registered. If the class is online, the email includes a video conferencing link.

This task is something that would be done by any new user of the makerspace, as a safety orientation class is required for all new users. For existing makerspace users, the task of booking a class may come up whenever the space is offering specific programming that the user is interested in. For this reason, booking classes is a frequent and important task for all space users.

1.4.1 Task 2: Checking if a machine is out of service

Ashley, a student at the University of Calgary, has been working on a series of carvings for her upcoming art exhibit. Newly inspired, she comes with a freshly concocted design for the centerpiece she has been missing. She rushes to the TFDL makerspace to use the CNC Milling Machine she has grown accustomed to operating to create her carvings over the last several months. To her dismay, she notices the machine is not working. She tries to troubleshoot the issue, but quickly gives up. In a panic, knowing she only has a week to create the perfect centerpiece, and not having planned for the Milling Machine to be broken, she immediately contacts the TFDL makerspace staff and a member is sent out to inspect the situation. After inspection, the staff member informs Ashley that the CNC Milling Machine is broken and it is going to take the team two weeks to repair the machine. Ashley, in a frenzy by the state of the situation, leaves the makerspace, now knowing she must find a replacement machine in time for her exhibit.

The expected user for this task is the students tasked with operating the makerspace who have either encountered out-of-service equipment or have been informed by other students, faculty or other staff members of equipment malfunction. This task will be done infrequently, but it is still important as users who are using the machine next will have to be informed that they will be unable to work on their projects when the machine is out-of-service.

1.4.3 Task 3: User creates a full-service job request

Eddy is interested in 3D printing a phone stand, but does not have the time nor experience using the 3D printer provided by the TFDL makerspace. He overhears from a friend that there is a full-serve 3D printing service provided by TFDL and quickly navigates to the website. Eddy is met with an encyclopedia's worth of information presented to him pertaining to Q/A of how the full-serve 3D printing process works as well as 3D printing policies. Eddy is not the most technologically inclined individual nor the most patient and quickly gets annoyed, thinking to himself "Where's the button to get started!". He is unaware that hidden deep within the text of a paragraph section towards the bottom of the webpage is a hyperlink to an online form for full-service 3D printing. Eddy gives up and closes the webpage.

Later, he asks his friend to help him navigate the process of setting up a self-serve print. His friend helps him find the link, and Eddy is able to fill out the steps of uploading his 3D model, picking the scale of the print, and making decisions about the color and type of material that should be used. He finishes the setup for the print job and receives a confirmation email telling him that his model is in queue. Eventually, Eddy receives another email telling him that his print job is ready to pick up at the library. He heads down to the makerspace to get his new phone stand.

The expected user of this task is someone that has already attended a safety orientation and is qualified to use the makerspace, but is not necessarily a dedicated maker or user of the space. They may not have the technical expertise or tinkering ability to set up their own 3D print. This task would be done whenever the user wants to use the full-service 3D print option. It is considered important as the user will need to complete this task to specify what they want for the print job so the staff will have the information to complete this job.

1.4.4 Task 4: Checking if a machine is booked by someone else

Josh wants to use the 3D printer but when he gets to TFDL there is someone already printing something. Josh leaves the makerspace and finds a way to pass time while waiting for the other person to finish. When Josh comes back, the other person is still printing for an obnoxiously long time and it is nearing closing time. Knowing that printers can not be left unattended, and that all print jobs must be initiated with enough time to finish before closing,

Josh gets impatient and angry. He leaves the makerspace and decides to come back sometime later.

Current users of the makerspace who have finished orientation would be frequently checking if machines are available for use, something that would be highly important if you want to use a machine. However, the current system in TFDL for using machines frustrates Josh as he is unable to check when machines are free, busy, or out-of-service.

1.4.5 Task 5: Experienced User 3D Prints Figurines

Jessica is a third year student on the university's soccer team who has a hidden talent for making 3D models. Jessica frequently visits the TFDL makerspace in order to print off her figurines, so many of the library staff are well acquainted with her. Upon arrival, Jessica is greeted by Jaime, who is one of the staff on the third floor of TFDL. Jaime knows Jessica is experienced with 3D printers, but as a formality, she mentions that she would like to do a self-serve print. Jaime tells Jessica that the third printer is not being used, so she may log on to the desktop computer to begin her printing.

Being fully certified to use the printer, Jessica walks over to one of the available computers next to her assigned machine and logs on to her google drive where her 3D models are saved. After hitting print, the process begins and Jessica is now left waiting for 2 hours. Printers cannot be left unattended, so Jessica waits in the space on her laptop, occasionally checking the job to make sure everything is working properly. Eventually, she finishes the print, cleans up the machine, and logs off the computer.

The expected user for this task is anyone with at least some experience using the machines in the makerspace. A user like Jessica taking on this task is quite frequent, since few students know about the TFDL makerspace, so if someone does know about it, they are likely to have experience in makerspaces beforehand. Supporting users like Jessica is especially important as they make up the community of the makerspace and they are the ones who can provide assistance for their inexperienced peers.

Phase 2: Tentative List of Requirements

2.1 Absolutely Must Include

- **Register for an orientation workshop:** This is something that all users must do in order to use the space at all. It is a pain point in the current system as users are required to search through lots of irrelevant data, so it is a high priority for the new system.
- **Book a time slot to use a machine:** Machine bookings are not currently supported in the current system, but would help users in many situations, especially post-COVID when trips to campus are more common. Knowing that a machine will be available and ready when needed is a major improvement over the existing solutions.
- **Send a model to staff for full-service printing:** Our system must cater to the needs of users with various experience levels. Support for staff-assisted 3D printing is vital for the class of users who are newer or not yet self-sufficient.

2.2 Should Include

- **Incorporate existing online learning resources for easy access:** There are some functional online resources developed by the makerspace, of which redoing them is out of scope. However, it would be very helpful to have a centralized location where users can find and access these external resources.
- **Get reminders about a machine booking or a workshop:** This is functionality to support the must-include tasks of registering for workshops and booking time on a machine. It can potentially be very simple, such as an email notification, and provides high value, so it is a good candidate for inclusion.

2.3 Could Include

- **Request or show interest in a workshop that is not currently offered:** Currently, when no orientation workshops are available, there is no built-in way to express interest. While this functionality would make the system more robust, it is not necessary as there are other ways to solve the problem such as emailing library staff.

- **Get live updates about a full-service print job in progress:** Though this feature would potentially be a good candidate for future iterations of the system, it is not necessary for the initial product and adds significant complexity.
- **Notify makerspace patrons of machine's deemed out of service:** Similar to getting live updates about a full-service print job in progress, this feature would potentially be a good candidate for future iterations of the system, however it is not necessary for the initial product and adds significant complexity.

2.4 Exclude

- **Display completion of workshops on your user profile:** We expect booking to be the main functionality of the system, and thus complex user profiles are not necessary.
- **Get certified to use a machine or tool:** The main focus of the system is to give users the ability to book in-person experiences such as workshops and machine times. Creating digital certification content is out of scope.
- **Community features:** While it would be really interesting to include community aspects such as the ability to share projects or connect with other users, this is also outside of the scope of the system.

Section 2: The first prototype and walk through

Phase 3: Prototyping

For our prototyping methodology, each individual in our group developed their own prototypes. These early prototyping examples can be found in *Appendix I: Initial Prototypes*. From those rough designs, we cherry-picked the qualities that we liked and amassed them together to create an alpha prototype (Figures 13.1 - 13.5, Appendix I). Following the re-evaluation of that prototype, we made some changes to it focusing on having more visuals and making it more interactive (Figure 14, Appendix I), rather than constraining the design to a static format with simple scrolling and clicking.

For the final prototype, we decided to keep some elements from the designs we had for "booking a machine" and "booking workshops" and further expand on them.

Phase 4: Team discussions and Walkthrough

The following walkthroughs were done to create the prototype presented in *Appendix II: Final Prototype* (Figures 13 - 14, Appendix I). The issues encountered in this walkthrough were fixed to create the final prototype.

4.1 Task 1: New User Going through Orientation

Description of Step	Does the user have the knowledge/training to do this?	Is it believable that they would do it? Are they motivated?	Comment/solution
Go to makerspace website	Low knowledge.	High motivation.	Joey is motivated to enter the webpage when interested in using the makerspace, however he might not know that he must browse the library website to use the

			makerspace. **Solution:** Ask the library staff to promote the makerspace on their webpage.
Navigate to 'Book Workshop' tab	High knowledge.	Medium motivation.	The library webpage indicates he should register for a safety orientation before he can do anything else. His motivation is medium because even though he would rather use the makerspace right away, he knows he must register for an orientation for safety reasons.
Select a workshop date	High-medium knowledge.	Highly believable, medium motivation.	Although the Booking tab states this workshop should specifically be an orientation the Events tab does not, so it may lower Joey's motivation to go back to confirm what type of workshop he must register to. Also if Joey does not find a workshop that fits his schedule this will lower the motivation to use the makerspace. **Solution:** Add asynchronous orientation link to the Events tab.
Click register.	High knowledge.	Highly believable	

		and high motivation.	
Enter name.	High knowledge.	Highly believable and high motivation.	Joey is prompted to enter his name and he is motivated to do so to provide his information to the workshop staff.
Enter email.	High knowledge.	Highly believable and high motivation.	
Enter UCID.	High knowledge.	High-medium motivation.	Joey is prompted to enter his UCID and he is motivated to do so to provide his information to the workshop staff. However, it could be the case that Joey does not have a UCID and therefore cannot use the makerspace. **Solution:** Add a notice reminding users that only students, faculty and staff are allowed to use the makerspace.
Click register	High knowledge.	High motivation and highly believable.	
Read confirmation details	High knowledge.	High motivation.	**Problem:** the day of the week is not displayed in the details.

			Since most people organize their schedules thinking of days of the week, not showing one is a disadvantage of the system. **Solution:** display day of the week for workshop events.
Export event to personal calendar.	High knowledge.	This step is optional so the motivation depends on the user.	
Click OK	High knowledge.	High motivation, highly believable.	

Other comments:
- Including a login in this task could be useful to save the completion of the orientation for each user, although it is not necessary for other steps of this task.

Pros:
- Not a lot of navigation required to complete the task.
- Steps for registering are clear and believable for the user to achieve. This helps ease the already tedious necessity to complete a safety orientation.
- Being able to export the event to a personal calendar makes it easier for the user to schedule.

Cons:
- Users are not aware they should complete the workshop if they do not try to book a machine from the makerspace. A welcome message or pop-up to new users could solve this problem.
- No alternative is provided if users do not find an orientation workshop that fits their schedule.
- Dates for workshops do not include the day of the week which might be inefficient for the users.
- Users are not aware they must be students, faculty or staff to use the makerspace until they try to register for a workshop. A warning in the events page or the booking page could solve this.

4.2 Task 2: Discovering a machine is out of service

Description of Step	Does the user have the knowledge/training to do this?	Is it believable that they would do it? Are they motivated?	Comment/solution
Go to makerspace website	Yes.	Yes, seeing as this is not too difficult of a task.	
Log in using UCID	Yes.	Yes.	It may be better to just ask for UCID upon booking.
Navigate to Booking tab	There is a possibility that she would be expecting a "machines" tab, but seeing as that does not exist, this would be the intuitive place to go.	Yes, there is no scrolling required, it is one of the first things you should see on the screen as it is on the top left.	This may be accelerated if we have notifications that tell you when one of your frequently used machines is out of order. Could also just be a list of all out of order machines since we are still contemplating on having a login.
Selecting the milling machine	She is used to using a milling machine so she knows what it looks like without even needing to hover over.	It is right in the middle of the screen, no scrolling required, so yes.	
Click left or right arrows to select a week	She is used to doing this on many apps including the university schedulebuilder, so she should know how.	She is so used to it by now that it should take little to no difficulty.	

Looking at the day and hours that she would like to use it	Yes, this is intuitive.	Yes.	
Seeing the whole day grayed out and hovering over it	Even if she did not, her first reaction would be to try and click on her date of choice.	Yes, she would try to click on the day to get her booking and the message would appear first.	
Being unable to click and reading the message from hovering that says unavailable	Anyone familiar with using any application is used to hovering over odd occurrences, most of the time it is because they try to click on it and the message appears before they click.	Yes, it is a short, single-line message, so reading it takes almost no effort.	
Choosing another day in the future to book	Intuitively, seeing other spaces that week that are not grayed out would signal to choose another day.	Having to look for another open day is rather annoying if it is many weeks in the future.	If the whole week is grayed out and the machine is out of order for many weeks, it might be better to include the next available date in the out of order message, that way she doesn't have to click right a bunch of times to find the next available week.
Hover over an available time slot	Yes because this would happen while she tries to click on it.	Yes because this would happen while she tries to click on it and she wants to	

		click to use the machine.	
Click the desired timeslot	Yes.	Medium motivation. Since times are adjustable, they may or may not click the desired time slot.	
Double-check booking details	Yes.	Yes, she is an experienced user and knows the importance of booking enough time for the job.	
Click 'Confirm Booking'	Yes.	Yes.	
Click 'Export booking to Google Calendar' (optional)	Yes. Experience is not required as the button describes itself.	Medium. Depends on the user's preferences, as this is a fully optional step.	

Other comments or problems we encountered:
- It may be beneficial to have a notification if any machines are out of order saving the user a lot of time on going through the booking process to see if their machine is available.
- Having a login would make this task easier since we would only display this notification if a frequently used machine is out of order.

Pros:

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- The hover mechanic and grayed out coloring is really intuitive as there are many applications with this feature. This means that a lot of users will be familiar with what this means.			
- Showing unavailable in the calendar booking section allows students to immediately book dates further in the future if they are not in a rush. This helps them with planning if they are a relatively busy person.			

Cons:
- If a machine is out of order for many weeks, having to go back and forth to find an available time slot may be annoying. We plan to add a note that tells you the next available date when you hover over an unavailable slot.
- Not having a login takes away our ability to send notifications about frequently used machines, but having a login increases complexity and requires more backend work.

4.3 Task 3: User creating a full-service job request

Description of Step	Does the user have the knowledge/training to do this?	Is it believable that they would do it? Are they motivated?	Comment/solution
Go to makerspace website	Probably. Full-service users are probably less technically inclined than other makerspace users. However, most people on campus are proficient with computers.	Yes. They are highly motivated. They are in search of a full-service solution for their project needs.	Like with some of the other tasks, the solution here would probably be non-technical, such as asking library or university staff to promote the space elsewhere online or in person.
Navigate to Bookings tab	Most likely. If the user has any experience with the makerspace website booking process, booking a self-serve and full-serve machine would	They are highly motivated. As the term "Bookings" is intuitive in nature, the user navigating	

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	follow this same navigation step.	to this tab would have clear intentions.	
Hover/click on a machine icon	Most likely. They know that they are looking for a full-serve option for their project design, therefore they know what machine they need to click/hover to accomplish their project goals.	Yes. They are highly motivated.	Problem: When a user hovers over a machine they are prompted with the option to book it, however our design does not specify to the user if the booking is for the self-serve or full-serve option. Solution: When a machine has multiple options, include a popup or button for each option instead of just 'Book' button
Read the full-serve job guidelines	Eddy is inexperienced with 3D printing therefore reading this section is essential.	Although users can be very impatient it is crucial to read this section if they want their full-serve job to be accepted by the service staff.	
Click the submission form	This should be clearly presented to the user and thus completing this step should not require previous experience.	Yes, the user should be highly motivated if they have reached this point in the full-serve process.	Problem: It is inevitable that some users will skip the full-serve guide. Solution: We could give a warning pop-up to the user

			prior to starting their submission form asking if they have read the guide and warning that their full-serve job can be rejected if not meeting guidelines.
Fill out job details	Yes, this should be clearly presented to the user and thus completing this step should not require previous experience.	Yes, the user should be highly motivated if they have reached this point in the full-serve process.	Problem: If the user tries to submit a file that does not fit the guidelines then the user's job will not be accepted. Solution: Small message below file submission section stating file type/max size.
Fill out personal info	Yes, this should be clearly presented to the user.	Yes, highly motivated.	
Submit full-serve job request	Yes, this should be clearly presented to the user.	Yes, highly motivated.	
Receive confirmation email that full-serve request is approved and in queue.	Yes. They must have included an email in their submission form to get this far in the process.	Yes, highly motivated.	
Receive email that the full-serve job is completed and ready for pick-up.	Yes. They must have included an email in their submission form to get this far in the process.	Yes, highly motivated.	Problem: we have some user's that may have forgotten to check their email that day/week. Solution: Send subsequent emails that their order is

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			ready for pick-up for up to a week.
Come to TFDL main service desk to pick-up your order.	Yes. Pick up details/guidelines should be included in the email informing the user to pick up their order.	Yes, highly motivated as they have already paid for the order.	

Other comments or problems we encountered:
- No cancellation guidelines in place if the user wants to cancel their print job.

Pros:
- Starting to really dig deep into details of where users might get stuck. Especially important for this job as we expect full-service users to be less tech savvy.

Cons:
- We have lots of asynchronous elements to this task that are hard to manage. Sending more and more emails doesn't feel like a great solution.
- Still no back button.

4.4 Task 4: Checking if a Machine is Booked by Someone Else

Description of Step	Does the user have the knowledge/training to do this?	Is it believable that they would do it? Are they motivated?	Comment/solution
Go to makerspace website	Yes.	High motivation. If they want to check if a machine is available for use on a specific day or time they would need to use the	

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		website.	
Navigate to "book a machine" tab	Yes.	Yes.	Problem: If they are a new user wanting to just check the calendar, they may not know it is under the "book a machine" tab, especially if they are not looking to book a machine.
Click on a machine icon	Yes.	High motivation. Will need to select a machine to check if it is available on certain days and or times.	
Click left or right arrows to select a week	Yes. It is a common feature when using online calendars.	High motivation.	
Hover over time slots highlighted in red to check details	Not necessarily. If the user is experienced in using the app, they may know about this function. If the user is new, they may not know but could have the curiosity to check.	High to low motivation. If the user already has experience using the app then they may not feel the need to hover over and check the details.	
Hover over time slots highlighted in gray to check	Not necessarily. Same as above.	High to low motivation. Same as	

details		above.	
Check for time slots not highlighted in gray or red	Yes.	High motivation.	

Pros:
-   Easy to navigate
-   Use of colors and legends to display occupied time slots.

Cons:
-   Some features like highlighting the calendar might be confusing for new users.

4.5 Task 5: Experienced User Booking a Self-serve Machine

Description of Step	Does the user have the knowledge/ training to do this?	Is it believable that they would do it? Are they motivated?	Comment/ solution
Go to makerspace website	Yes, she is an experienced user and well acquainted with the system.	Yes, she is an established community member and is motivated to use the space.	
Log in using UCID	Yes, she is acquainted with the system and is used to using UCID to log into a variety of systems.	High motivation. in order to book a machine they would have to log in for identification.	Comment: After further discussion, we've decided to remove the need for users to log in. The pieces that truly required it ended up being out of scope and it introduces lots of complexity.
Navigate to Bookings tab	Yes, she is an experienced user and	High motivation. She wants to book a	

	well acquainted with the system.	machine.	
Click on a machine icon	Yes, she is an experienced user and well acquainted with the system.	Yes.	Comment: On Tim's suggestion, we tried to improve this section visually from previous iterations
Click left or right arrows to select a week	Yes, she is an experienced user. Additionally, this is a common format for navigating online calendars.	High motivation, since the user would like to find a day to use a machine that is most convenient for them.	
Hover over an available time slot	Yes, they are well acquainted with the system. They would know this.	Yes.	
Click the desired timeslot	Yes.	Medium motivation. Since times are adjustable, they may or may not click the desired time slot.	
Double-check booking details	Yes, this is something very easy to do.	Yes, she is an experienced user and knows the importance of	Problem (from Tim): the day of the week goes away in this view, most people don't think of dates as days in the

		booking enough time for the job.	month. Solution: Add the weekday to the confirmation popup Problem: user may not know some of the booking details, such as how to estimate how much time they need Solution: system should default to a reasonable time, and attempts to change it should be allowed but should create a popup showing users how to estimate their needs
Click 'Confirm Booking'	Yes.	Yes, you will have to do so if you want to book your desired spot.	
Click 'Export booking to Google Calendar' (optional)	Yes. Experience is not required as the button describes itself.	Medium. Depends on the user's preferences, as this is a fully optional step.	
Receive confirmation email	Yes, they are an experienced user so they expect a confirmation email.	Requires no effort on her end.	
Arrive at makerspace 10	Yes, she is an	Medium	Problem: we have some text

minutes early	experienced user, so she would know that she has to arrive 10 minutes early.	motivation. Depends on whether or not the user decides to listen to this or if they remember.	telling the user to come early, but they may have forgotten by the time their booking comes around. Solution: Send a second email on the day of the user's booking
Show UCID to makerspace staff	Yes, all students should know what a UCID is.	Most students keep their ID on them while on campus, so this is not a very difficult task.	
Setup machine	She has used the machines many times, so she knows how to do this.	High motivation. It is self-serve printing and she is an experienced user. It is expected that you set up the printer yourself in order to start printing.	
Use machine	She has used the machine many times, so she knows how to do this.	Seeing as this is a hobby of hers, she is motivated to use the machine.	
Other comments or problems we encountered: - We agreed that requiring users to log in was unnecessary and created a lot of overhead in other places that we wanted to avoid, so we have removed it. This requires some other pieces of the prototype to			

change in response. Specifically, we need to add fields to the bookings detail page which require users to input their UCID and email

Pros:

- Feels more cohesive than other attempts. Fewer edge cases and fewer opportunities for users to back themselves into corners.

Cons:

- Design could take more risks, tends toward being 'clicky' when maybe there are better solutions.
- Some of the steps, only work because the user is experienced and already knows what to do.
- Some weird flow issues where we couldn't figure out a good way to get the correct info to the user at the correct time. Especially because we want to avoid a wall of text.

4.6 Analysis of Design

Overall, the design of this prototype is much more polished than previous iterations. There are far fewer places where a user requires specific knowledge to figure out where to go next. Additionally, the design feels more lively and engaging. Upon analysis of this prototype, we also realized that the system no longer needs user login features, which is a major reduction in unnecessary complexity.

The remaining challenges of this prototype were mostly surrounding the flow of asynchronous task portions, including figuring out when to provide the user with more information. For example, we realized that there were multiple places where the system needs the ability to get back in touch with a user at a later date, such as a booking reminder or a heads up that their full-serve 3D print job is complete.

Though this walkthrough revealed issues, most of the problems are easily fixed via tweaks or by adding additional context, as opposed to reworking major portions of the design. With these slight changes made, we feel that this prototype is in a good position to move ahead.

Section 3: Redesign Rationale

Throughout the redesign process, including the prototyping and walkthrough phases, a more cohesive design began to develop. However, there were still some usability and design challenges that we were able to address in the iteration that eventually became our horizontal prototype. First, we found that our previous design relied too heavily on modals and popups, which were annoying to use and added unnecessary clicks to complete basic tasks. Our issues with modals also revealed a second issue; we realised that we had several areas where interaction with one part of our UI caused information from another part to become hidden, even when that information was still relevant. Finally, we found our design to be too sparse, and we often didn't give the user enough information. Overall, we realised that we could be much more liberal in the amount of information that we could fit on a single page, which allowed us to address many of these issues while maintaining the pieces of the design that we thought were effective in previous iterations.

Dialogs and modals were a prevalent feature of many of our early designs. We often employed a popup to allow users to type in more information, and then a modal to confirm that their information had been processed. This resulted in multiple button clicks to complete even simple tasks. The use of modals was especially problematic, as they often contained little or no new information. An additional challenge related to our use of modals and popups was the occlusion of important information. In a number of cases, interacting with one part of the UI would cause other pieces of the UI to be hidden, essentially removing valuable information from view.

To fix these issues, we redesigned our UI to put less emphasis on modals, dialogs, and popups. This allowed us to take functionality and information that had previously been spread across two or even three popups, and collapse it into fewer pages. The major design change that incorporated this idea can be seen in the booking schedule page. Previous iterations had used separate pages for the schedule and the user's details (Figures 2.1, 2.2), and a popup to confirm that a user's booking had completed successfully (Figure 2.5). We were able to successfully put the visual schedule view, the user details, and the confirmation information on a single page, reducing 'busy work' and unnecessary clicks, while also ensuring that all relevant data is visible simultaneously (Figure 2.10).

The last aspect added to the prototype in the redesign process was giving the user more information that was helpful for the completion of tasks. For example, in the low-fidelity prototype the step of selecting a machine required a user to already know what each machine is useful for. Without a good understanding of what to look for, the "Book a Machine" page was not helpful to the user in finding the right device for their project. To solve this, both the list view and the visual view of the page were redesigned to include this information (Figure 1.3), where the user is able to select a machine from the makerspace and read its features. Additionally, the user is warned that they should complete a safety orientation before choosing to book a machine (Figure 1.4), which was not present previously.

Similarly, more information was added to the calendar view of bookings and the booking details page. For both, the day of the week was added along with the date since most students and faculty organise their schedules according to these. This way booking a machine can become more convenient. Finally, a way to estimate the time needed for a project was added to the

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booking section. This tool gives the user an estimated time to complete a project based on its size and level of detail so that they can book a machine for that period and not struggle with overlapping bookings.

Phase 5: Medium Fidelity Illustrations:

Previous: Booking a machine List View
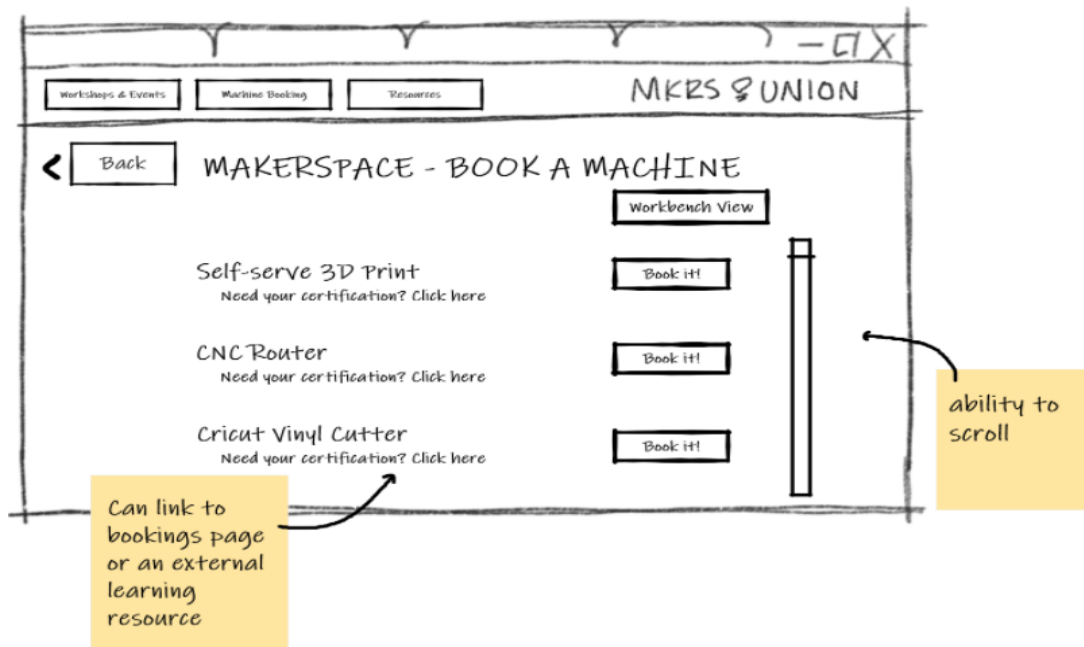
Figure 1.1: Previous - Booking a machine List View

Previous: Booking a machine Workbench View
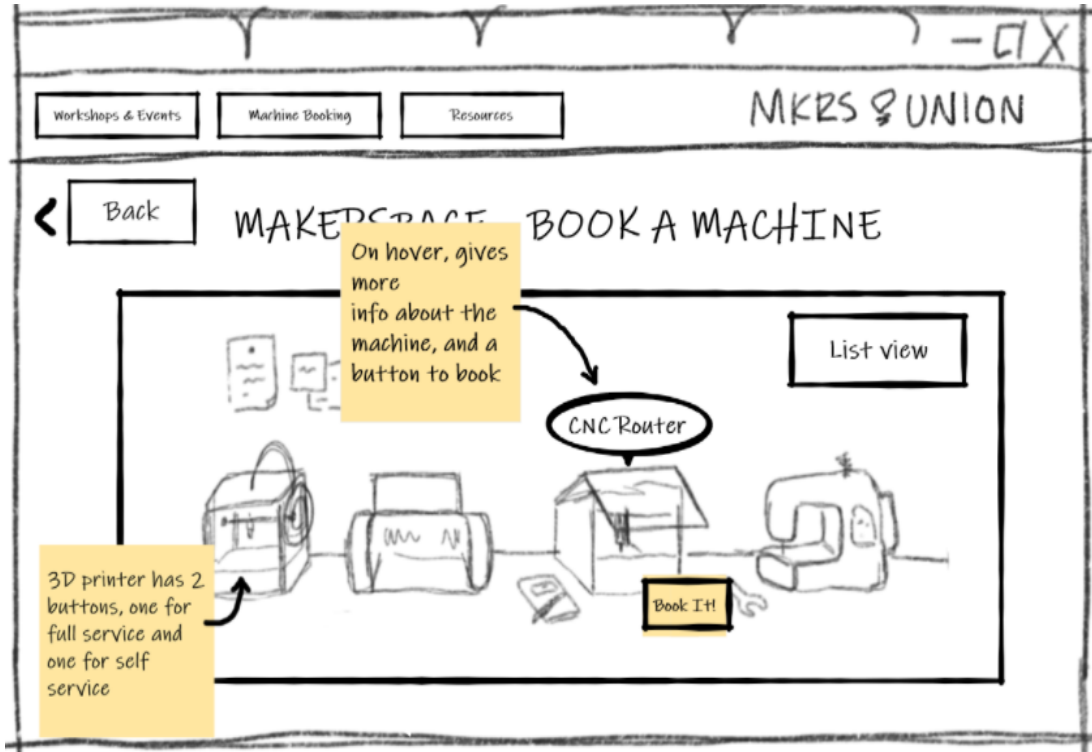
Figure 1.2: Previous - Booking a machine Workbench View

Updated: Booking a Machine List View

Workshops and Events　Machines and Bookings　Resources

MKRS UNION

← Back

Book a Machine

Machine List

Machine View

Carvey CNC Router ⌃

An entry-level, fully enclosed desktop CNC milling machine that you can use to create 3D carved objects out of materials like wood, plastic, wax and foam using digital designs. It is set up with a PC in the makerspace so that you can import images and set up your milling job on the spot.

To book the Carvey CNC router, you need to complete a safety orientation.
If you haven't done so yet, click here!

Book It!

Self-Serve 3D Print ⌄

Embroidery Machine ⌄

Sewing Machine ⌄

Figure 1.3: Updated - Booking a machine List View

Updated: Booking a Machine Workbench View
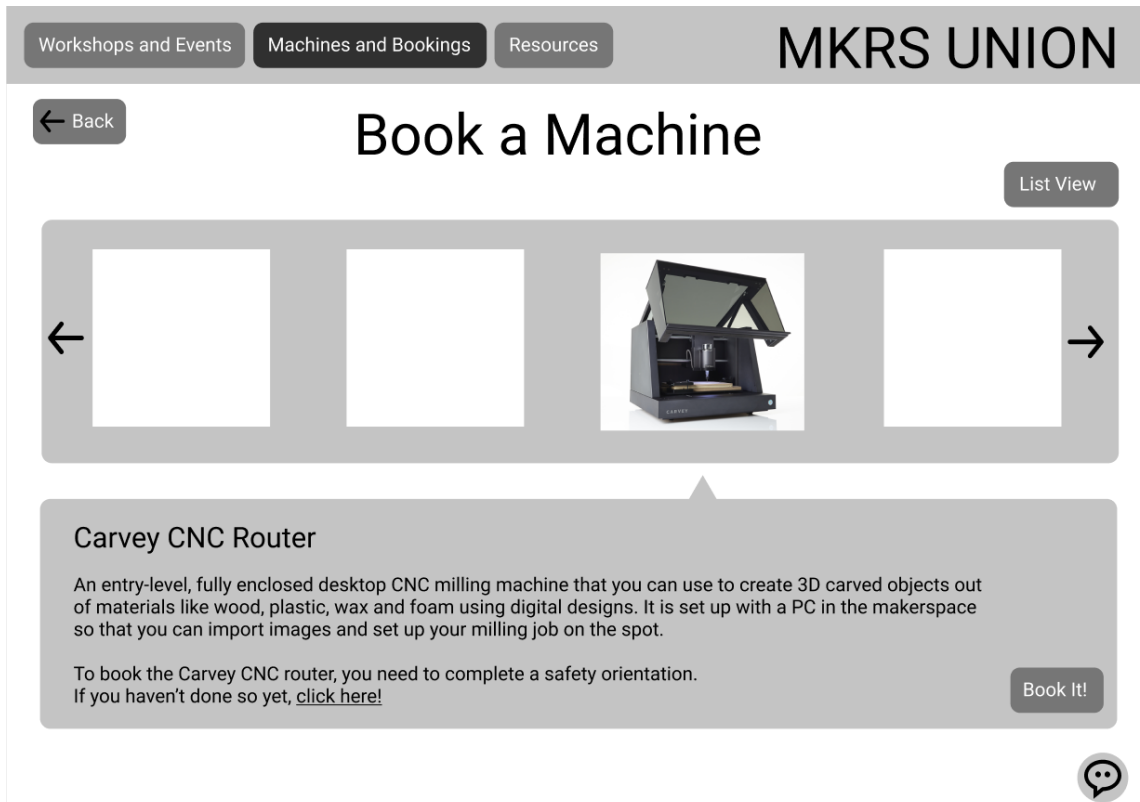
Figure 1.4: Updated - Booking a machine, Machine View

Previous: Booking a Machine Date and Time Selection
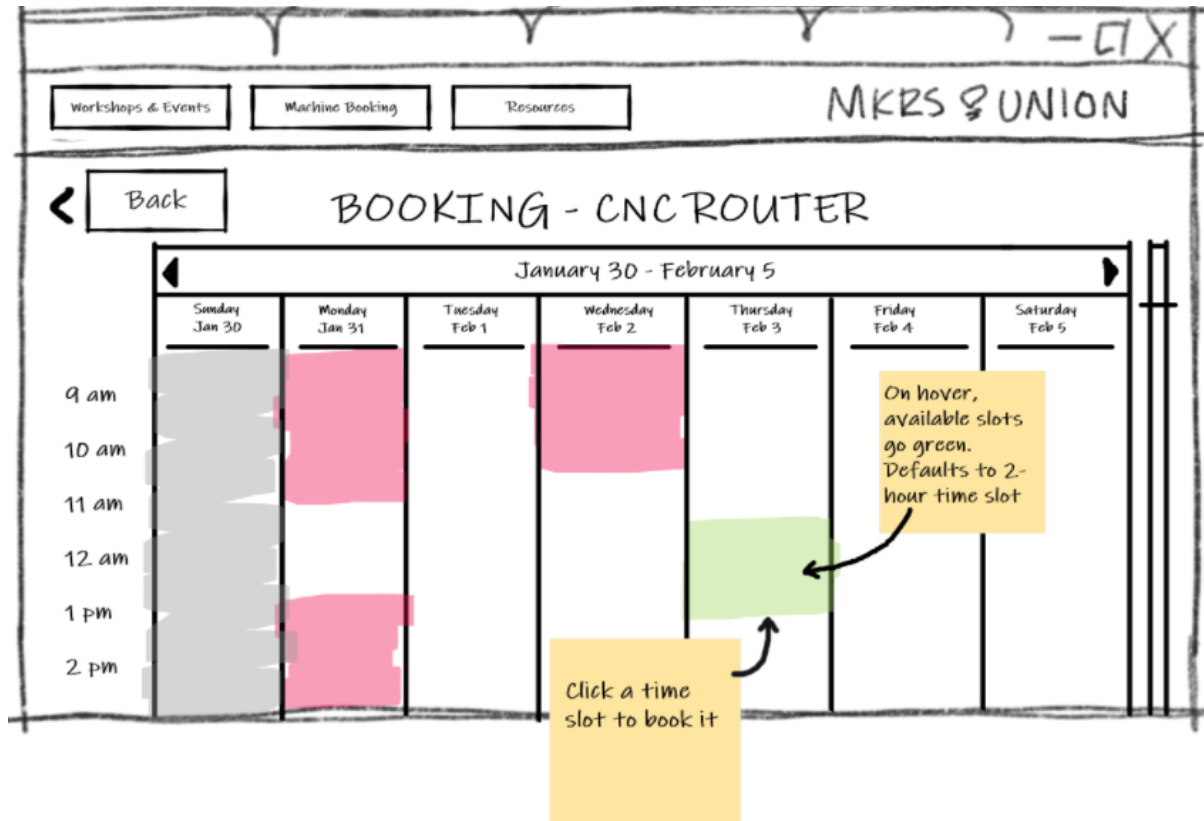
Figure 2.1: Previous - Booking a Machine Date and Time Selection

Previous: Booking a Machine Confirmation
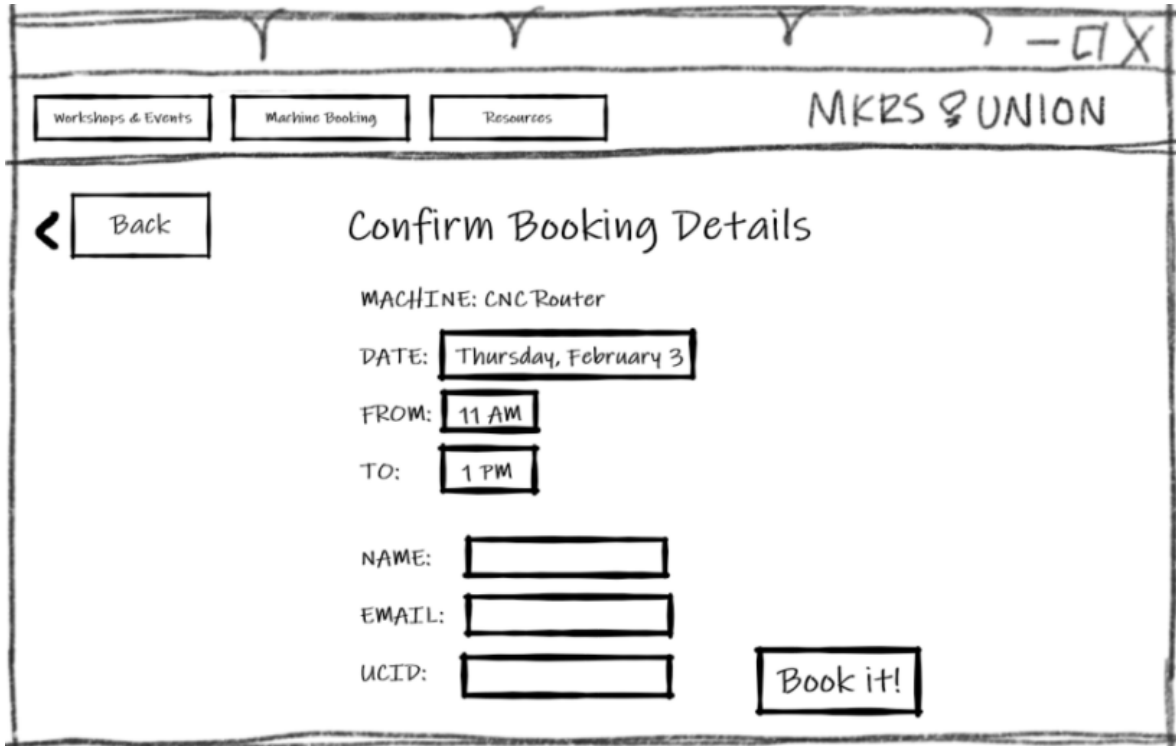
Figure 2.2: Previous - Booking a Machine Confirmation

Previous: Booking a Machine Confirmation Time Recommendation
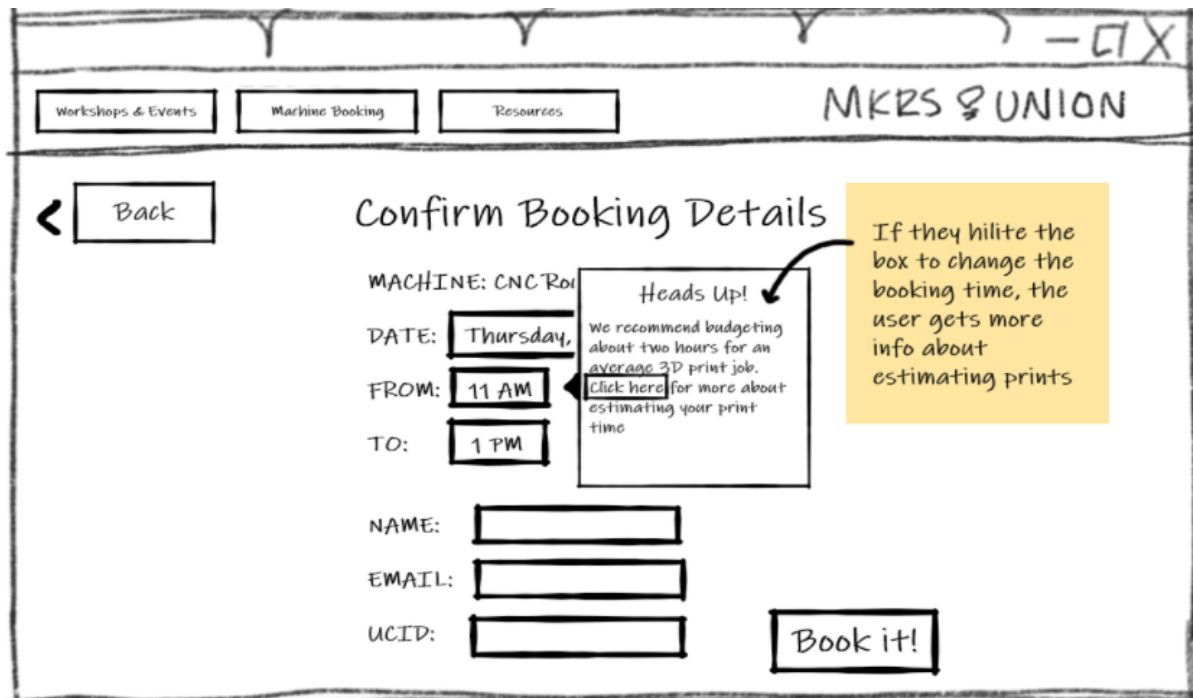
Figure 2.3: Previous - Booking a Machine Confirmation Time Recommendation

Previous: Booking a Machine Confirmation Safety Reminder
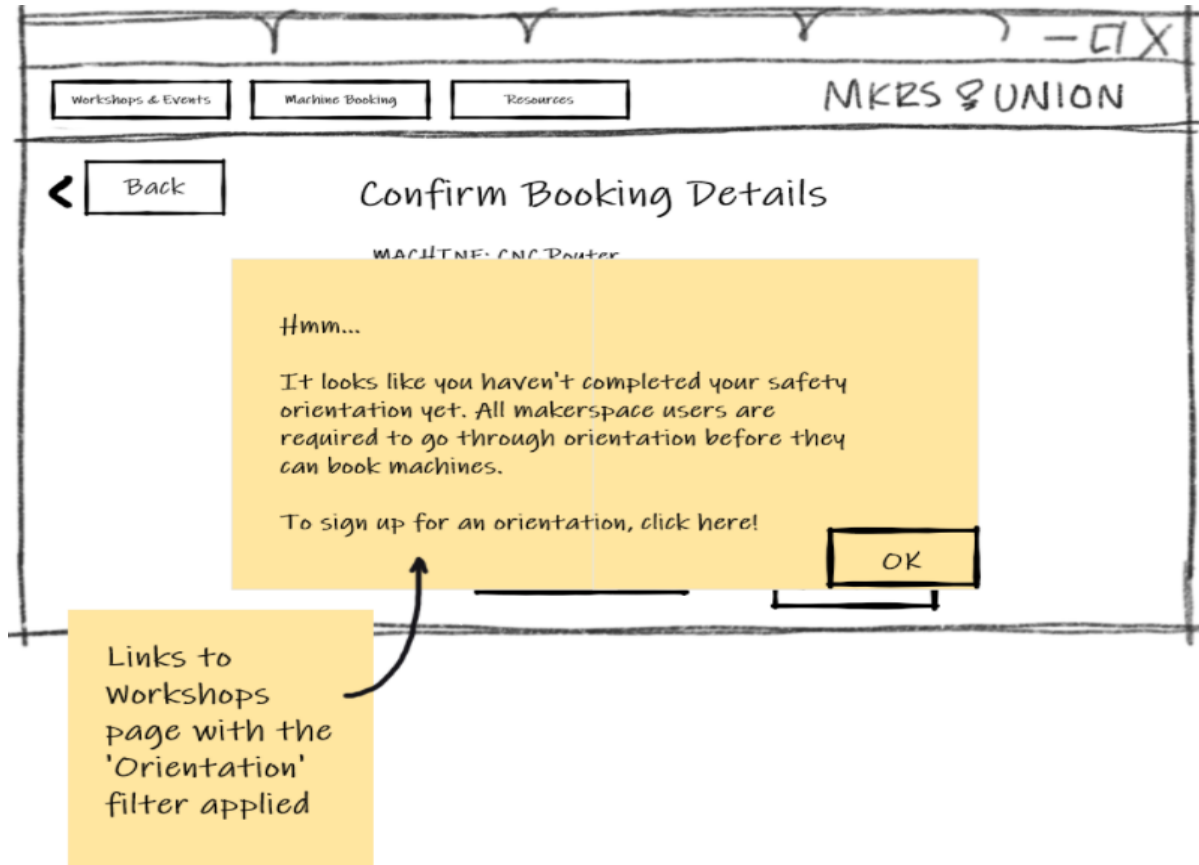
Figure 2.4: Previous - Booking a Machine Confirmation Safety Reminder

Previous: Booking a Machine Confirmation Message
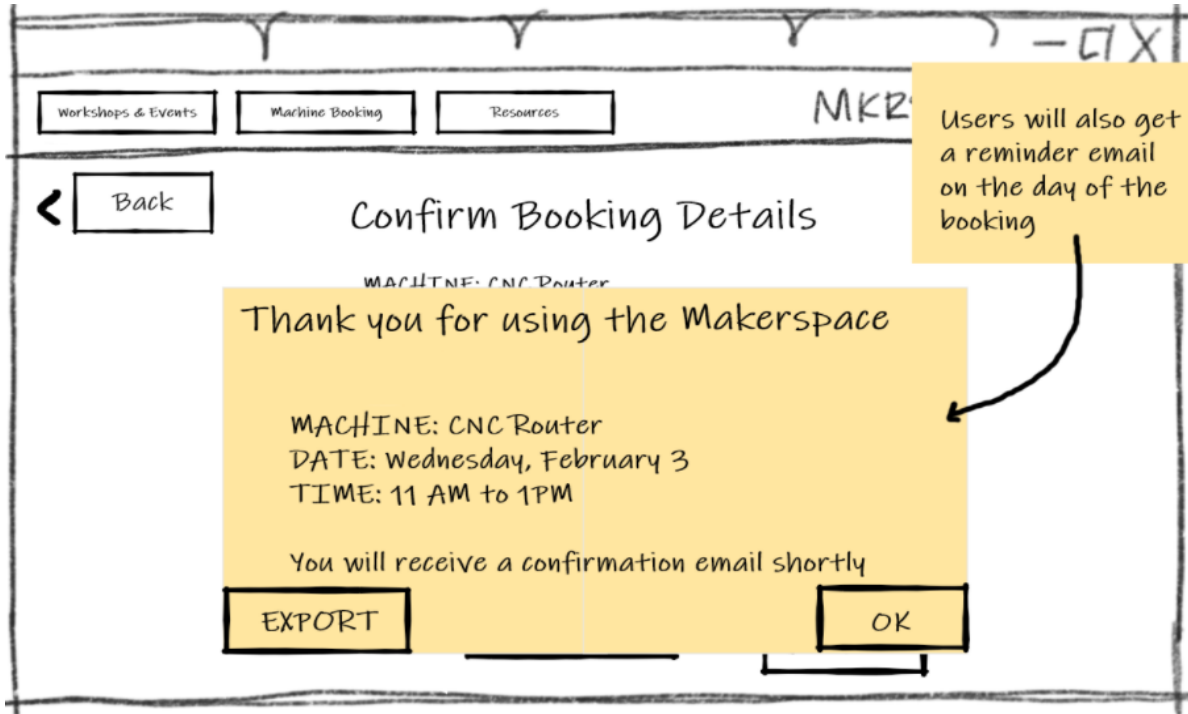
Figure 2.5: Previous - Booking a Machine Confirmation Message

Update: Booking a Machine Date and Time Selection Safety Course Needed
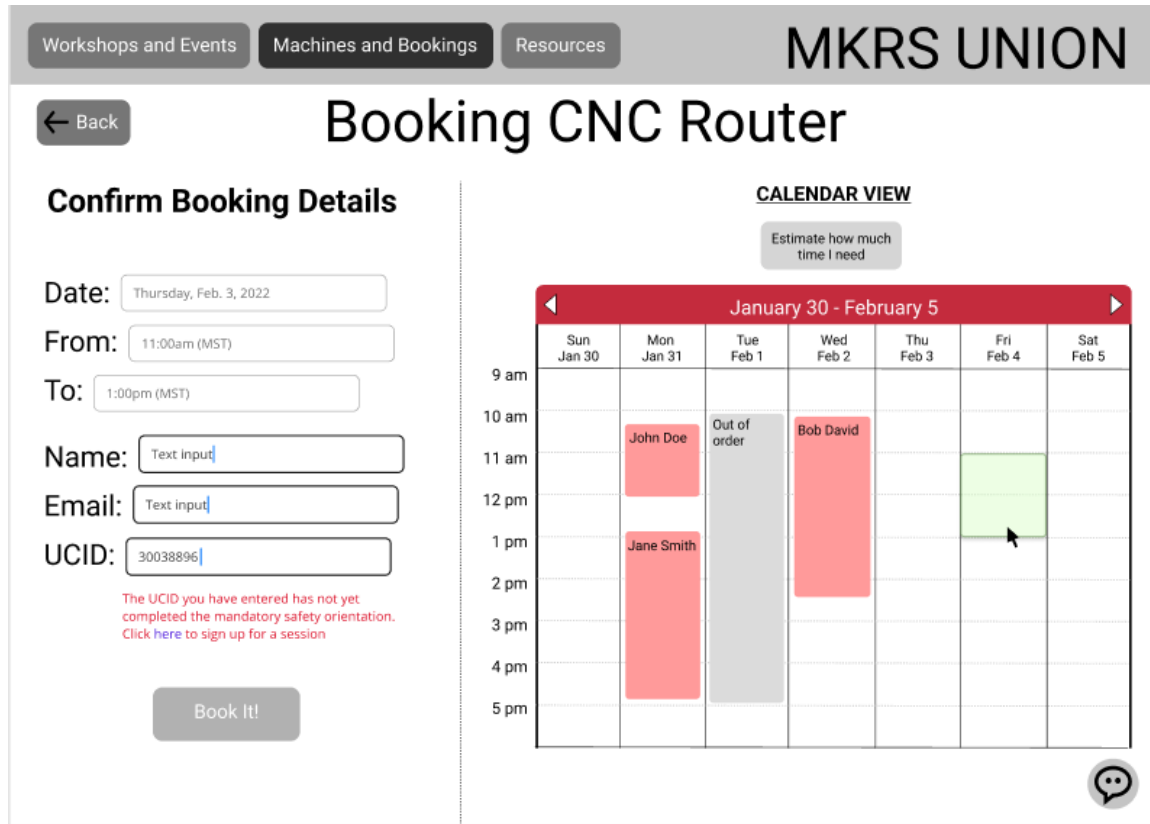
Figure 2.6: Update - Booking a Machine Date and Time Selection Safety Course Needed

<u>Update: Booking a Machine Date and Time Selection Safety Course Complete</u>

Figure 2.7: Update - Booking a Machine Date and Time Selection Safety Course Complete

<u>Update: Booking a Machine Date and Time Selection Project Size</u>

Figure 2.8: Update - Booking a machine date and time selection recommendation, estimating project time through questionnaire

Update: Booking a Machine Date and Time Selection Recommendation

Figure 2.9: Update - Booking a machine date and time selection recommendation, estimating project time results

Update: Booking a Machine Confirmation Message

Figure 2.10: Update - Booking a machine confirmation message

Updated: Confirmation Email

Figure 2.11: Update - Confirmation Email

Previous: Full Service 3D Print Guidelines
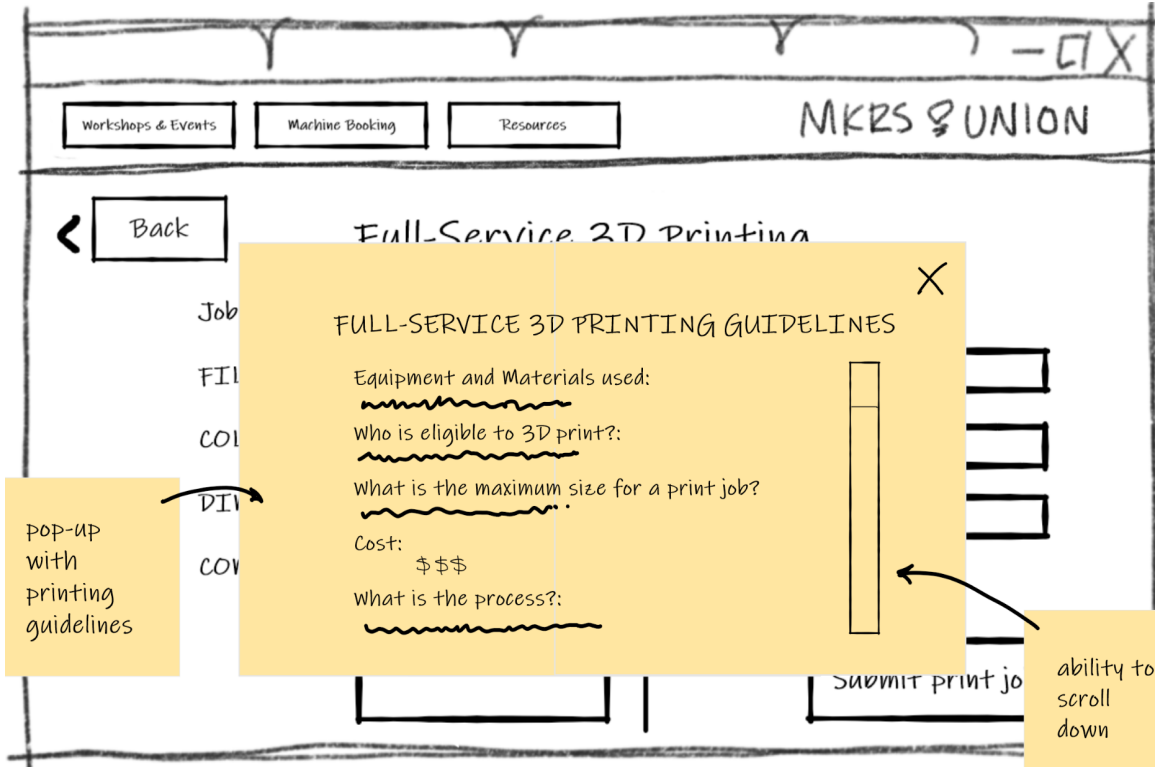
Figure 3.1: Previous - Full service 3D print guidelines

Previous: Full Service 3D Print Information
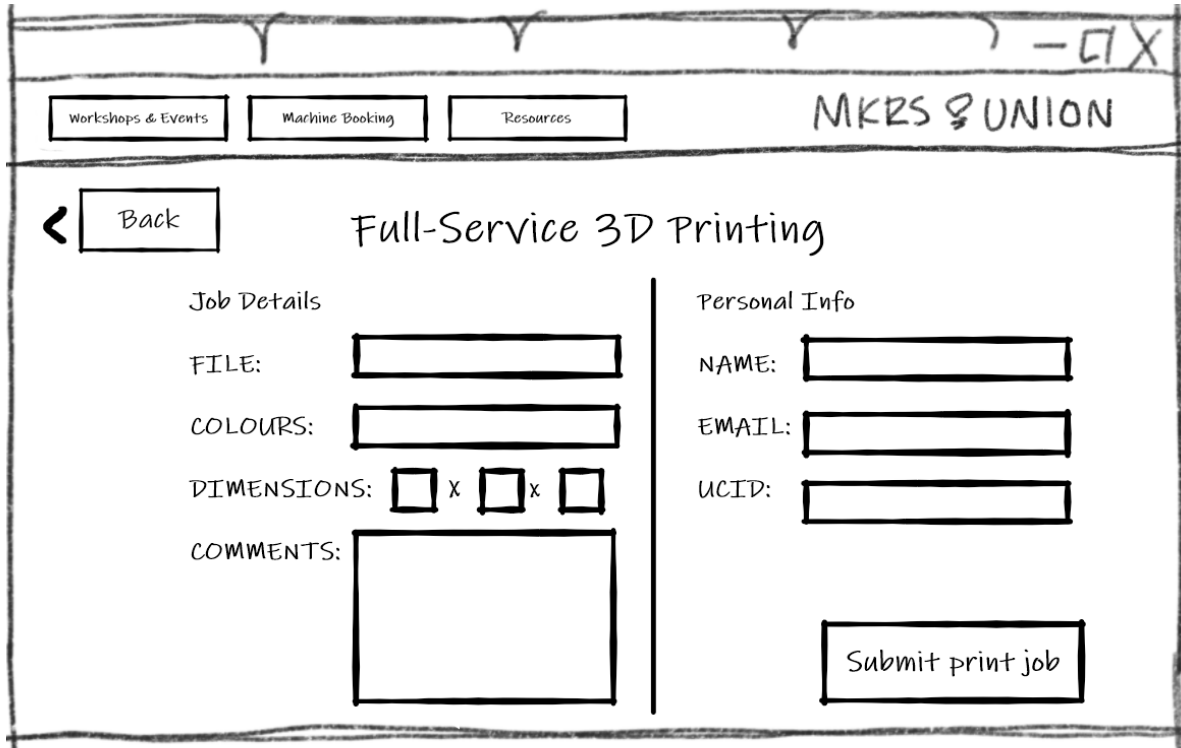
Figure 3.2: Previous - Full service 3D print information

Previous: Full Service 3D Print Submission Confirmation

Figure 3.3: Previous - Full service 3D print submission confirmation

Update: Full Service 3D Print FAQ

Figure 3.3: Update - Full service 3D print FAQ

Update: Full Service 3D Print FAQ Information

Figure 3.4: Update - Full service 3D print FAQ information and booking page

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Previous: Events and Workshops

Figure 4.1: Previous - Events and workshops page

Update: Events and Workshops

Figure 4.2: Update - Events and workshops page

Update: Events and Workshops Expanded
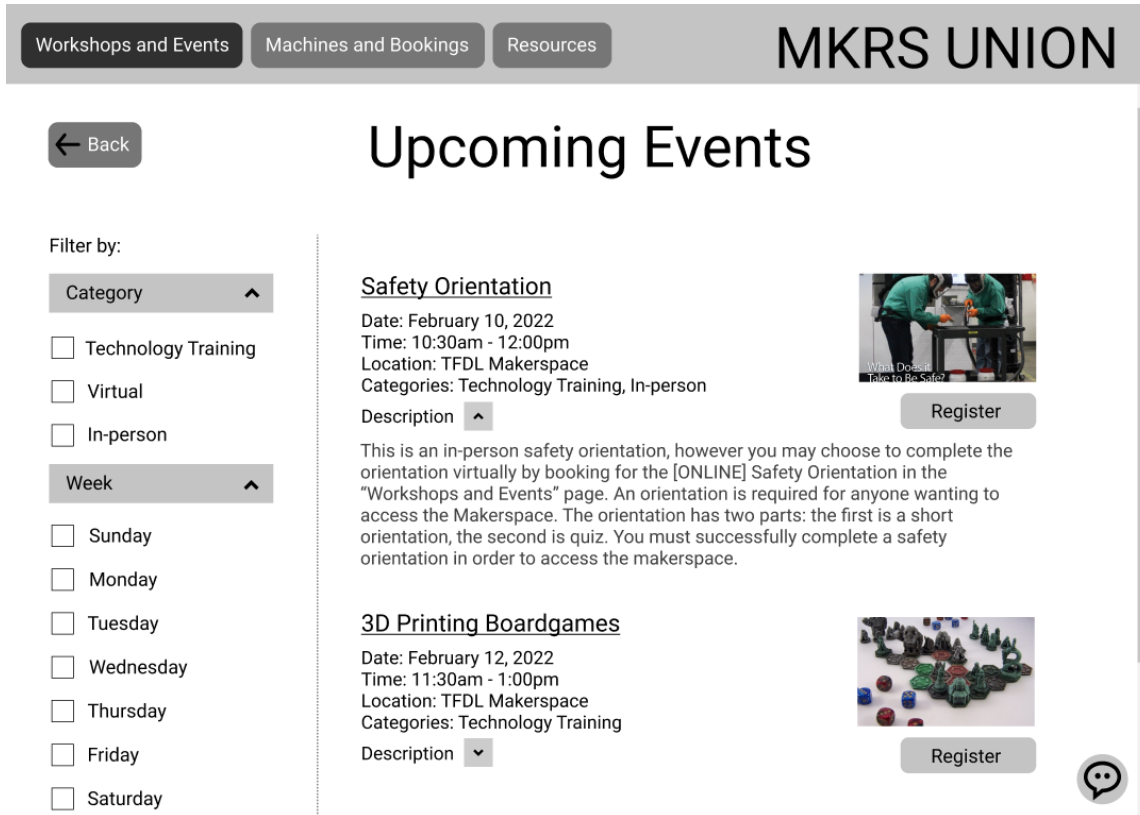
Figure 4.3: Update - Events and workshops page, filters and descriptions expanded

Previous: Safety Orientation
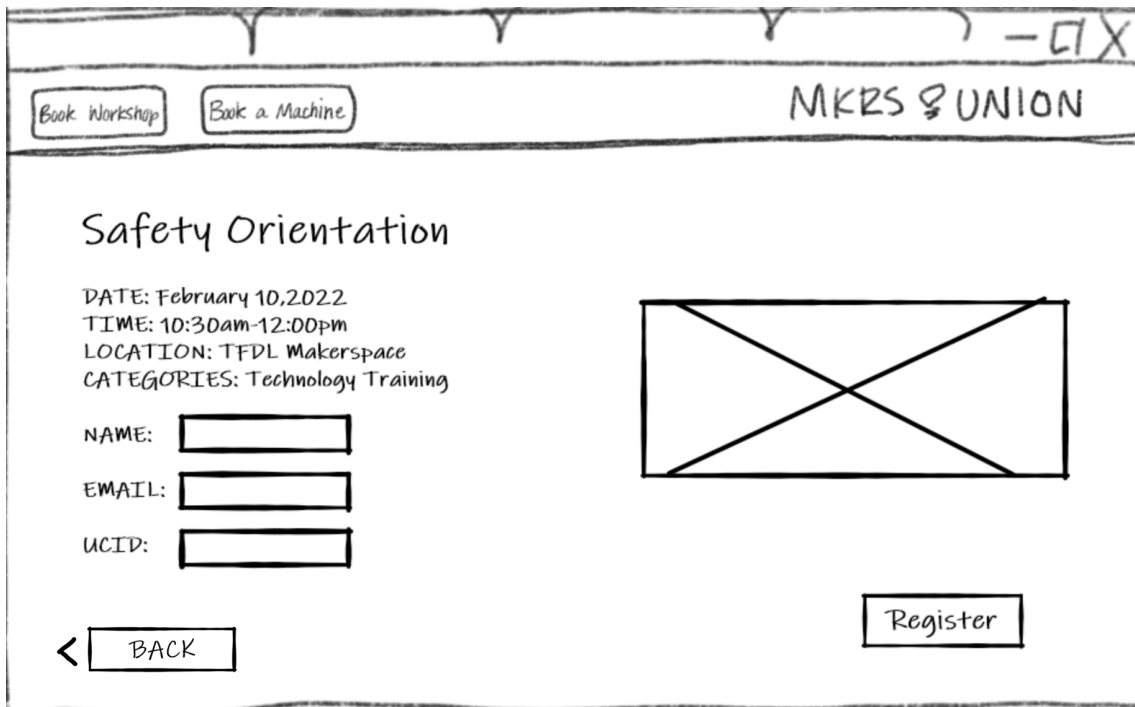
Figure 4.4: Previous - Safety orientation bookings page

Previous: Safety Orientation Confirmation
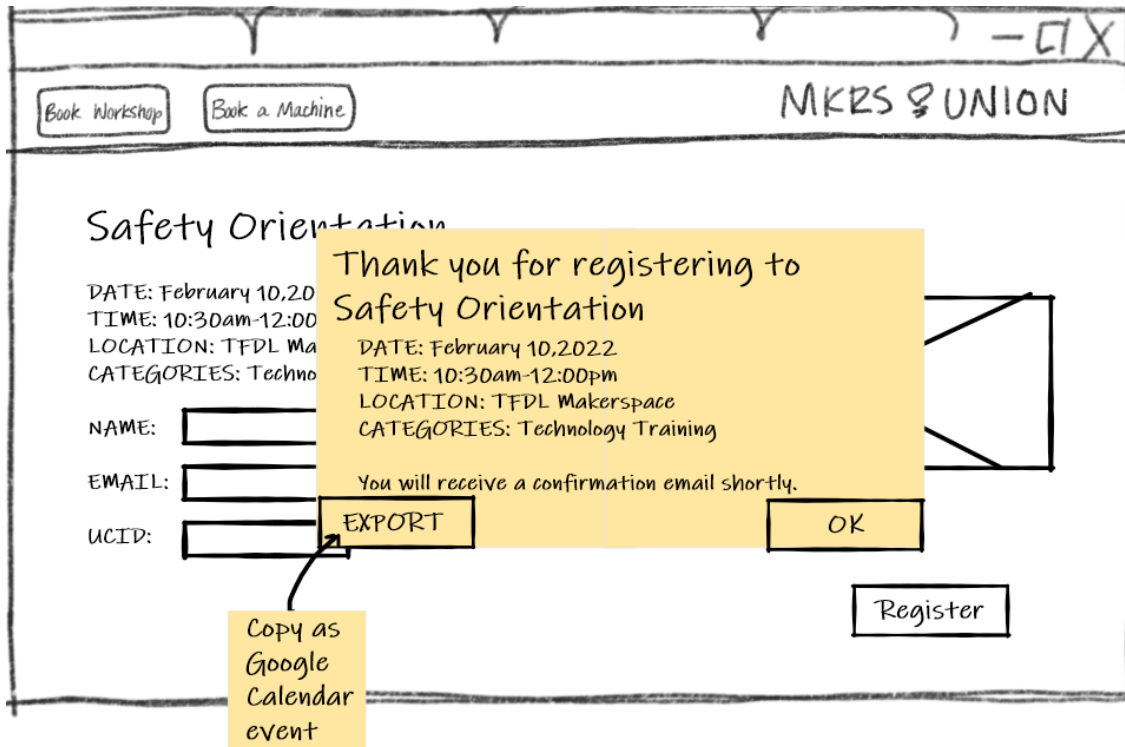
Figure 4.5: Previous - Safety orientation bookings page confirmation dialogue

Updated: Safety Orientation

Figure 4.6: Updated - Safety orientation bookings page

Updated: Safety Orientation Confirmation
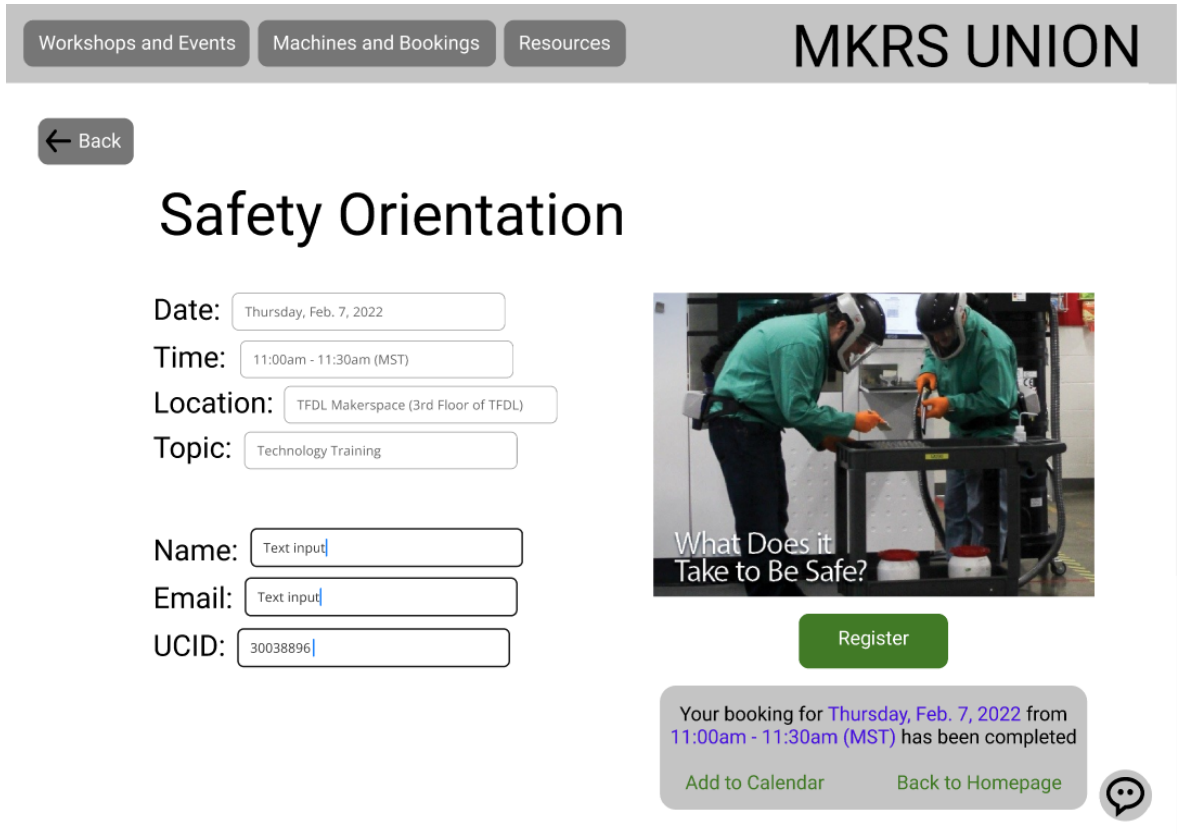
Figure 4.6: Updated - Safety orientation bookings page and confirmation blurb

Previous: Other Resources
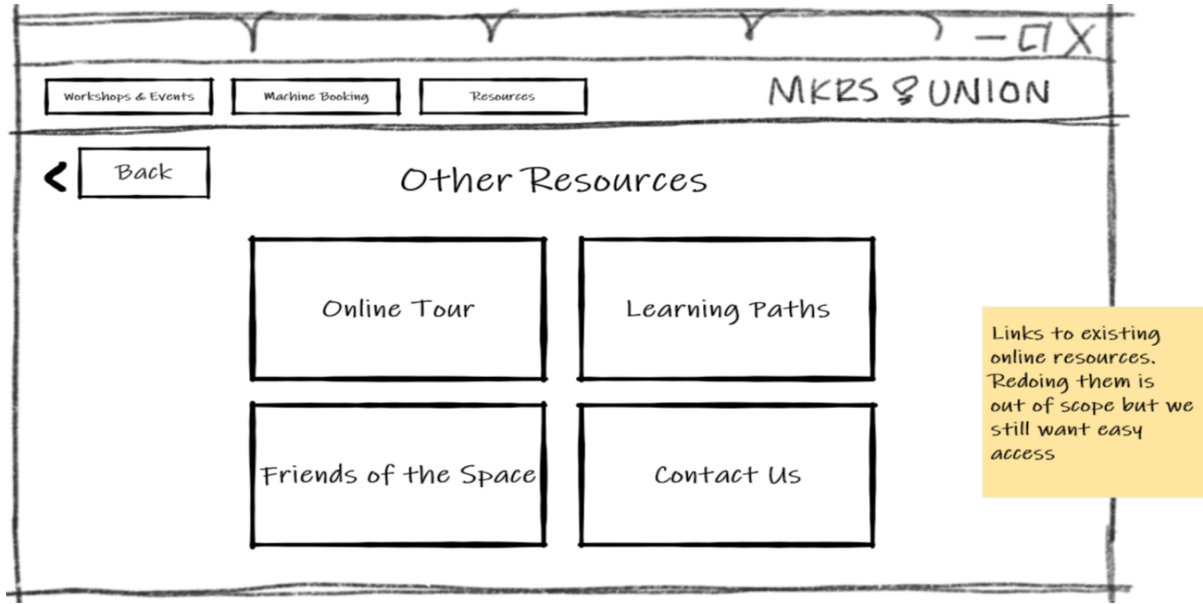
Figure 4.7: Previous - Tab to find other resources that the users may need

<u>Updated: Other Resources</u>
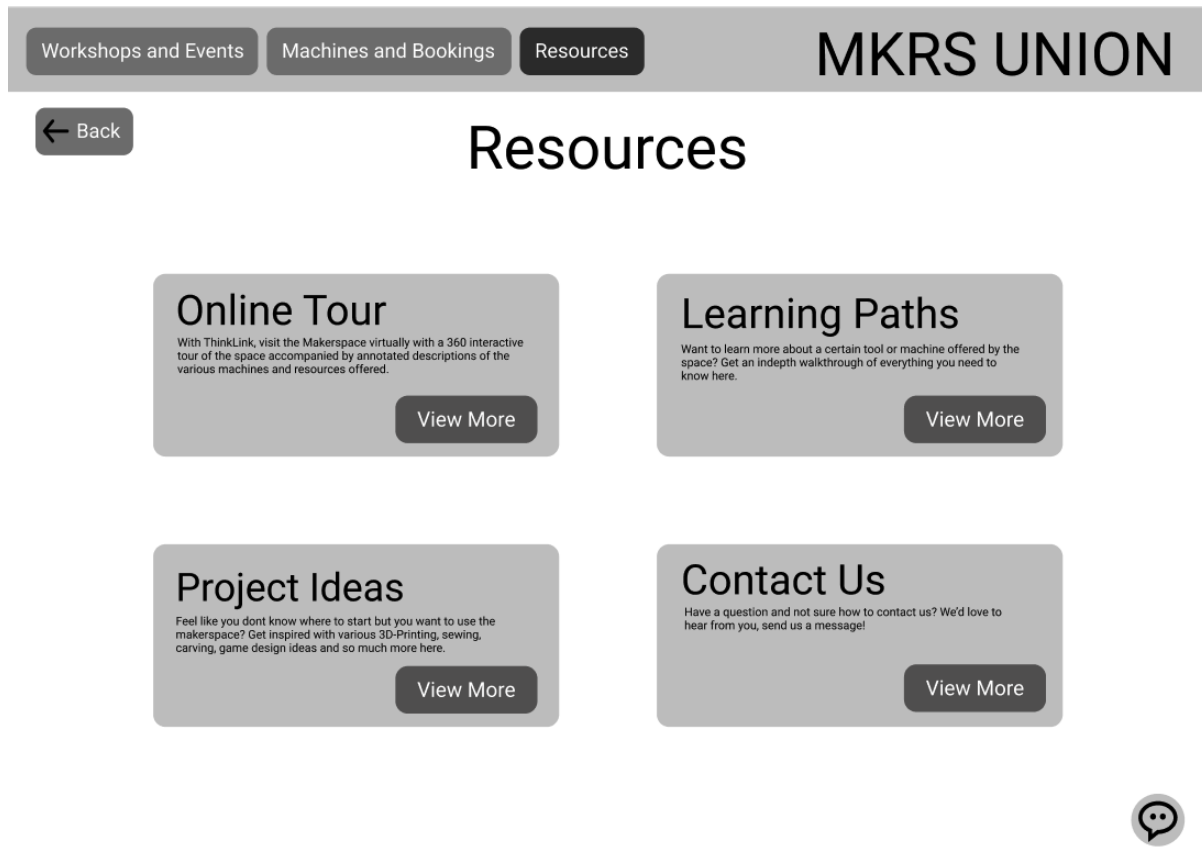
Figure 4.8: Updated - Tab to find other resources that the users may need

Section 4: Vertical Prototype Illustrations

Landing Page:

Figure 1.1 Landing Page

Getting Started

Figure 2.1 Getting Started

Workshop Selection

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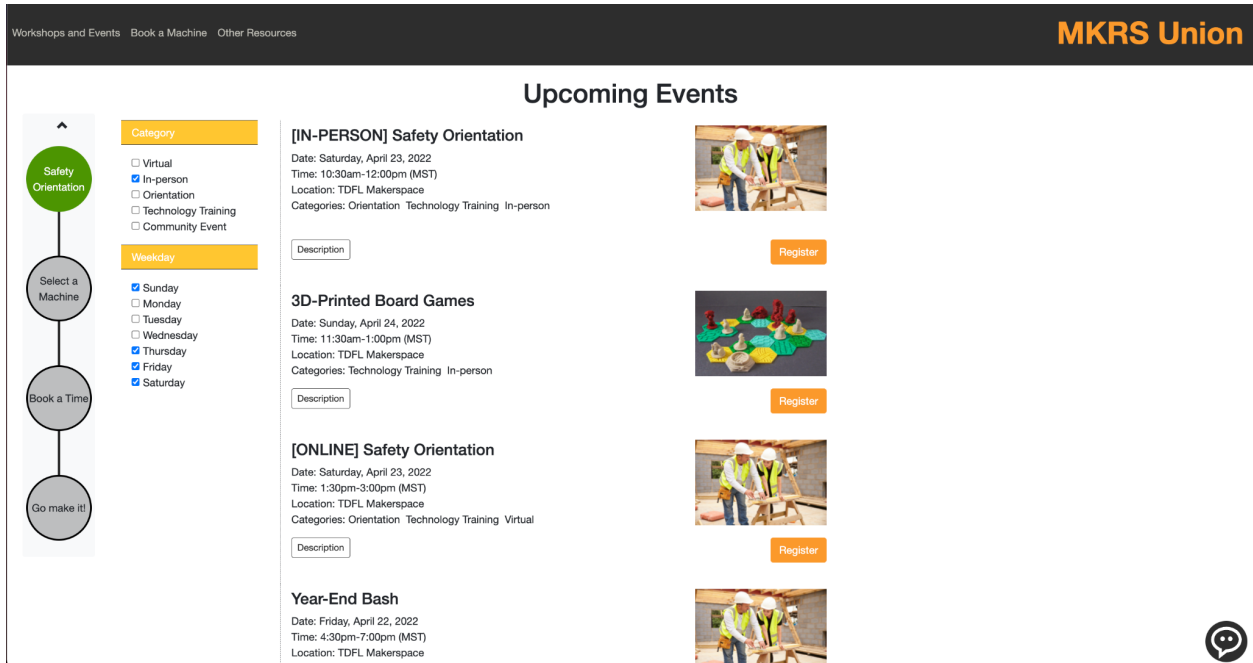
Figure 3.1 Selecting a Workshop with Filters
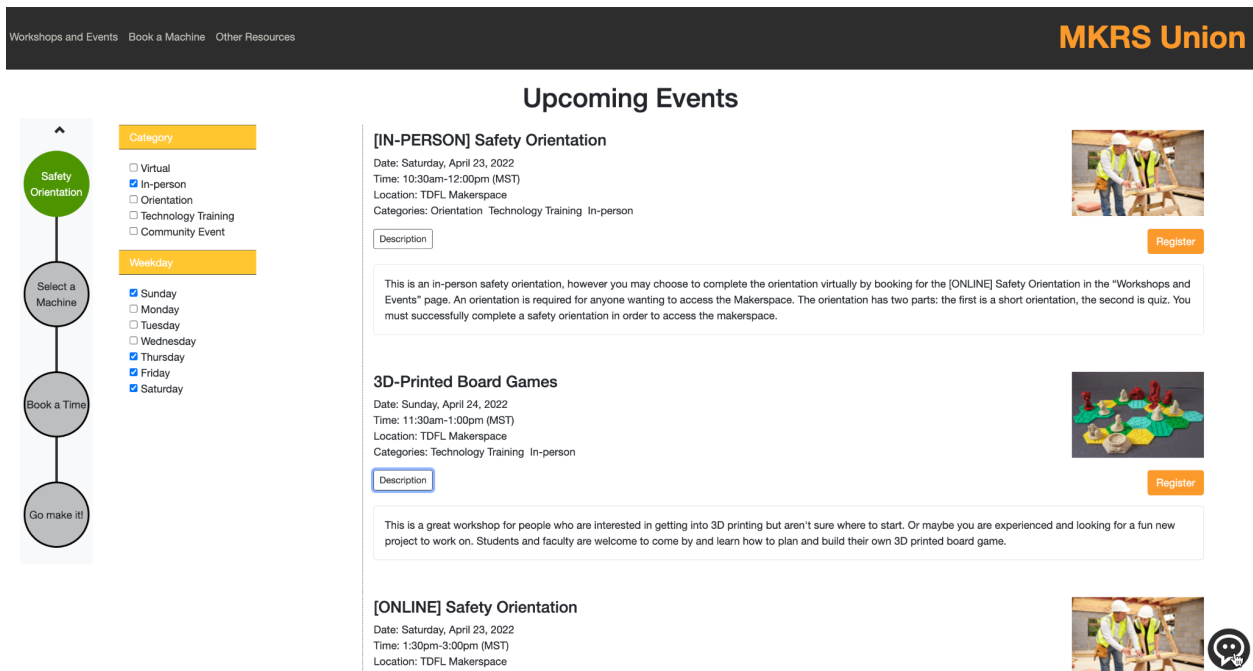
Figure 3.2 Selecting a Workshop Descriptions Expanded

Booking a Workshop:

Figure 4.1 Booking a Workshop, Nothing Filled

Figure 4.2 Booking a Workshop, Invalid Entries

Figure 4.3 Booking a Workshop, Valid Entries

Figure 4.4 Booking a Workshop, Booked
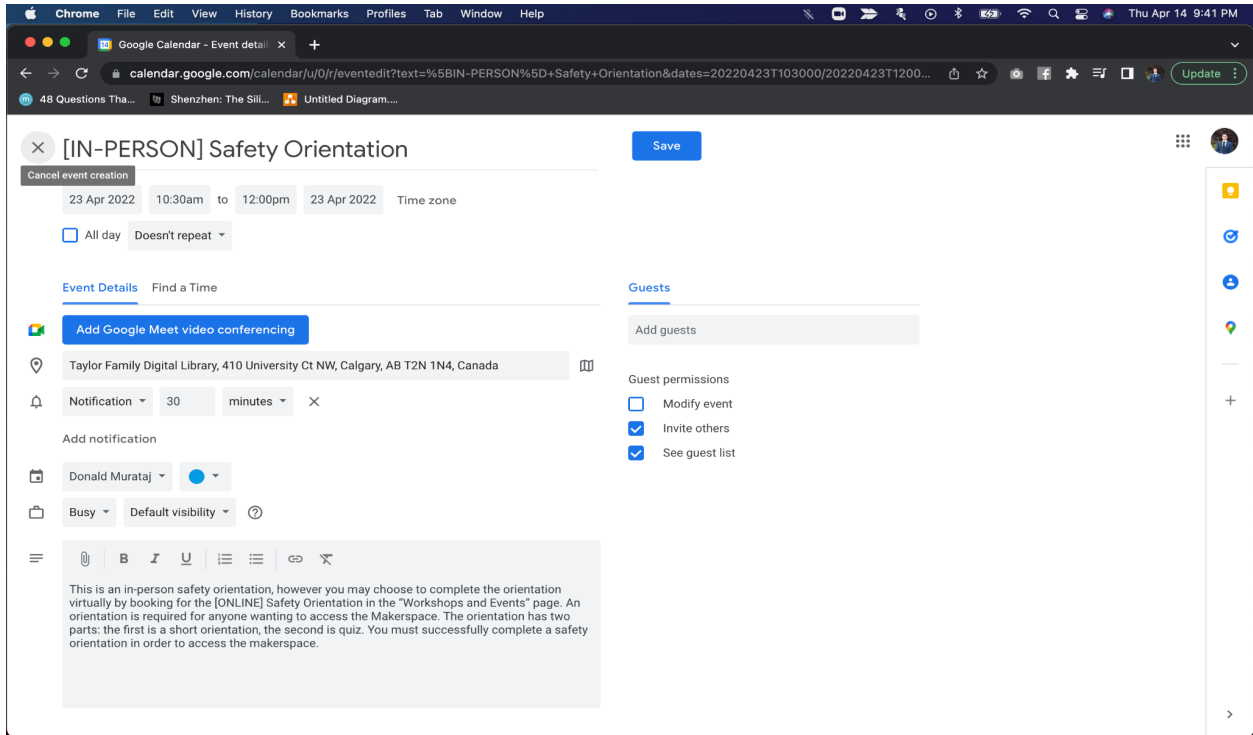
Figure 4.5 Booking a Workshop, Add to Calendar

Selecting a Machine:
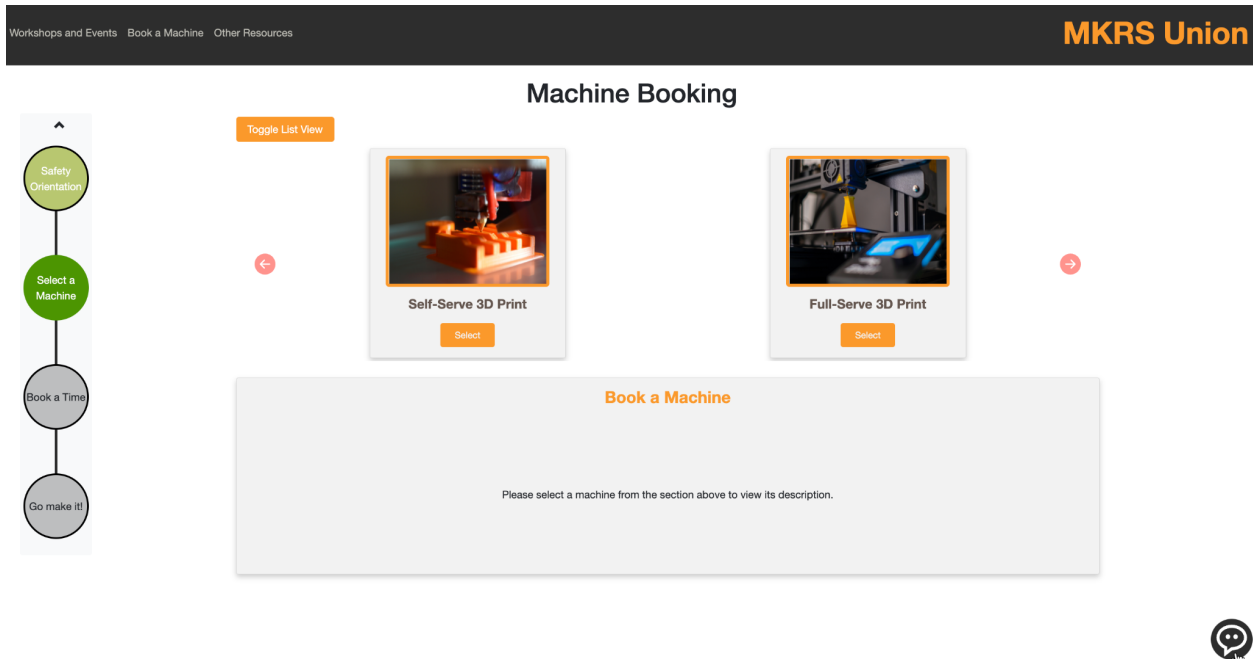
Figure 5.1 Selecting a Machine, Main Page
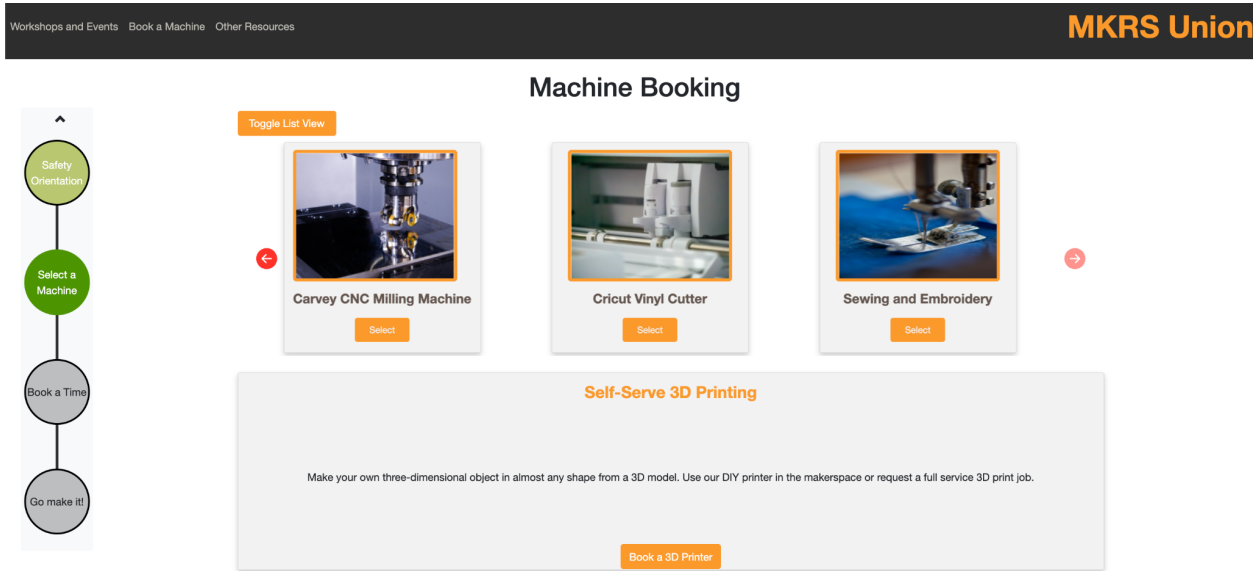
Figure 5.2 Selecting a Machine, Scroll Left

Booking a Machine:
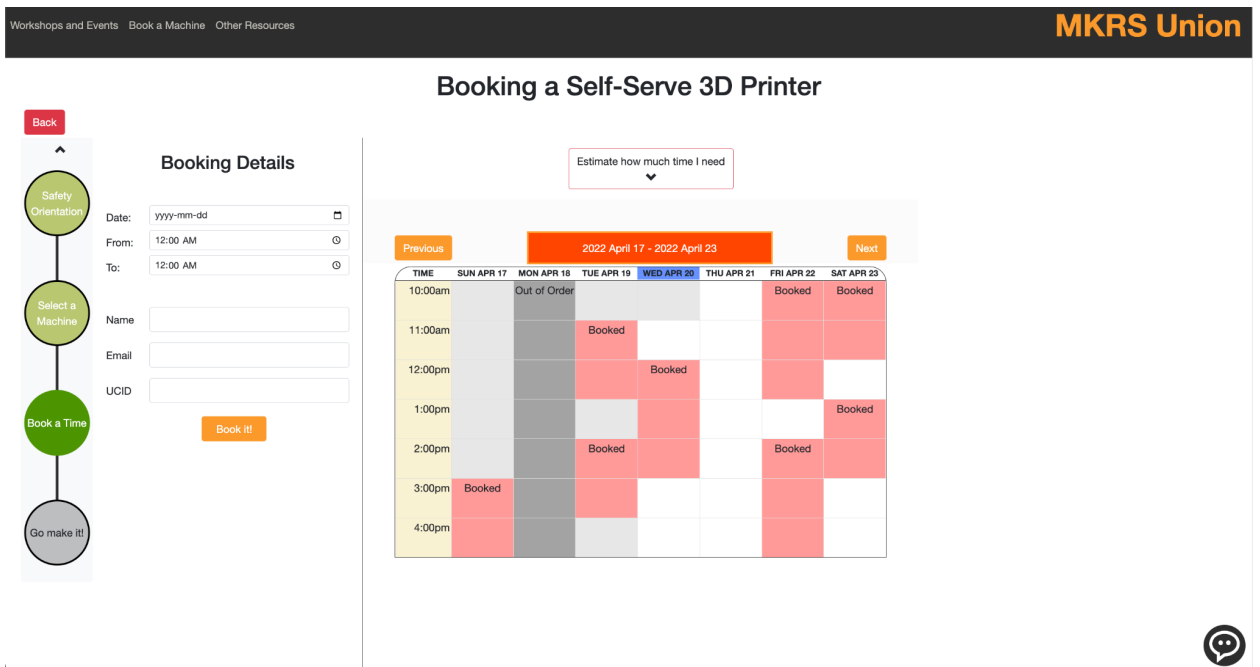
Figure 6.1 Booking a Machine, Nothing Selected

Figure 6.2 Booking a Machine, Estimate Given

Figure 6.3 Booking a Machine, Next Week

Figure 6.4 Booking a Machine, Invalids

Figure 6.5 Booking a Machine, Valids

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Figure 6.6 Booking a Machine, Booking Finished

Figure 6.7 Booking a Machine, Add to Calendar

Other Resources:

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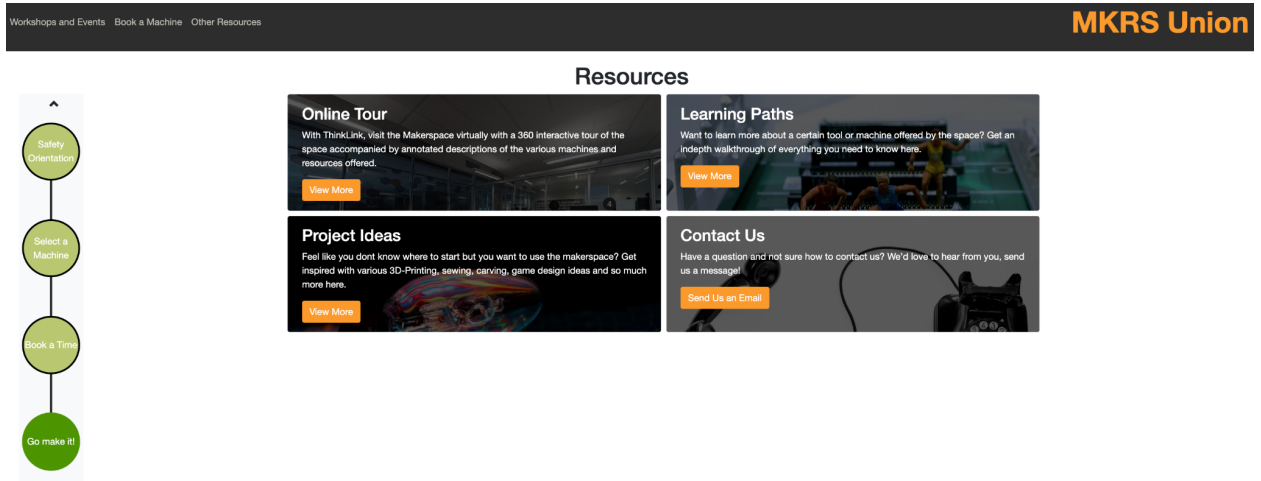
Figure 7.1 Other Resources, Home
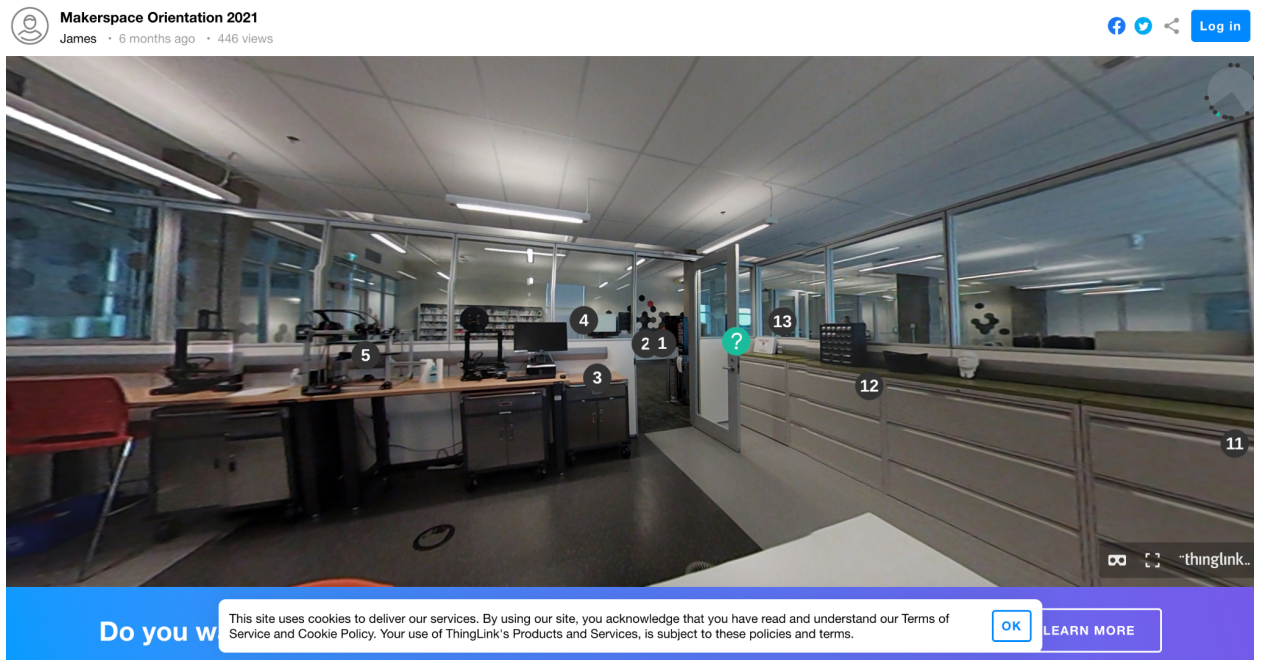
Figure 7.2 Other Resources, Online Tour (Sends you to this site)

Figure 7.3 Other Resources, Learning Paths (Sends you to this site)

Figure 7.4 Other Resources, Project Ideas (Sends you to this site)

Figure 7.5 & 7.6 Other Resources, Contact Us (Sends you to email). So does the Chat logo found in all pages

Full-Serve Resources:
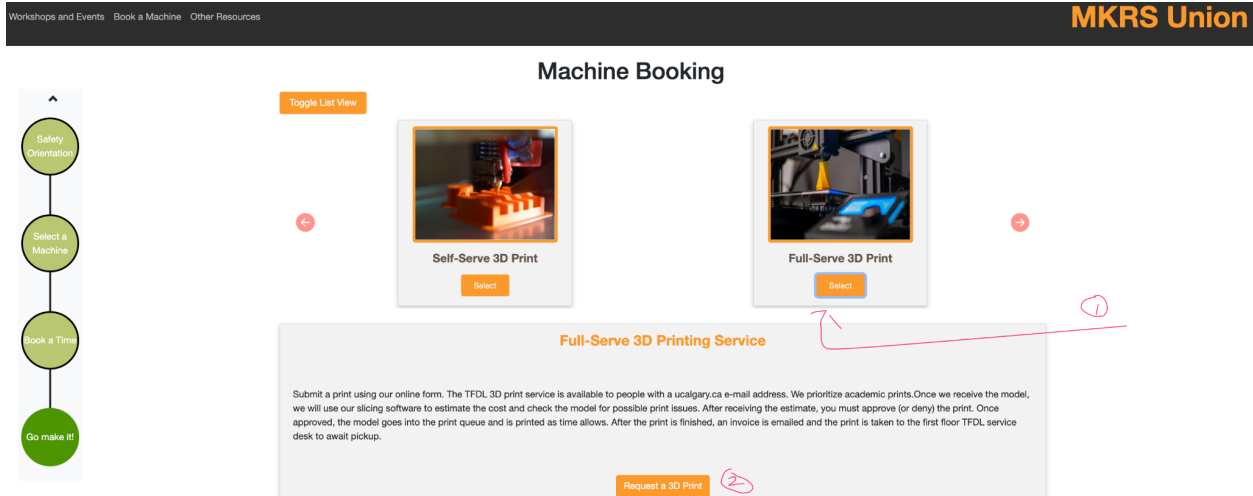
Figure 8.1 Full Serve Resources, Select a Machine
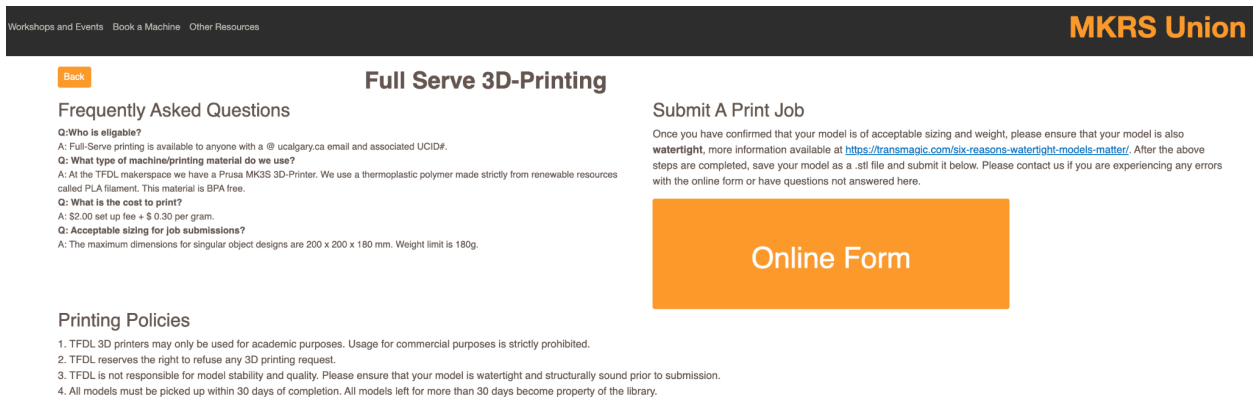
Figure 8.2 Full Serve Resources, Request Page

Figure 8.3 Full Serve Resources, Submission Form

Figure 8.4 Full Serve Resources, Invalid Submission

Figure 8.5 Full Serve Resources, Valid Submission

Figure 8.6 Full Serve Resources, Complete Submission

Section 5: Heuristic Evaluation

In total, the team has compiled together 31 issues from our heuristic evaluation ranging from severities 1-4. These issues are fixable if given slightly more time, so we are not worried about the nature of our design.

As expected, there are a few violations with a severity 1, that do not hinder the user, but could be adjusted to improve cosmetics. This includes shortening a couple descriptions and syncing the colors of various buttons and nodes to be more intuitive.

A majority of the issues we found have a severity rating of 2, which are considered minor usability problems. Many of the issues with this rating involve missing details and descriptors or vague visual cues that could confuse the user, but is not considered to be confusing enough to hinder the user from getting the task done. For issues with a rating 3, three of these issues involved consistency and standards where we could have been more concise and clear with our design. The other two issues with this rating involved error prevention and diagnosing errors in regards to the selecting time in the scheduler.

Focusing on our more major issues, our evaluation led us to discover 3 required improvements with a severity of 4 (usability catastrophe). Two of which pertained to the booking of a full-serve machine. First, there is no warning when the 3D model dimensions exceed the limit for the provided job. Second, there is currently no check to ensure that a ".stl" file has been provided before a submission. Both of these problems violate the principle of error prevention and can be fixed by adding checks or blocking the submission of the form to ensure the sizing is within limits and a correct file is given. The last issue is the inability to cancel any workshop or machine booking that was previously made. This violates the principle of user control and freedom as they are stuck with the booking with no way to edit or cancel it. A suggested fix is that the user should be able to cancel the booking via email.

Name	Heuristic Violated	Location	Description	Suggested Fix	Rating
Emily, Fysal	1: Visibility of system status 8: Aesthetic and minimalist design	Machine booking	When users click on the "select" button for a machine, they need to scroll down in order to actually see the changes to the page, and to see the "Book" button	Snug up the description section and icons so they all fit in one viewport	2

			appear		
Emily, Fysal	1: Visibility of system status	New User sidebar	No indication that the steps are clickable, no indication of how to navigate to the next step	Use colour to indicate that the sidebar contains buttons that can be clicked. Use animation or highlighting to show users where to click to advance to the next step	2
Arantxa, Fysal	1: Visibility of System status	Machine booking	Toggle list view button does not indicate it can go back to previous view	Change button text when user is in list view to display "go back to carousel view"	2
Emily	2: Match between system and real world	Workshop booking	Event's location status (in-person vs virtual) is presented in the same grouping of options as the type of event (Orientation, technology training, etc) which is not how we naturally categorize things in the real world	Separate drop down menus for location status and event type	2
Emily, Donald	2: Match between system and real world	Machine booking, Workshop Booking	"Toggle list view" (machine booking), "technology training" (workshop booking) has no meaning to users	Change wording, and or remove list view altogether in machine booking	2
Emily, Fysal	2: Match between system and real world	New User sidebar	The user's current step is green which can be interpreted as already being successful	Change the current step's colour to blue or yellow to indicate in-progress	1
Emily, Britney	3: User control and freedom	Workshop confirmation	No option to review details before finalizing booking, 'Confirm' button automatically completes booking	Extra step asking user to confirm booking details before completing booking	2
Donald	3: User control and freedom	All bookings	Clicking "add to calendar" brings you to a google calendar site in the same tab.	Open a new tab for the google calendar instead	2
Emily	4: Consistency and standards	Machine booking	Option for self-serve printing mentions the ability to "request a full service 3D print job" which is not something	Change wording in description of self-serve print to remove this reference	3

			that can be done from this dialog		
Emily	4: Consistency and standards	Full-service form	The back button on the full-service explanation page takes users to the homepage, instead of navigating back in the browser	Make back button navigate back in the browser	3
Emily	4: Consistency and standards	Scheduler	The date and time fields appear to be editable from within the form, but are not	Allow the date and time fields to be changed from within the form, reflect the current selection back into the calendar's state	3
Emily, Arantxa, Donald	4: Consistency and standards 6: Recognition rather than recall	All pages	Bottom "Contact us" button has no indication of what it does	Remove this button entirely	2
Donald	4: Consistency and standards	New User sidebar	Unclear that the up arrow is clickable since it doesn't follow button consistencies	Make it orange like all other buttons	2
Britney, Fysal	4: Consistency and standards	Header	Logo in the top right corner also acts as a home button. No explicit method or visual that the user can use to navigate back to the homepage.	Add an explicit home button in the navigation bar.	2
Arantxa	4: Consistency and standards	Machine Booking	List view could be more aesthetically pleasing by matching the first pages of the web app	Match list buttons to landing page style buttons.	1
Donald	4: Consistency and standards	Scheduler	Week range appears clickable	Make it look like less of a button, e.g. remove the border	2
Donald, Fysal	4: Consistency and standards	Workshop Booking	It is unclear that the "category" and "weekday" buttons are dropdowns	Add a downward arrow head icon to give the user visual aid that the category/weekday filters expand upon clicking them.	2
Emily, Britney, Donald	5: Error Prevention	Workshop confirmation, Scheduler	Unclear what is considered correct input for the textboxes.	Add placeholder text or example input in the textboxes	2

Donald	5: Error prevention	Scheduler	When you pick a time frame in one week, go to the next week and pick a different time, then come back to the first week, the original time frame is still selected	Clear all other time frames in all weeks when sliding back and for or selecting a new time	3
Britney, Fysal	5: Error prevention, 9: Help users recognize and recover from errors	Full serve form	There is no warning for when the print job object dimensions exceed the acceptable sizing for job submissions. Users can submit the print job form if the dimensions exceed the acceptable sizing for job submissions.	Block the user from submitting a full serve form if they happened to exceed the acceptable sizing for job submissions.	4
Fysal, Britney	5: Error Prevention	Full-Serve Form	"Choose file" does not give the user an error message if it is left empty or if the user uploads the wrong file type.	Block the user from submitting a full serve form.	4
Emily	6: Recognition rather than recall, 10: Documentation	New User sidebar	No way to get back to the descriptions of what each task involves	Include a button to maximize the current step's description	2
Britney	6: recognition rather than recall	Full serve form, Full serve information	Users may not remember the specific size dimensions limit from the full serve information page when inputting their values into the full serve form. The full serve form does not display this information anywhere.	Add information somewhere onto the full serve form.	2
Fysal	7: Flexibility and efficiency of use	All user info fields	Inability for experienced users to save their personal information who just want to book a machine as quickly as possible.	Add save settings functionality so experienced users don't need to retype their account details to book a machine.	2
Donald	8: Aesthetic and minimal design	Landing Page	"I'm New Here" is too long	Shorten it to "Get started using a makerspace. For those with little to no experience."	1

Arantxa, Fysal	8: Aesthetic and minimalist design	Machine Booking	Message button gets covered by description box	Restrict description box to allow message button display	1
Britney	8: Aesthetic and minimalist design	Machine Booking	Descriptions for the machines could be more concise, others could be more descriptive and provide context for what the machine does.	Change the descriptions so that they are more concise but still descriptive enough to get information across.	2
Emily, Britney, Donald	9: Help users recognize and recover from errors	Workshop confirmation, Scheduler	No way for users to cancel a booking	Send users a confirmation email with a link to cancel their booking if needed	4
Emily	9: Help users diagnose and recover from error	Scheduler	No way to deselect a time, other than just selecting a completely different time	Allow a second click on a green square to deselect a time slot	3
Arantxa	9: Help users recognize, diagnose, and recover from errors	Workshop Confirmation	Email error message is not updated when the right email is entered. User must go back and enter it again to continue	Live update on email validity	2
Donald	9: Help users recognize, diagnose, and recover from errors	Workshop Confirmation, Scheduler	Invalid UCID should be more descriptive	"too short", "too long", "Not a number"	2

Section 6: Final Design Rational and Discussion

From the start of our design process, we set out with a set of clear goals for the redesign of the TFDL makerspace website and through the use of both low fidelity and horizontal prototyping as well as walkthrough phases we were able to create a firm foundation for our final design to be built upon. Through each iteration we encountered usability and design challenges both obvious and unexpected and after addressing these issues our final product began to take shape. However, we did meet our fair share of roadblocks along the way and it was only after we began to program our interface that yet another set of

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usability and design issues came to our attention. These issues which would only have been discoverable through a functional interface and the use of a heuristic evaluation.

We aimed to create a minimalistic interface with the main objective of providing both new and experienced users of the makerspace an improved way to book workshops and events in addition to implementing the ability for users to book time on machines offered. Our final interface excels in addressing the level of experience of the user, providing from the get-go a clear path for both novices and experts alike. In our new system, new users are offered a step-by-step breakdown of the booking procedure, from completing their safety orientation to selecting a machine that suits their needs, new users are set on a clear path to reach their goals. In addition, new users are provided with an optional sidebar showing them how far they are in the booking process in case they had forgotten what else they needed to do. Users who have completed their safety orientation can now select their desired machine, view its availability, and book time on it. This is a big improvement over the existing system which simply told users to show up to the makerspace and hope for the best. Another improvement we added to our booking system is now having the ability to give users an estimated time that their project will need to be completed. This helps users book what they will actually need, without accidentally over- or undershooting. It is especially helpful for newer users who may not have a good sense of how long a project will take. Though our system in its current state does align with our vision, there are nevertheless some remaining issues that were brought to light during our group heuristic evaluation.

First, it became quite apparent that there was a common theme of a violation of the visibility of the system status in many pages, specifically in regards to whether or not certain webpage attributes such as buttons, filters or navigation were in fact clickable/interactable attributes. For example, within our scheduler page, the week range appears clickable, however it is in fact not. In hindsight, we could have made it look less like a button to deter users from attempting to interact with it. Though it was frustrating to see such simple issues that can have large implications, it was very insightful for us as a team, as it

allowed us to see a pattern emerging in our own behaviour as developers. We are confident that if we had the opportunity to do another iteration of this project, these would be areas where we could easily improve, getting a lot of 'bang for our buck' in terms of time and effort that would make a significant difference in usability.

Furthermore, another common problem we discovered is a series of violations in consistency and standards. Moreover, we did have a series of aesthetic and minimal design violations. Some issues included places where wording could have been more concise, and other places where it could have been much more informative. Although they are less severe violations, these would again be places where another iteration could make big improvements. Thus, correcting these violations are still essential to the user experience. We also had a large number of small violations that do not represent significant issues, but that are good places for improvement.

In conclusion, our system in its current state does align with our vision of a manager that centralized the needs of makerspace users. We set out to fill some significant gaps in the current offerings, and our design provides an elegant solution. Although we did find violations of the heuristic evaluation in our interface, we believe that our new system would help bridge the gap for both prospective and existing users looking for an accessible way to use the TDFL makerspace.

Appendix I: Initial Prototypes

Note: For our early design drafts, each person created their own set of prototypes independently, which we combined in later iterations. This accounts for the vastly different designs of early prototypes.

Some initial prototypes focused on a mobile-first web application, because our users are students who likely spend a lot of time on their phones.
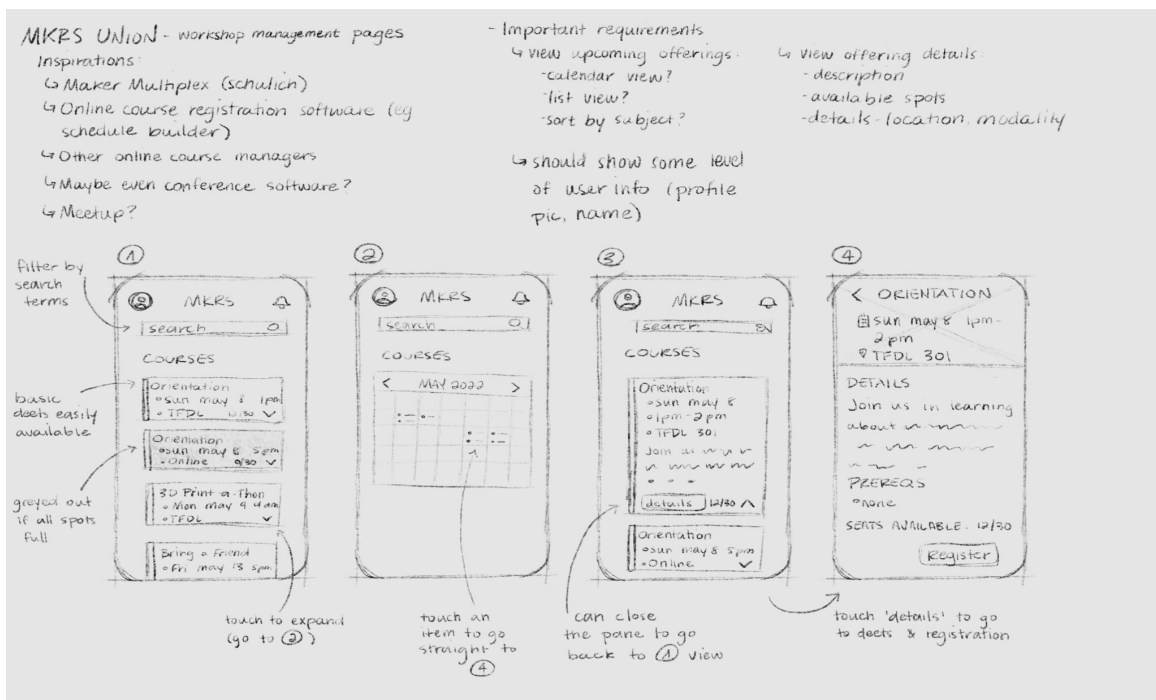
Figure 1. Pictive draft for booking time on a machine
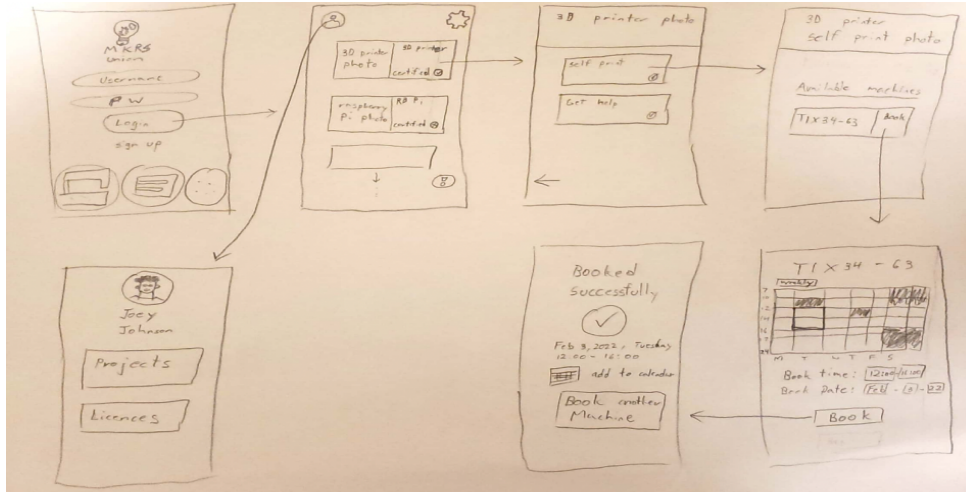
Figure 2. Storyboard draft for booking time on a machine

The mobile application ended up not being feasible when we reanalyzed the work context. Integrating with the existing library website was a high priority, so a desktop web app made more sense.

When moving from mobile to desktop, we decided to adjust the equipment screens to have 2 columns, decreasing the amount of scroll time to find your equipment of interest.

Figure 3.1 Storyboard draft for booking a safety orientation

Figure 3.2 Registration for safety orientation

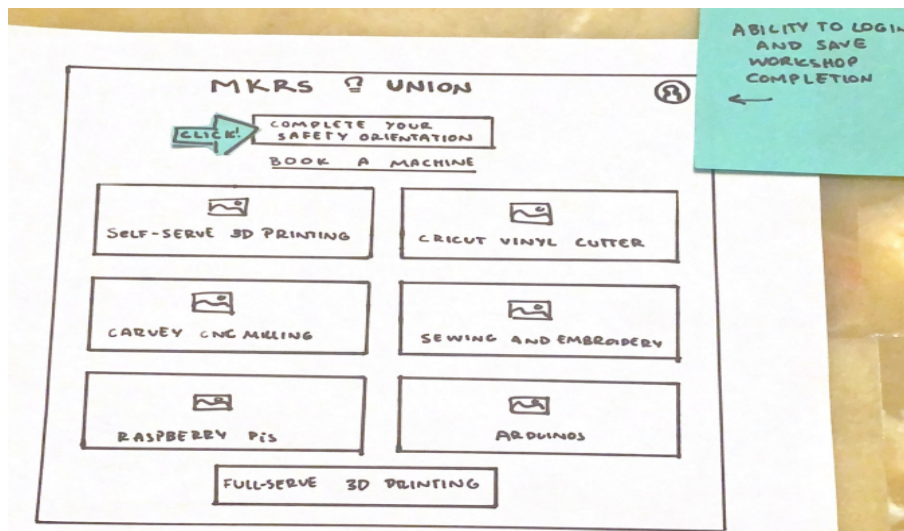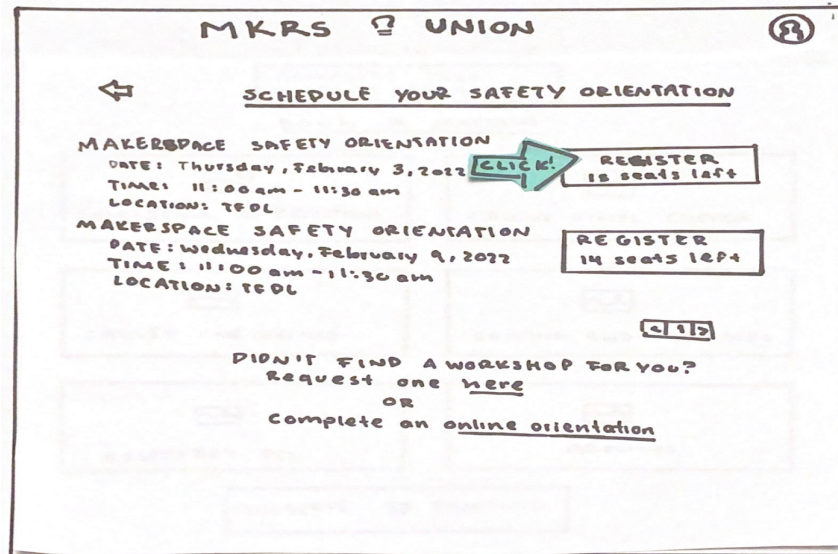Another one of our initial ideas was to have the feature of allowing people to login with their U of C account. This was later scrapped when some of the features that required it (such as community features, sharing projects, etc) were determined to be too far out of scope for us to reasonably achieve them in the time span of the project.
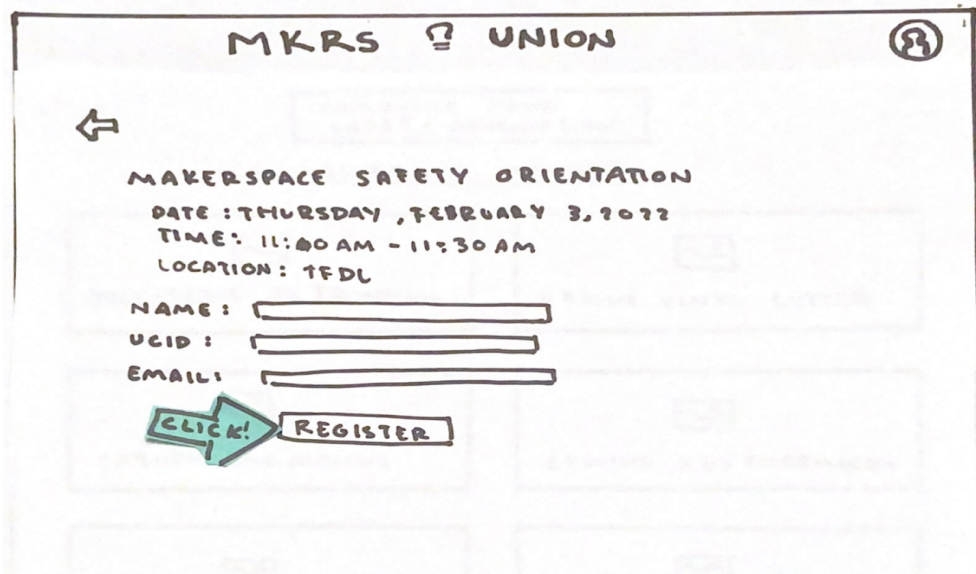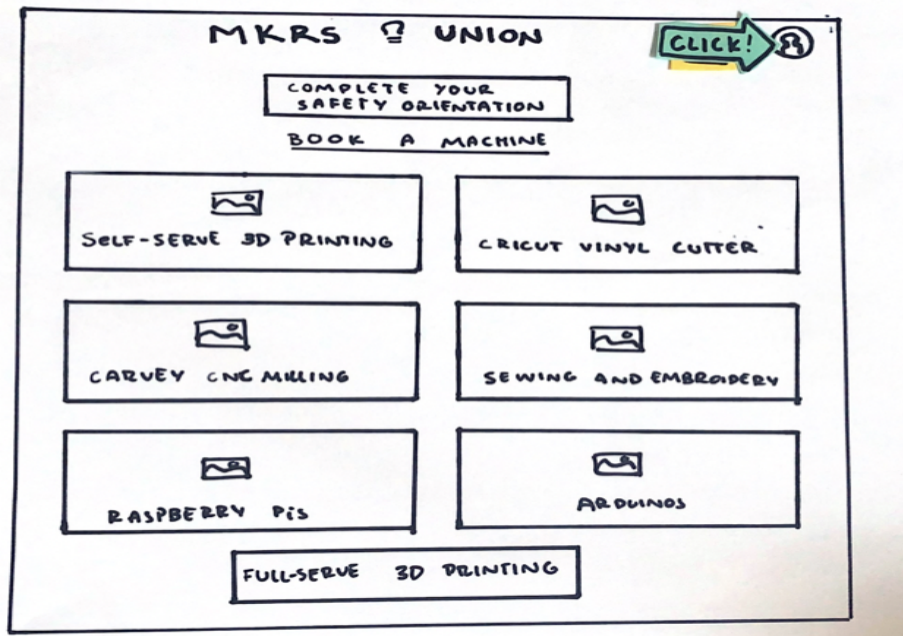

Figure 3.3 Login and Registration page

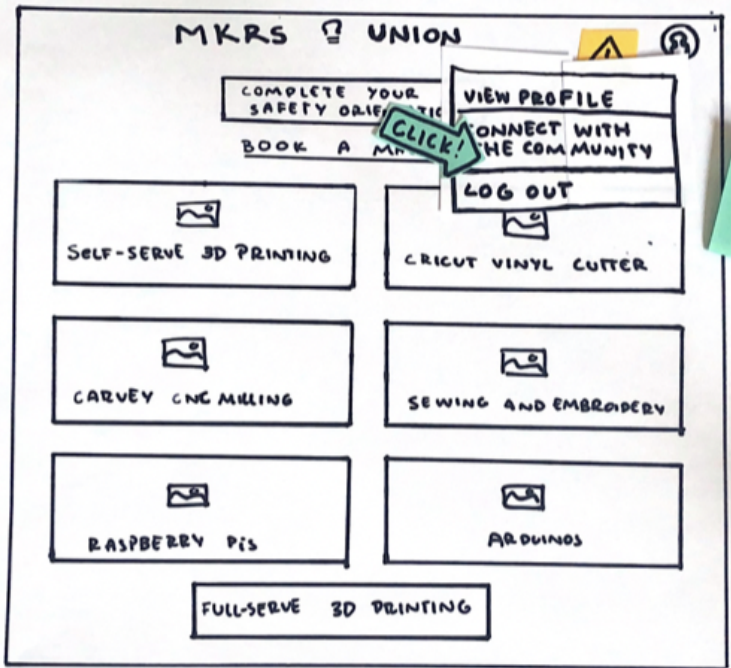Figure 3.4 Navigating through user profiles

Figure 3.5 User profile details

Even the earliest iterations had some version of a calendar or schedule for picking a date and time to book a machine. This version was deemed to be too busy, so it was dropped in favor of having a separate booking page for each machine.
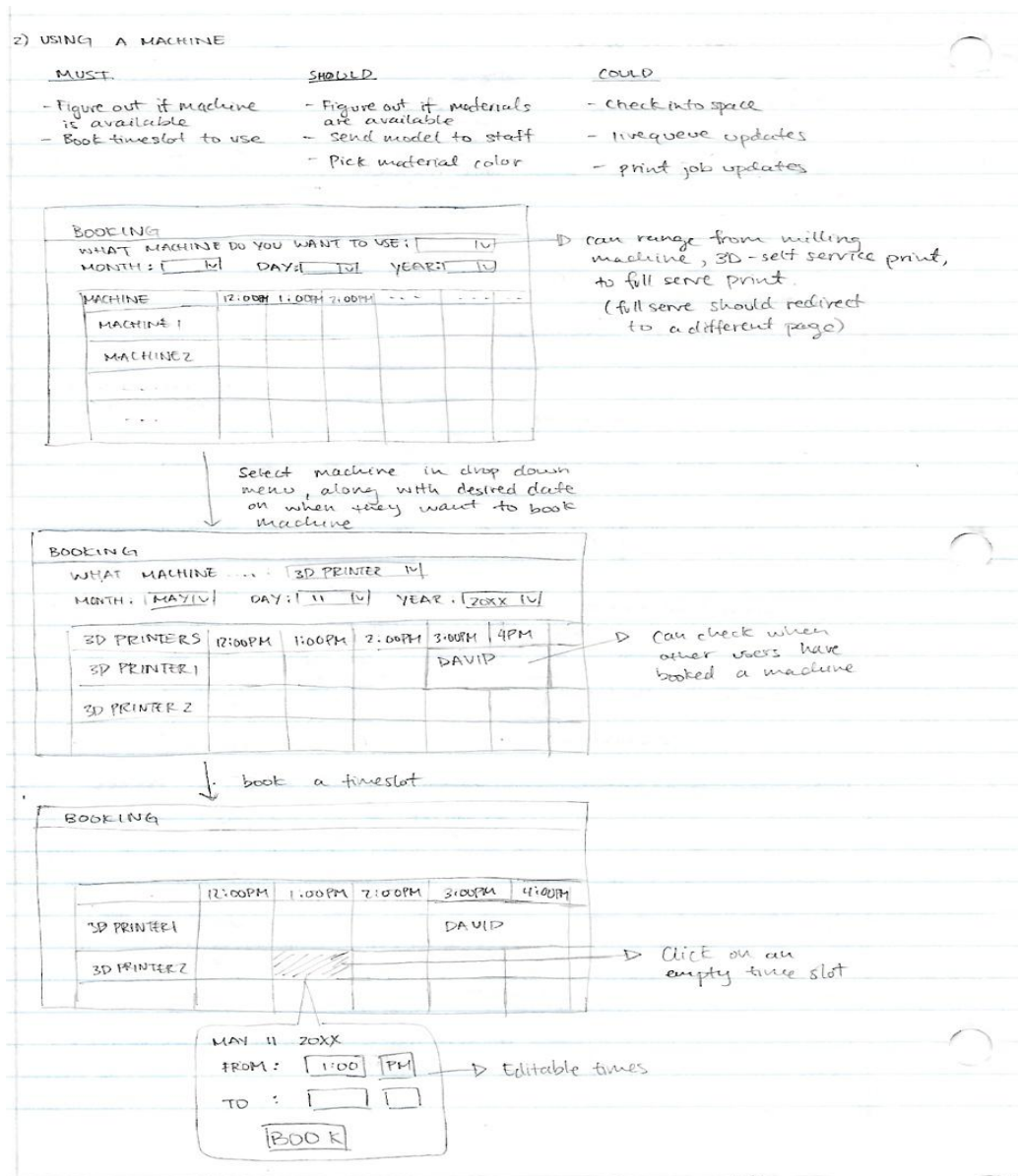

Figure 4. Storyboard draft for booking a machine

Many features of this prototype made their way into the final prototype, such as the horizontally stacked cards for different workshops. Additionally, the confirmation details of name, email, and UCID actually ended up coming back in later iterations when we decided to drop the need for a login.
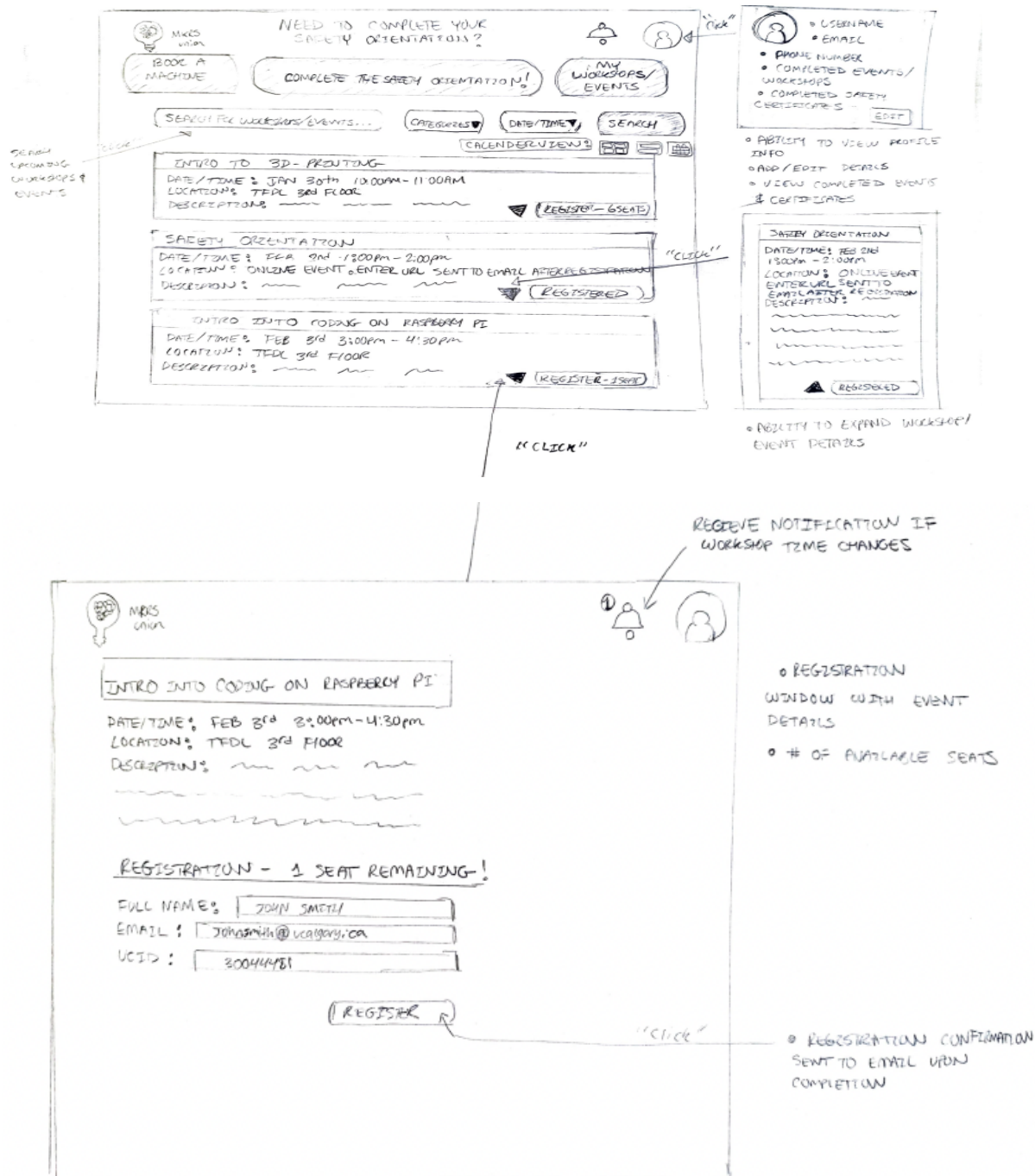
Figure 5. Storyboard draft for registering to take a course

Upon further analyzing the web application, we discovered that we needed an easier way for users to switch between the sections, so we added the tabs at the top. Early versions had more tabs: Events, Book a Time, Resources and Community. Some of these were renamed, and others were dropped from the later iterations as we realized that the project had undergone some serious scope creep.
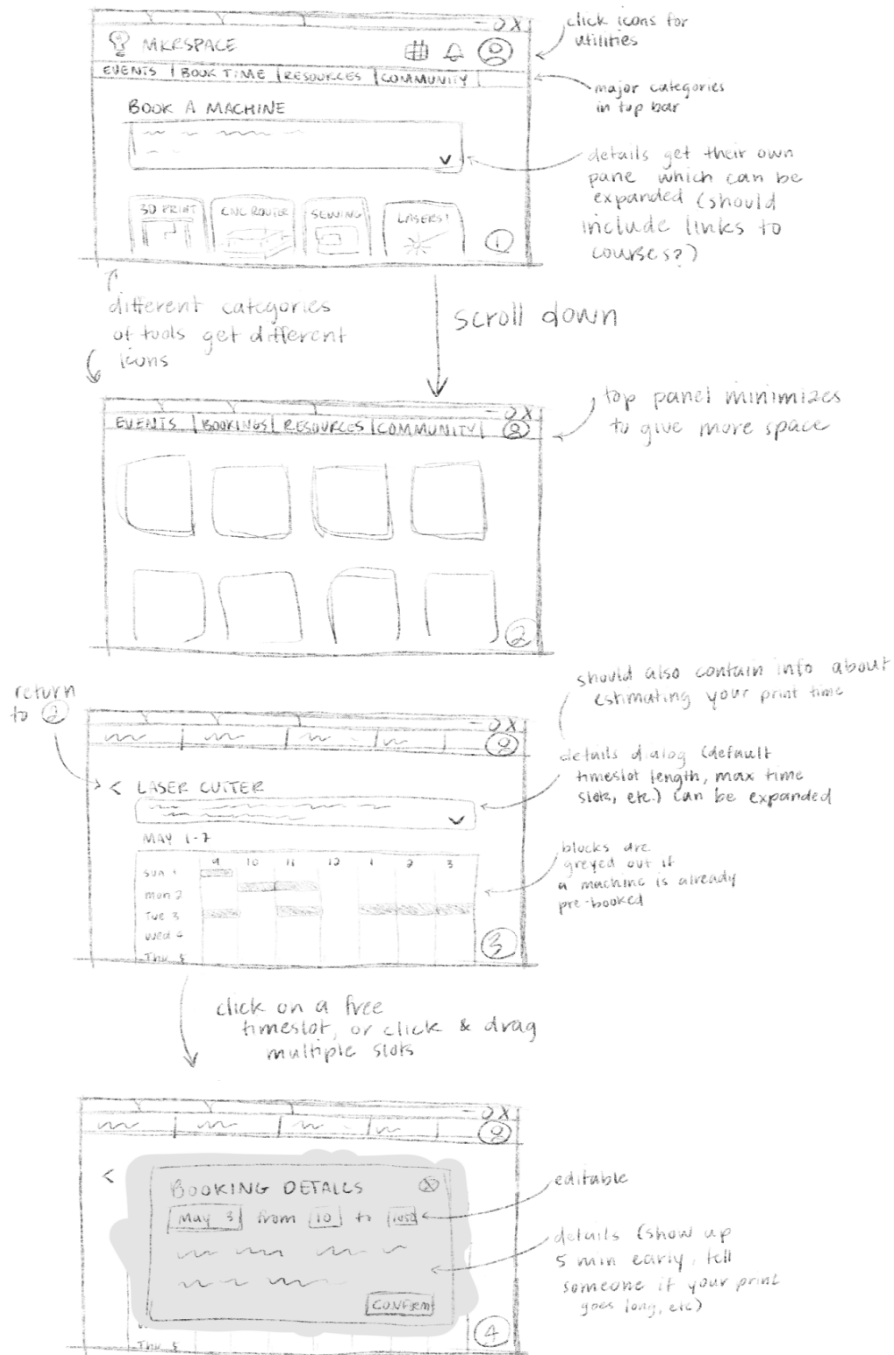
Figure 6. Storyboard draft of booking a time

Before booking a machine, we wanted to add a feature that allows you to see whether or not a machine is available. The idea of seeing a machine's availability carried over into the final prototype, but ended up being part of the calendar view.
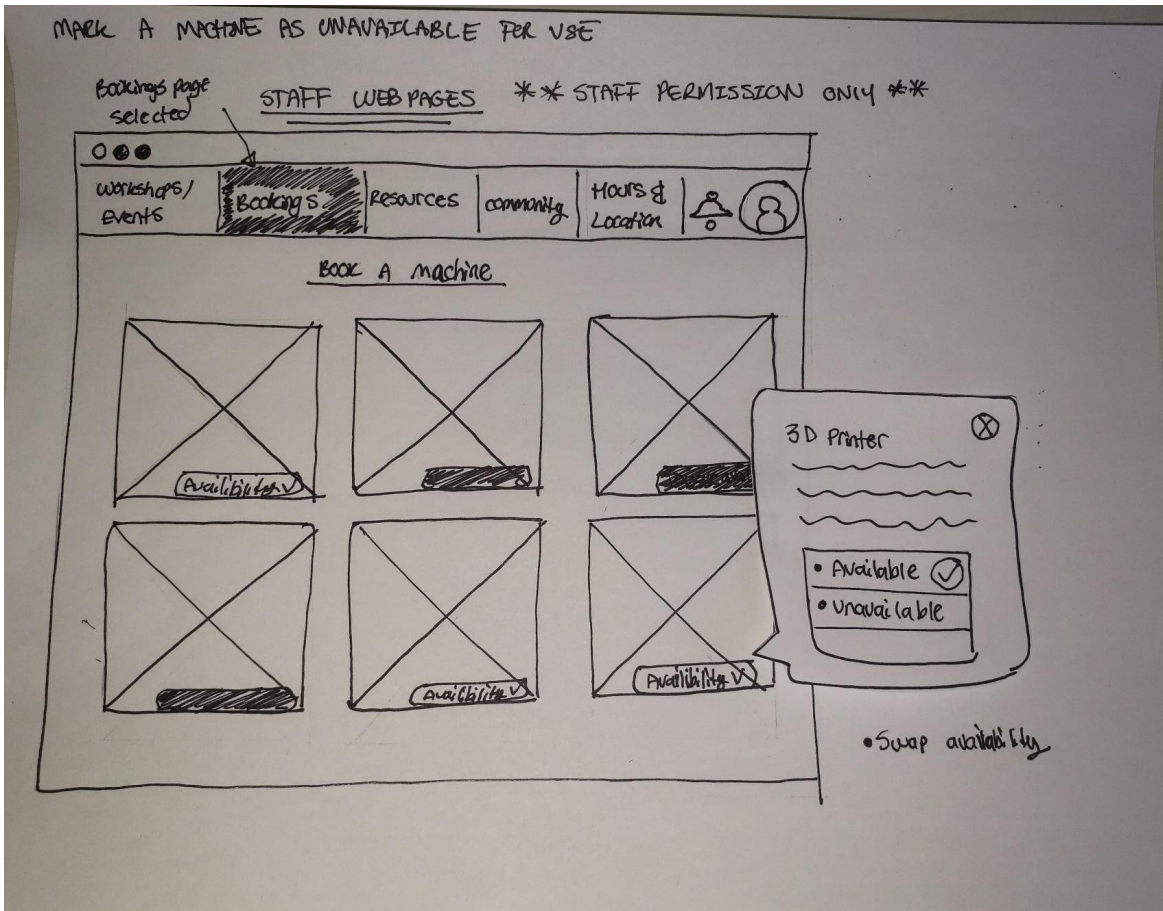
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Figure 7: Marking a machine as unavailable

This was one of the initial iterations for full-serve 3D printing. For the most part, the ideas seen in sketch 3 were carried forward wholesale into the final prototype, with some small visual changes to make forms look more consistent across different functionalities.
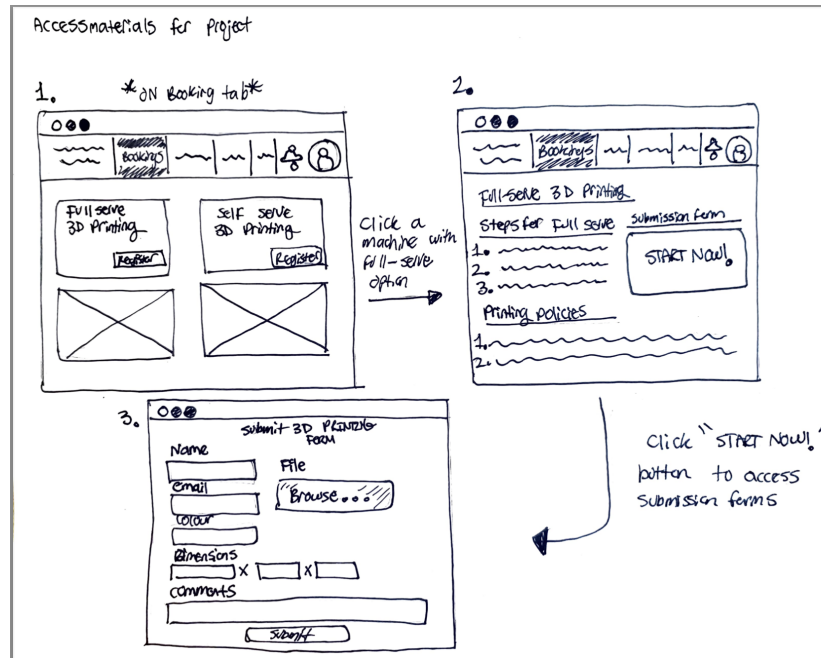

Figure 8. Setting up a full-serve print job

We initially wanted to expand on the idea of fully-managed services, which would have included options for users to choose a variety of materials. This was removed as it was out of scope.
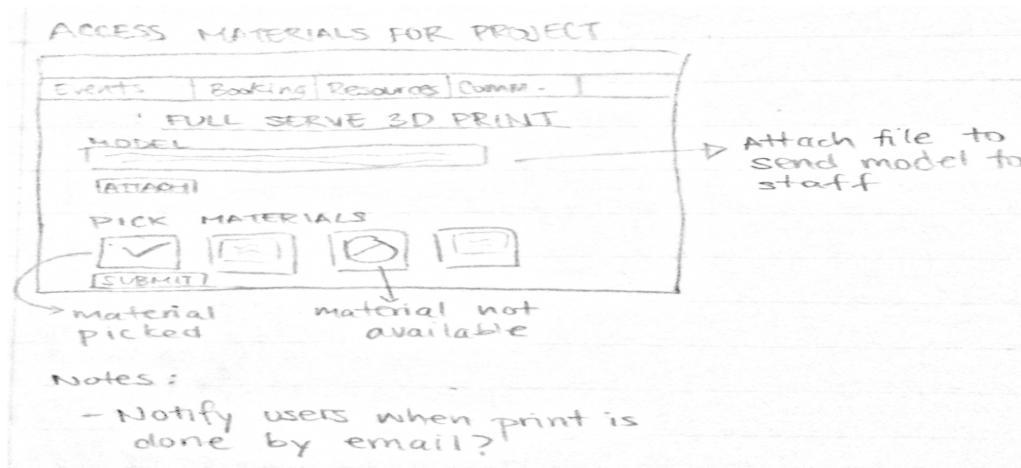
Figure 9. Accessing materials

Earlier iterations of the project included a task centered around an experienced user who comes to the makerspace primarily for a sense of community. This task led us to create prototypes for things such as user profiles, collaboration, and project progress and timelines. Designing for this task was fun, but we quickly realized that it essentially constituted a completely separate system and needed to be cut. Cutting this task was what eventually allowed us to remove the login requirements.
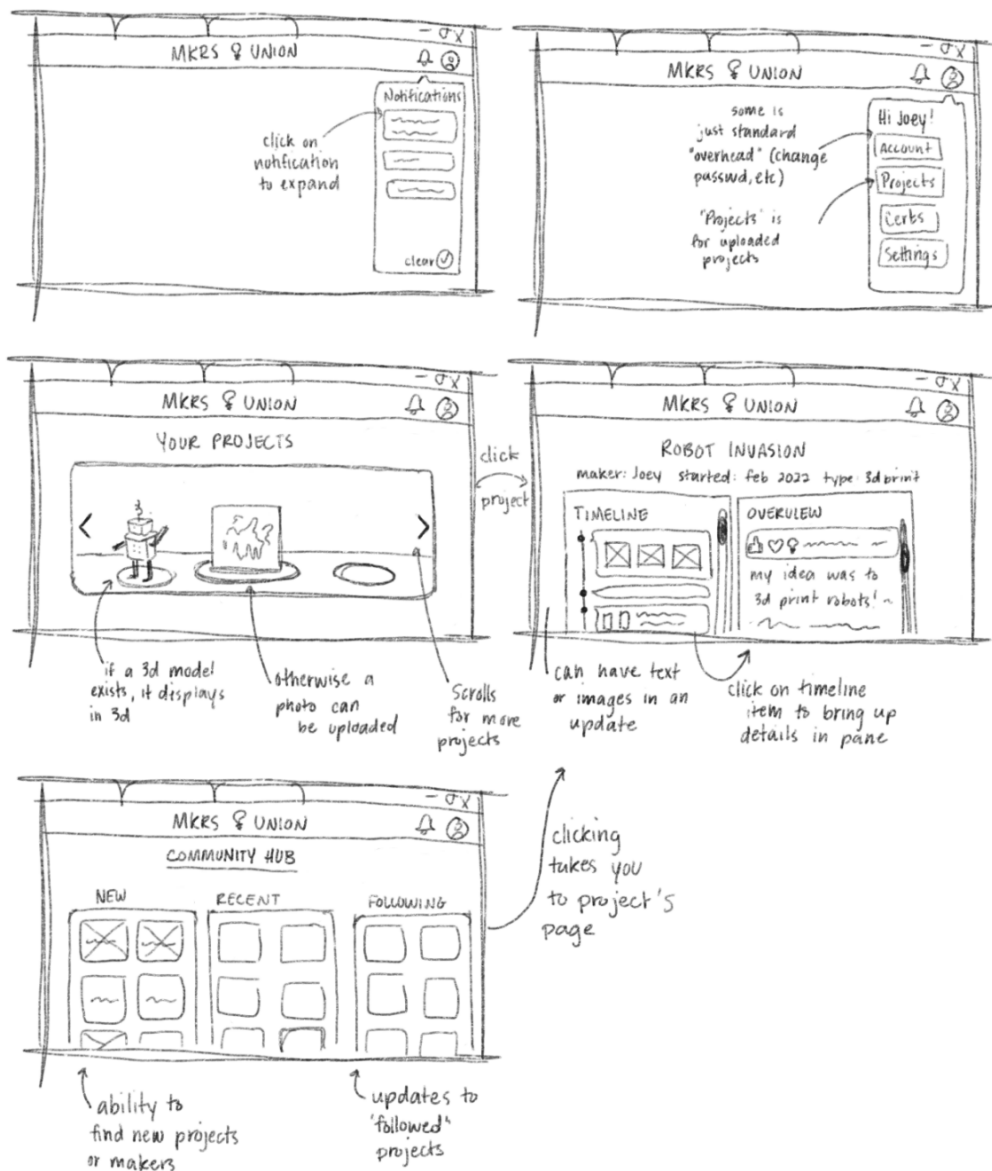

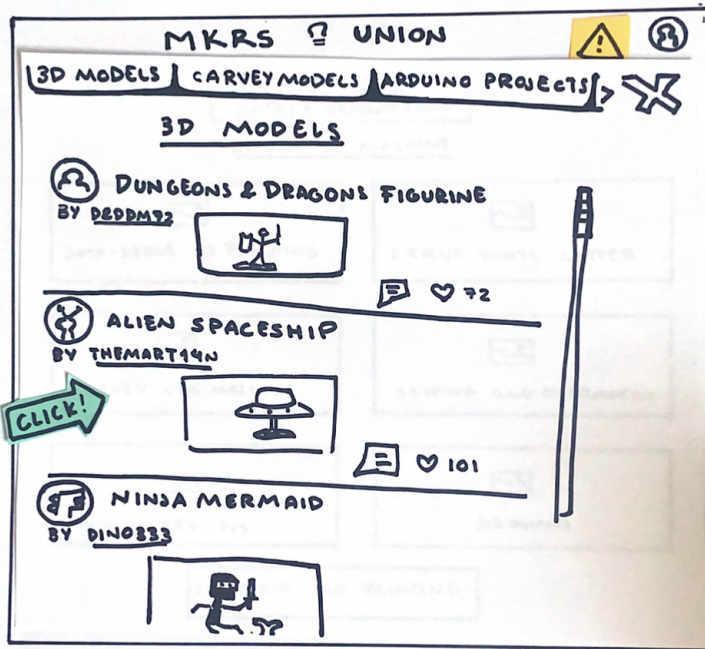Figure 10. Sketches for community features
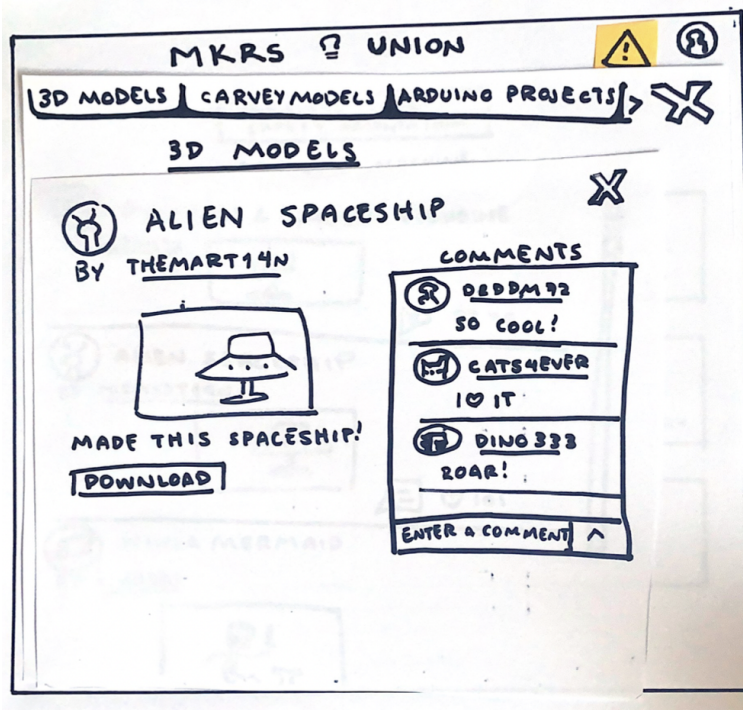
Figure 11.1 Pictive for community features

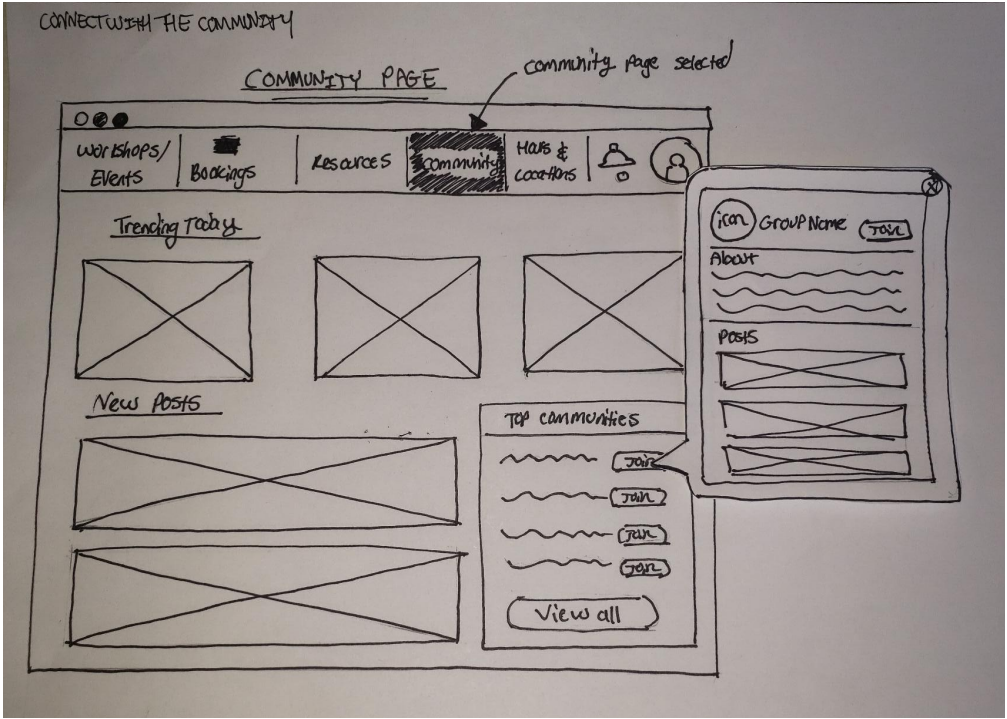Figure 11.2 Pictive for community and project features

Figure 12. Pictive for community features

Presentation Draft:

For the second tutorial demo, we created another iteration that combined design ideas from earlier prototypes. The notification bell, AI chatbot and selection of materials were removed from our prototype. At this point, we were still discussing whether or not to include some form of the community section.
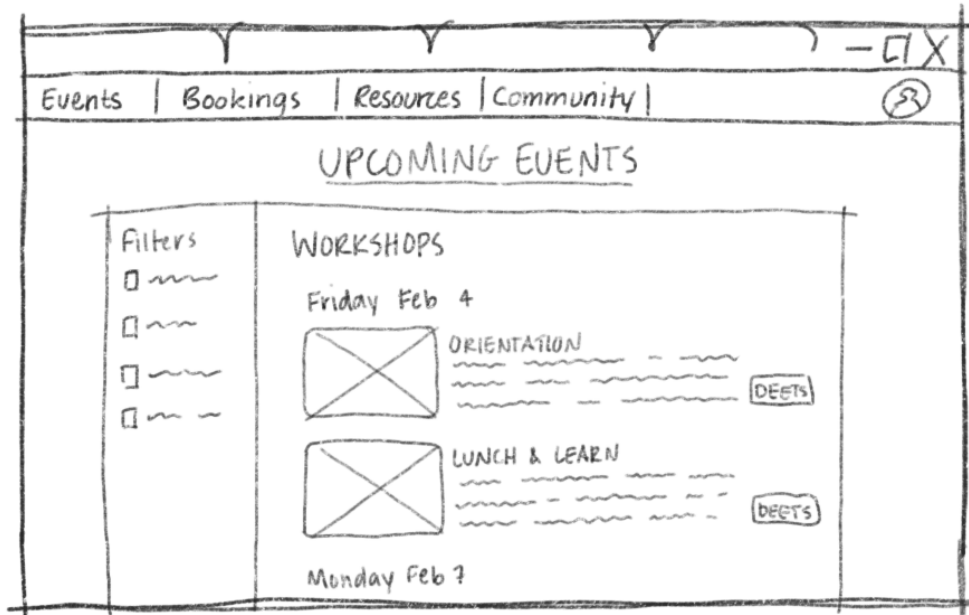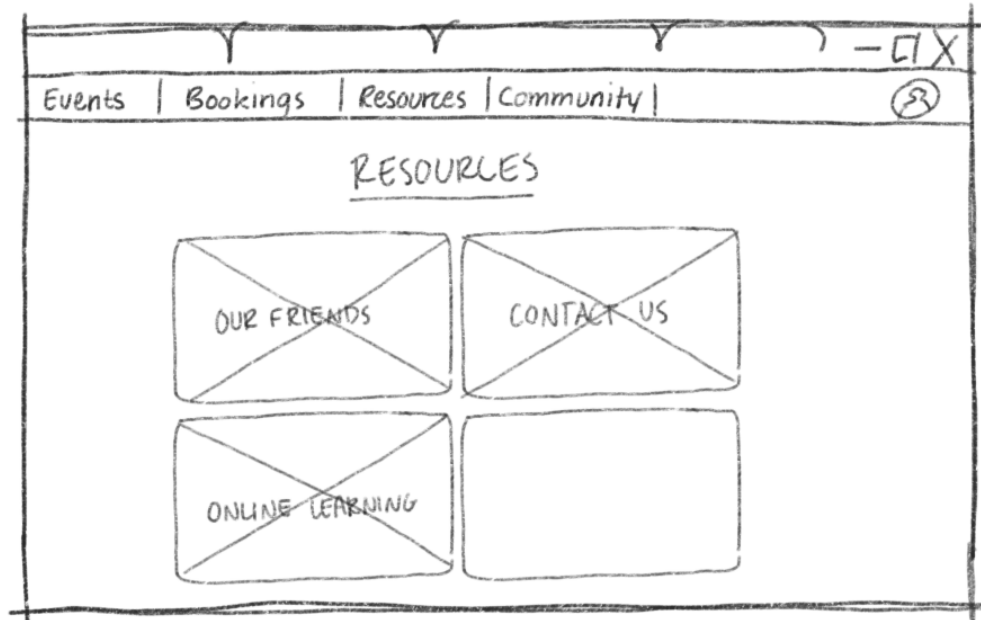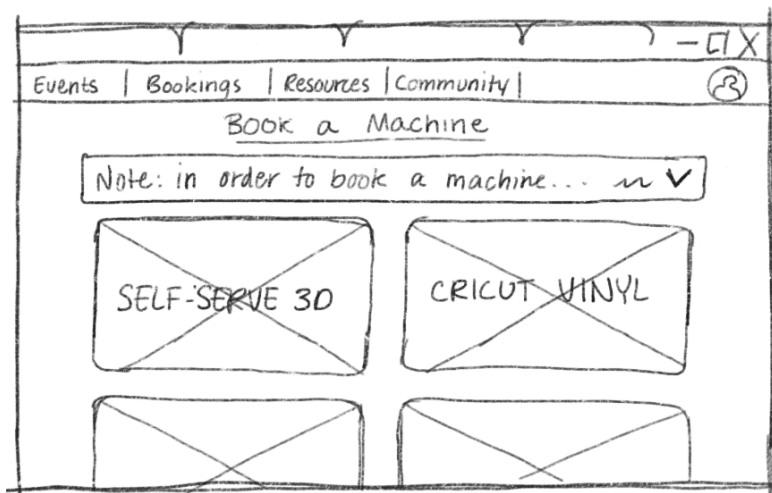

Figure 13.1 Events tab for demo presentation

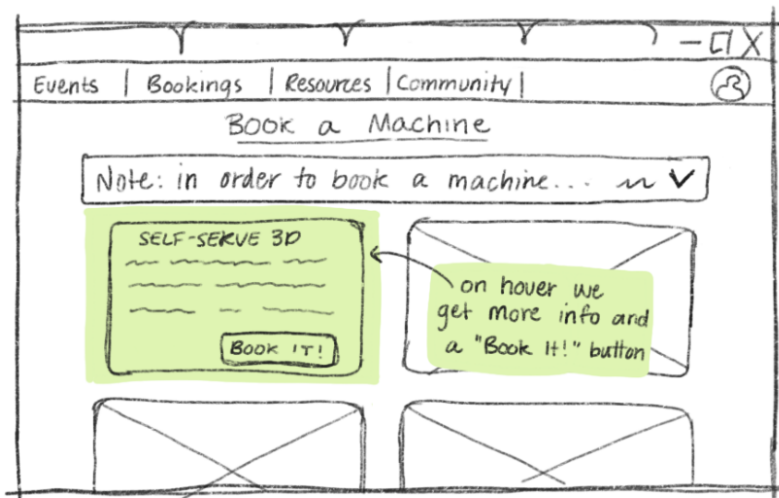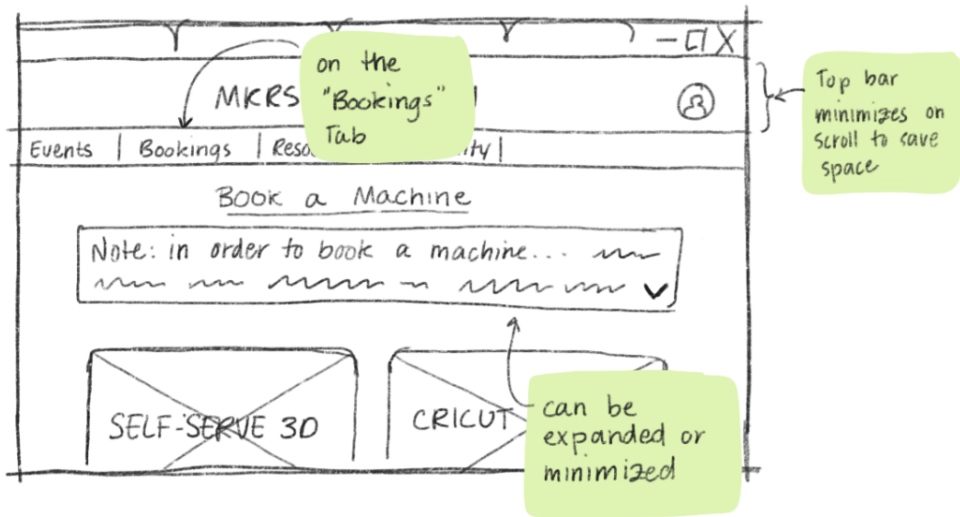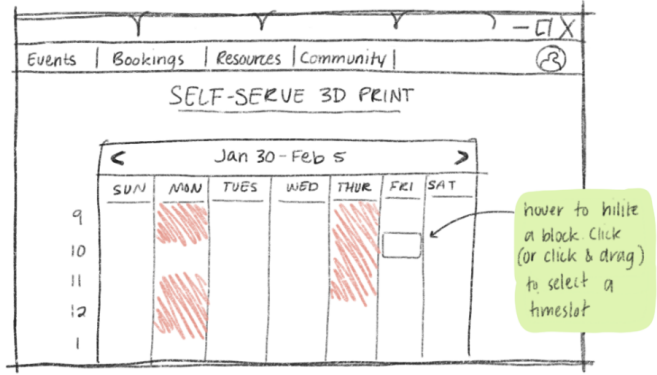Figure 13.2 Resources tab for demo presentation
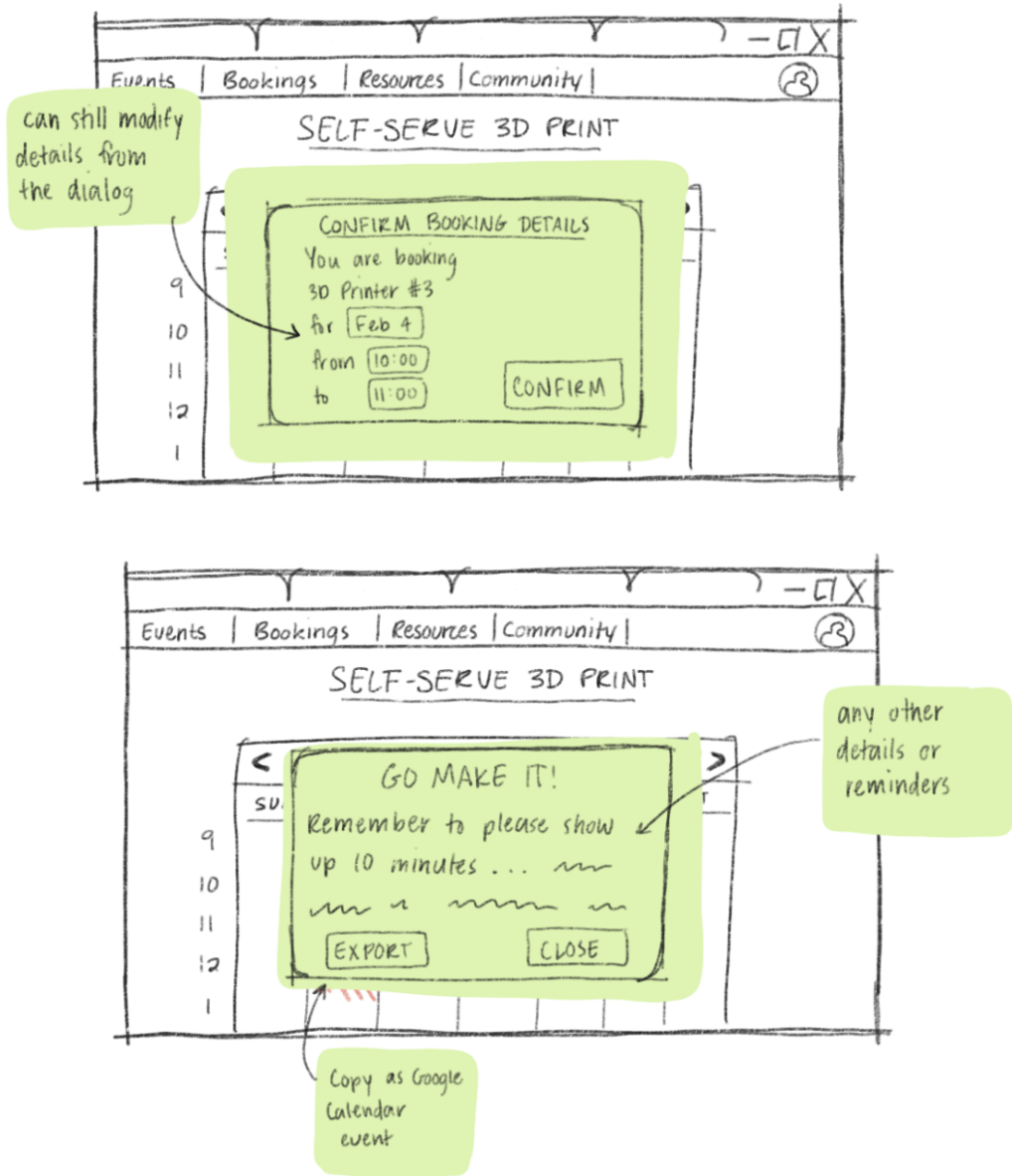
Figure 13.3 Bookings tab for demo presentation

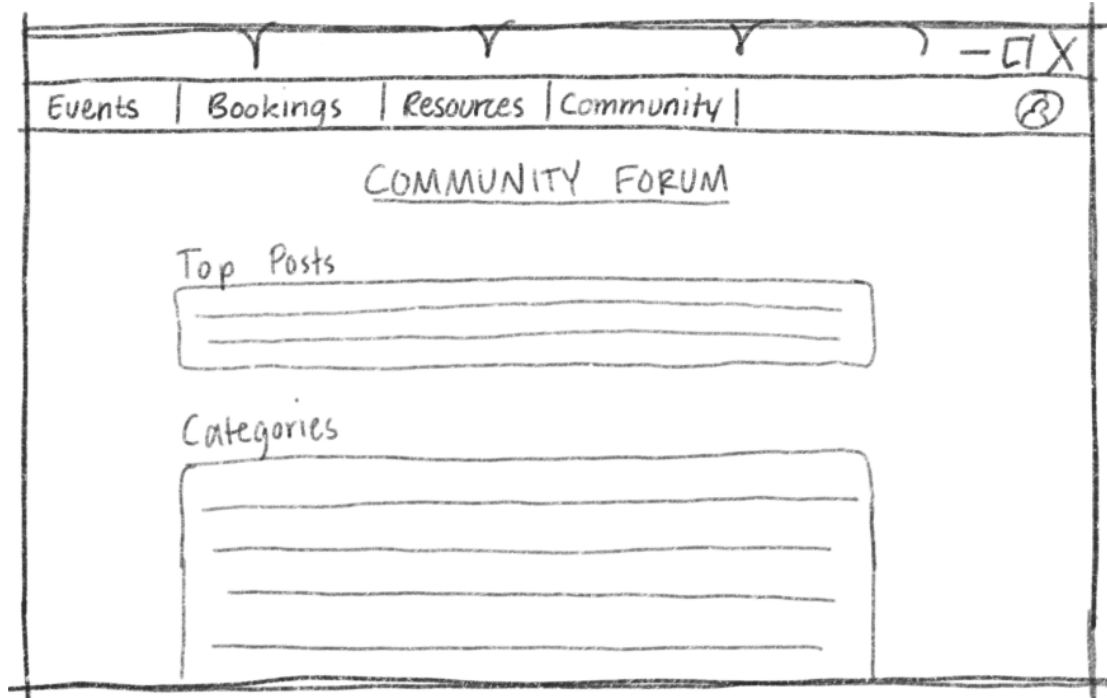Figure 13.4 Calendar view for demo presentation

Figure 13.5 Community tab for demo presentation

Following our presentation, we incorporated some feedback and made some small changes. We attempted to create something that was more visually interesting for the machine booking page, as well as allowing us to fit more info on screen without needing to scroll. This became a 'Workbench view' that showed the machines in context.
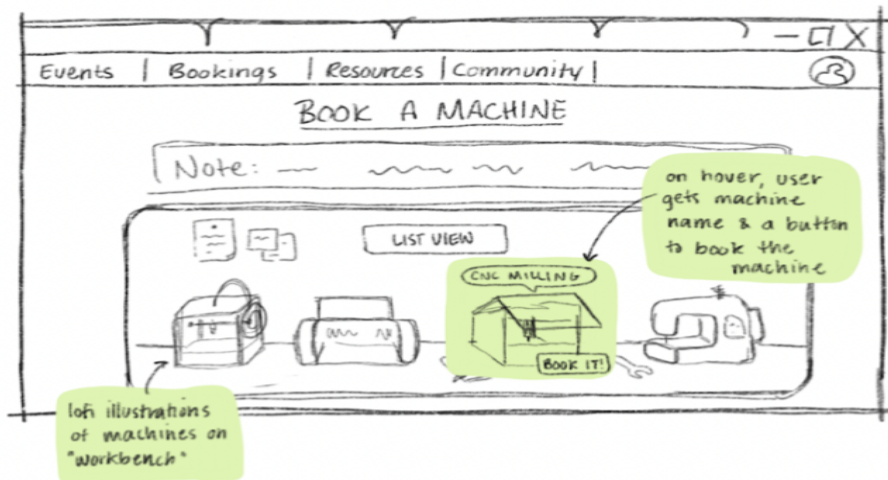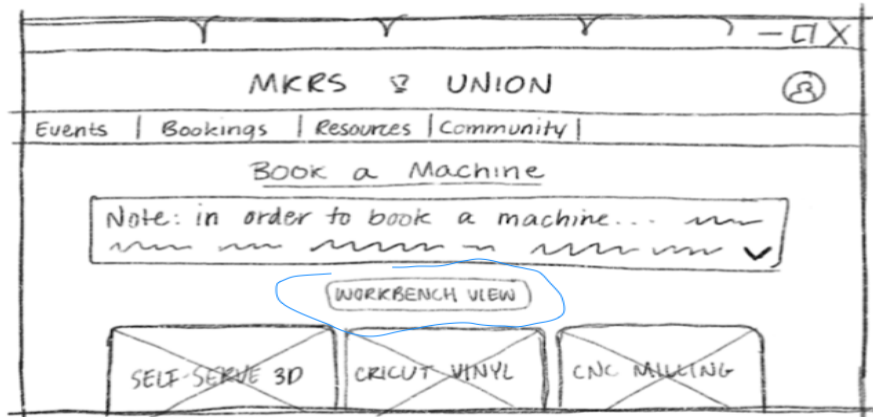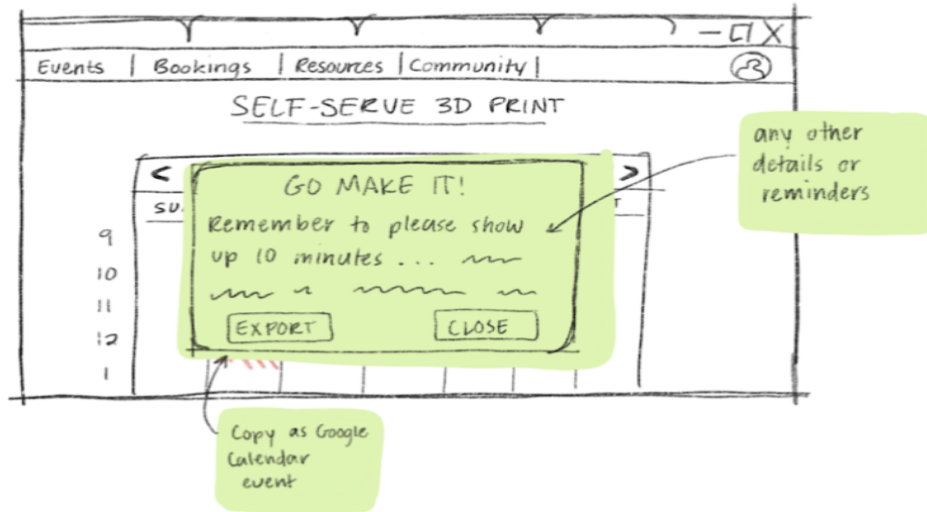
Figure 14. Post-presentation modifications

Appendix II: Final Low Fidelity Prototype

The walkthroughs in section 4 were used to develop this final prototype.
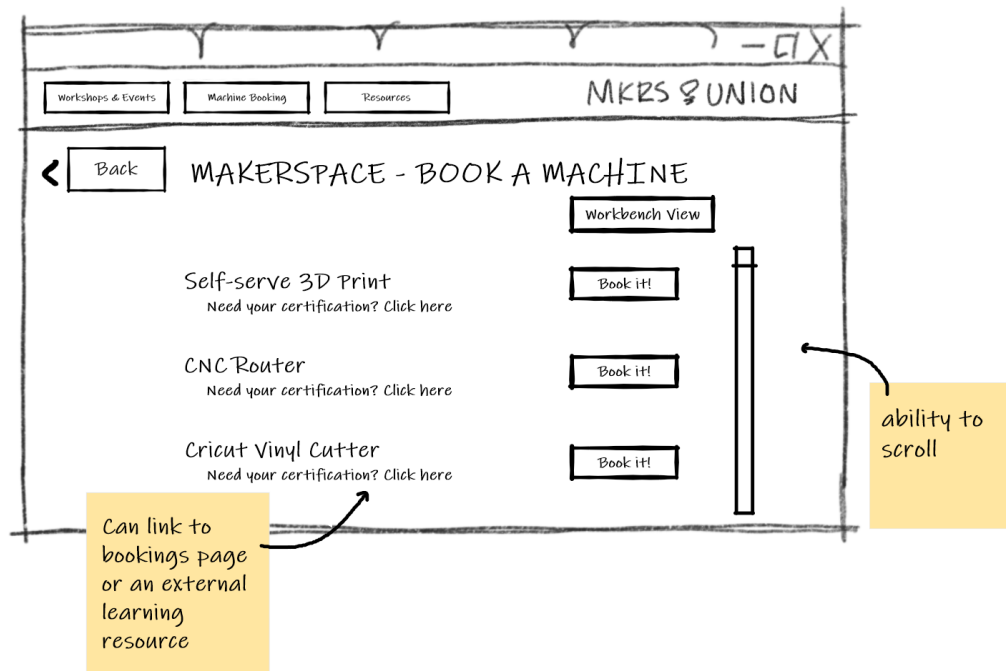
Picking a Machine:
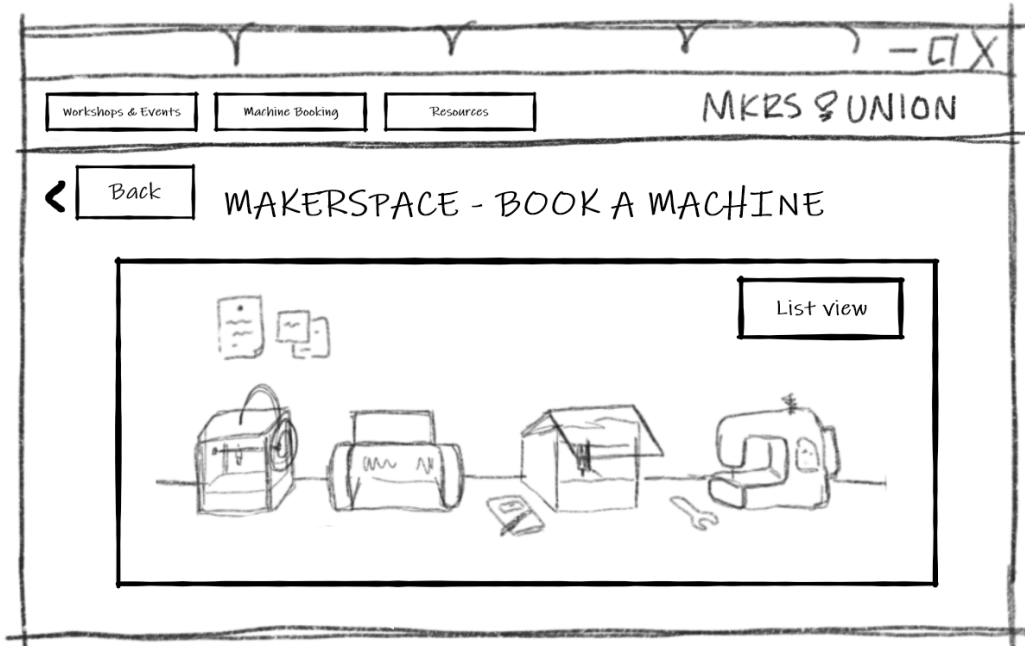

Figure 15.1. Picking a machine, list view.

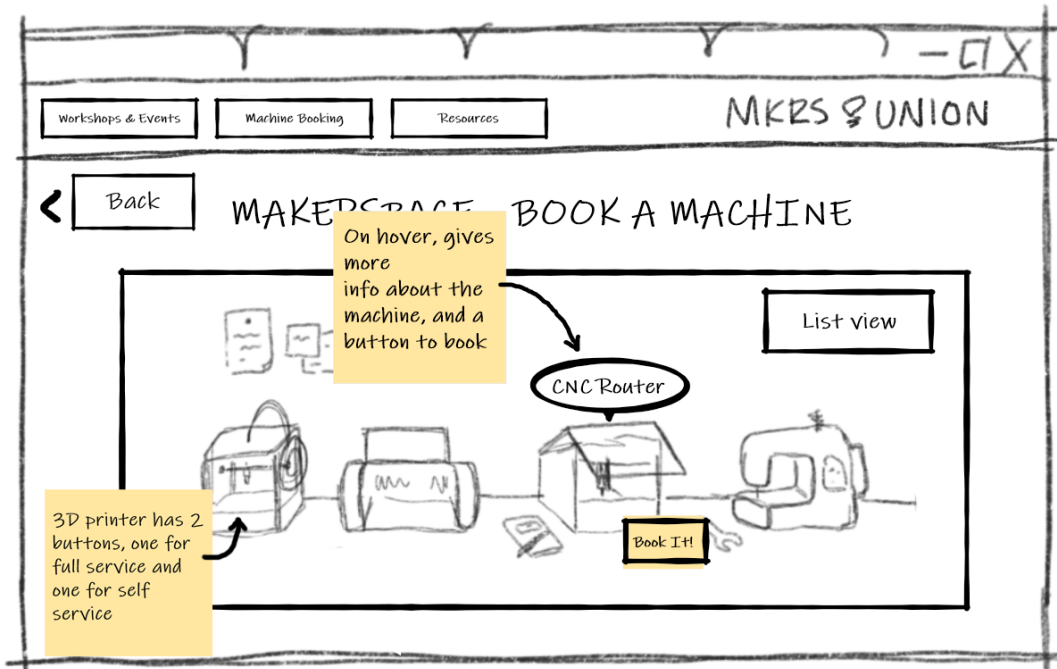Figure 15.2. Picking a machine, workbench view.

Figure 15.3. Visual details in workbench view when picking a machine.
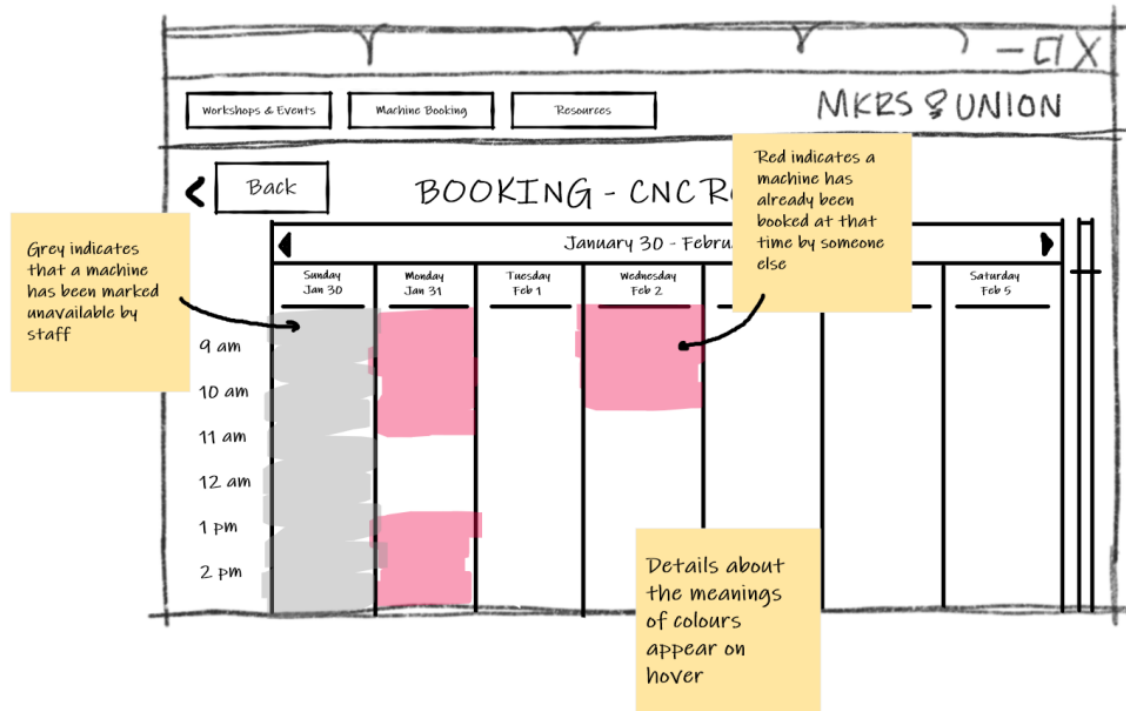
Schedule viewer:

Figure 16.1. The schedule viewer when booking a time slot for a machine and the visual details of when machines are not available for booking.
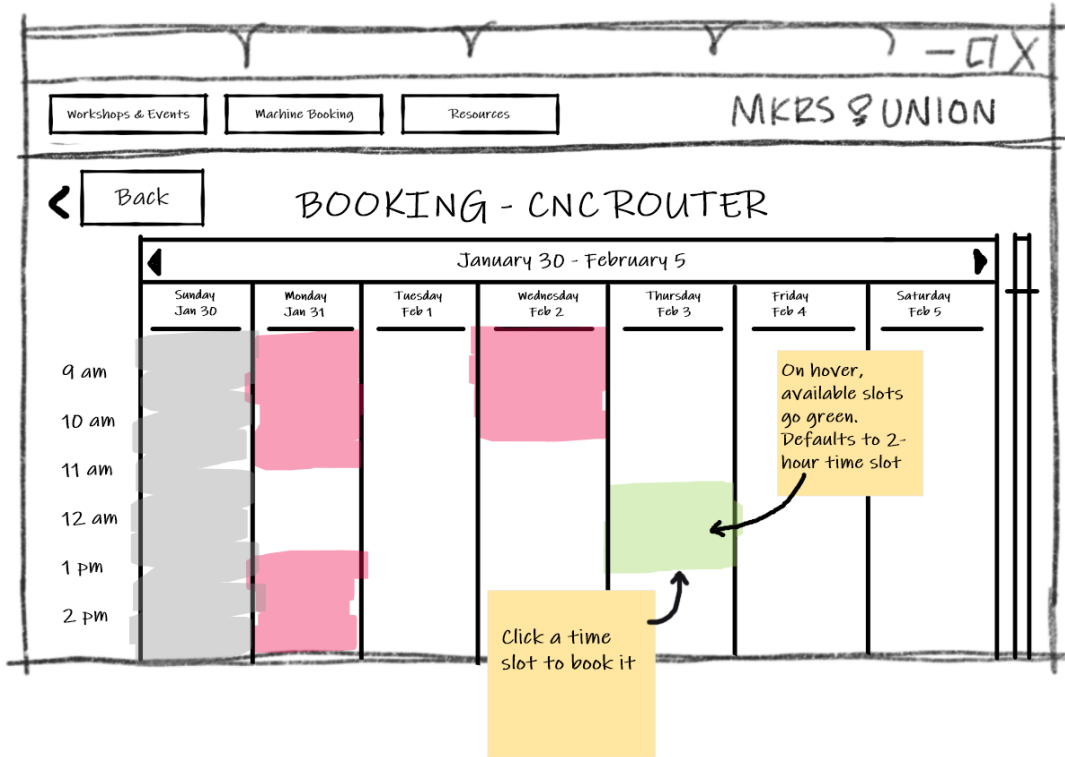
Figure 16.2. The schedule viewer when booking a time slot for a machine and the visual details of available time slots.
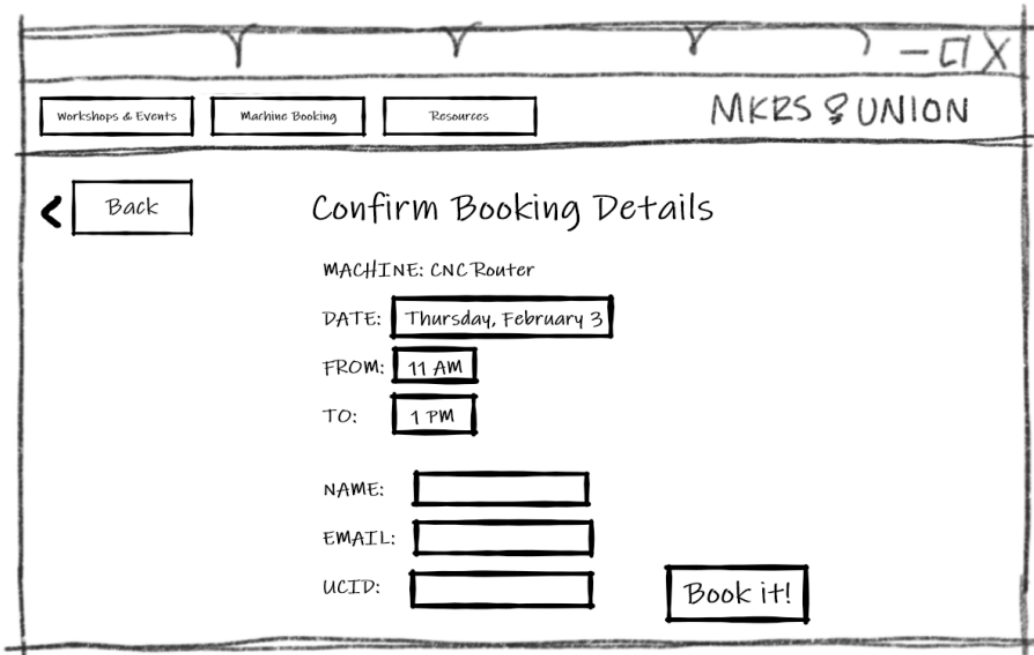
Booking details and confirmations:

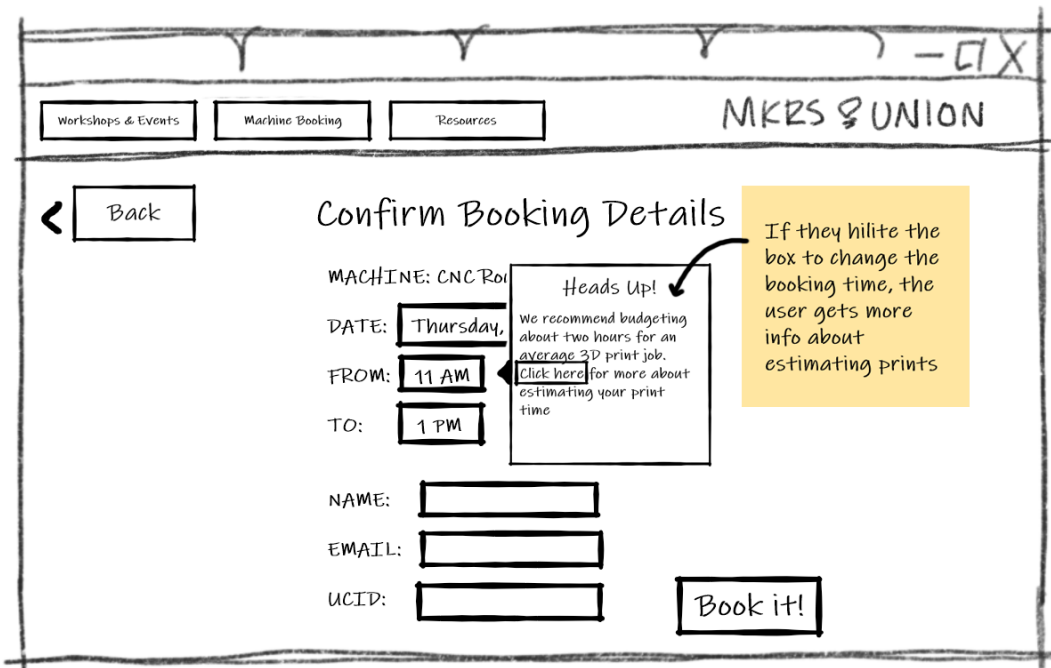Figure 17.1. Booking details confirmation page for a machine.

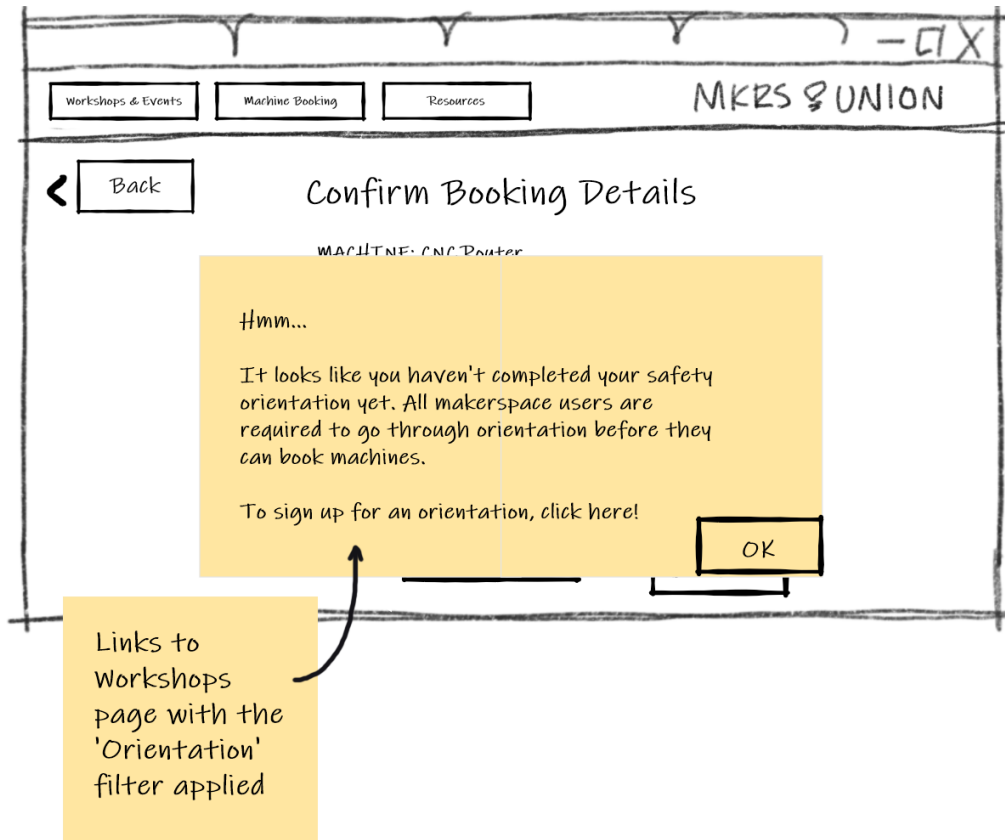Figure 17.2. Pop up about estimating print time when the user wants to change the booking time.

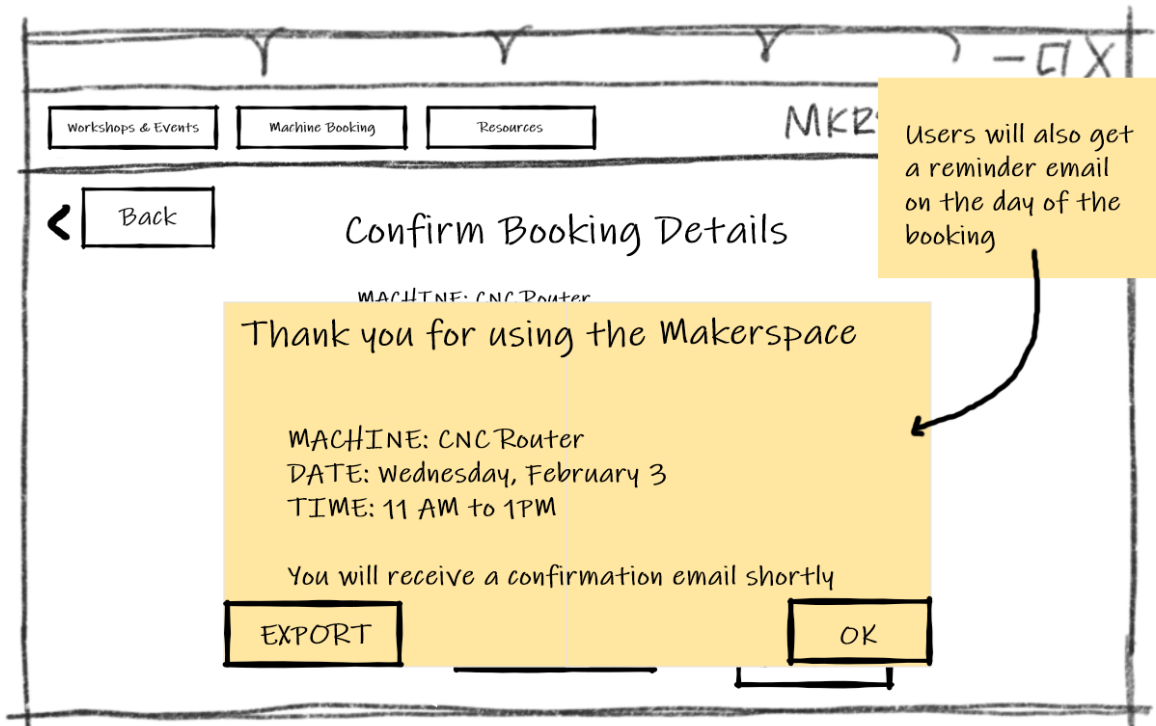Figure 17.3. Unsuccessful booking due to incomplete safety orientation.

Figure 17.4. Successful booking with option to export as a calendar event.
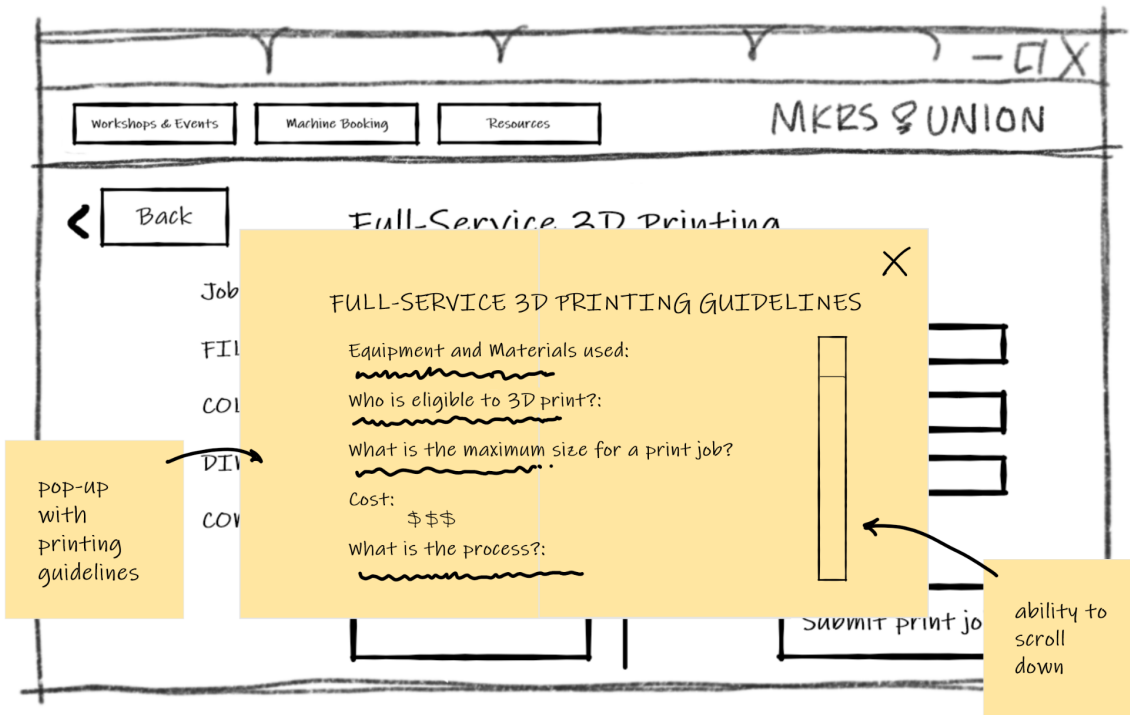
Full-service printing:

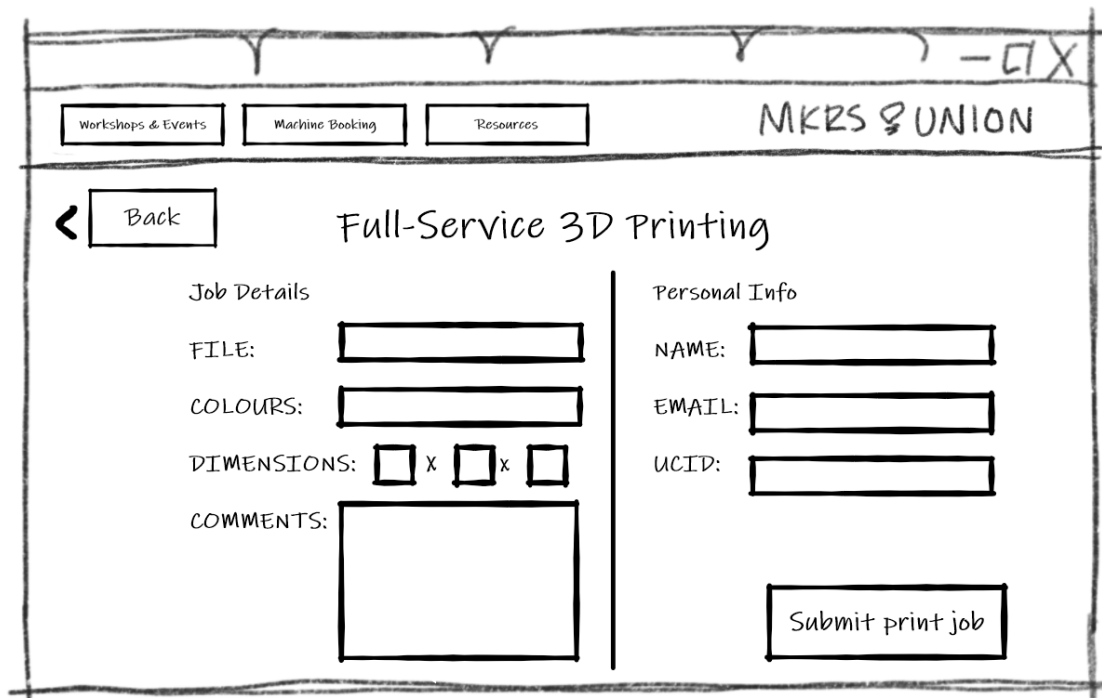Figure 18.1. Guidelines for full-service 3D printing.

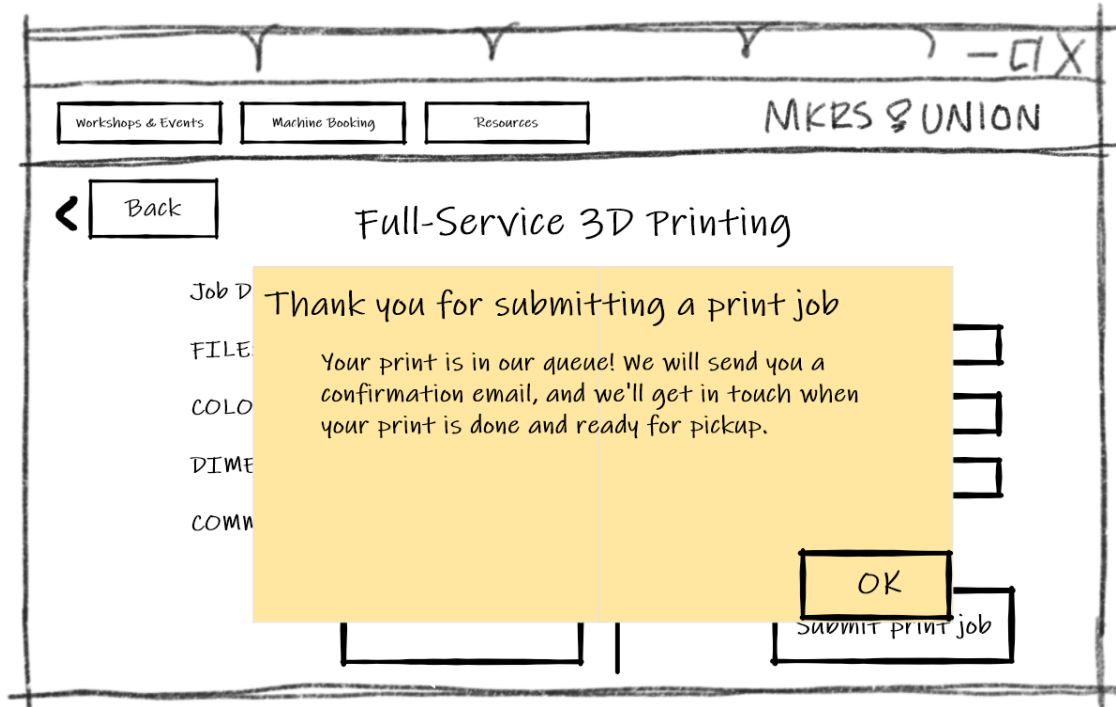Figure 18.2. Details form for submitting a full-service 3D print job.

Figure 18.3. Confirmation of successful full-serve 3D print job.
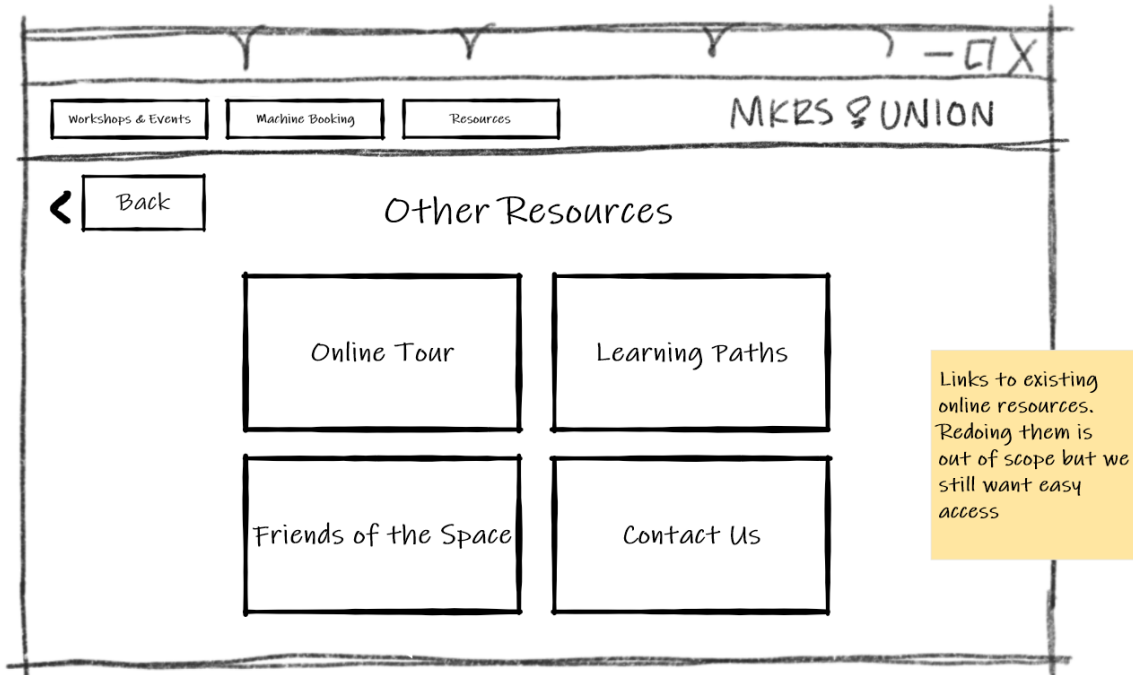
Other resources:

Figure 19. Other resources tab containing already existing resources from the TFDL makerspace website.
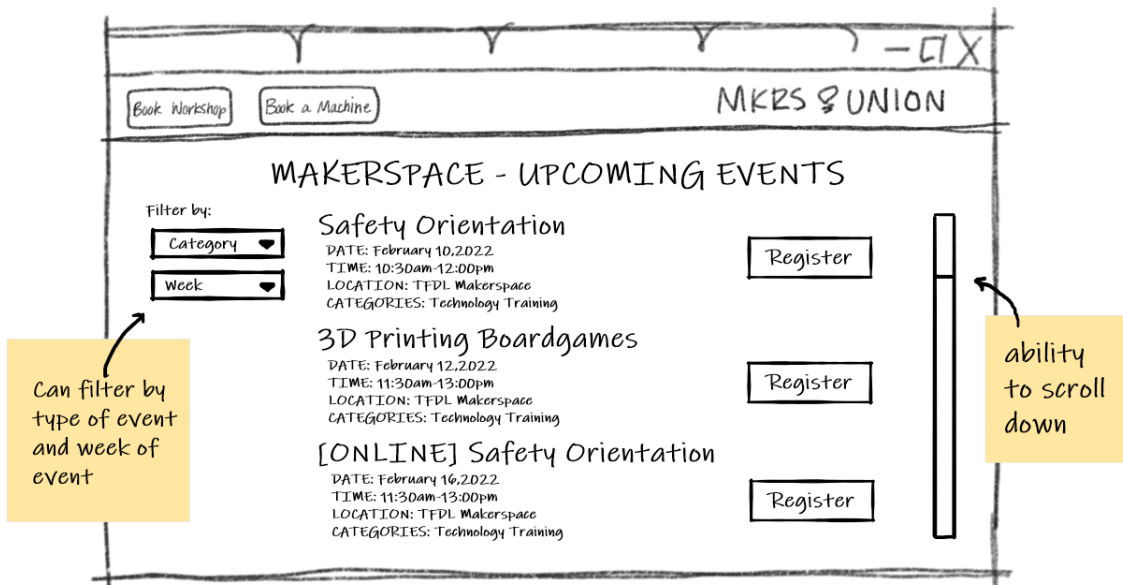
Booking a workshop:

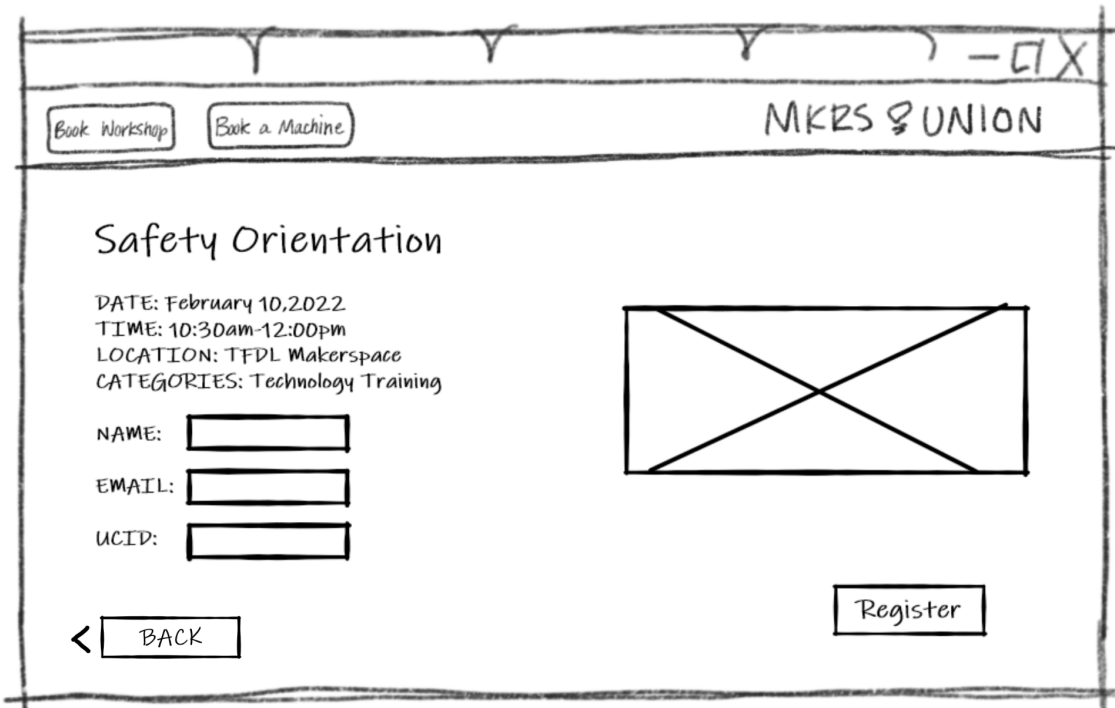Figure 20.1. Booking a workshop tab, listing all available workshops.

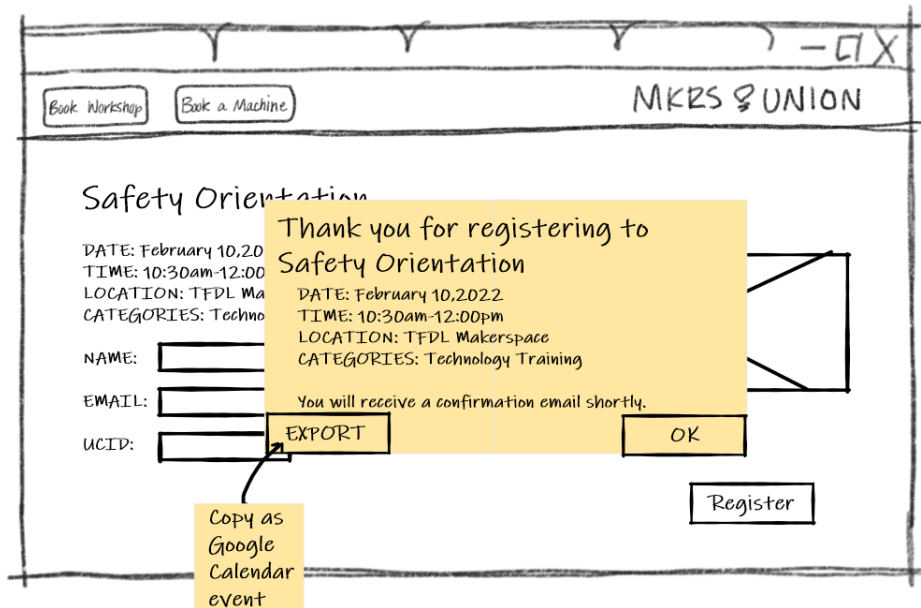Figure 20.2. Registering for a workshop page. Contains details regarding the workshop.

Figure 20.3. Confirmation of successful registration including option to export as calendar event.

Appendix III: Citations and References

This calendar was referenced as a template to make the first grid for the scheduler:

https://www.sketchappsources.com/free-source/2676-calendar-template-sketch-freebie-resource.html

Buttons, form, flexbox etc elements referenced from css bootstrap

https://getbootstrap.com/docs/3.4/css/