

bestrooms

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THE PROBLEM

Public restrooms are universally needed, but many user experiences are negative thanks to ignorance of the user's true needs on the part of restroom designers.

THE SOLUTION

A VR 3D visualization of a set of public restrooms, contrasting common design issues with the solutions suggested by my research.

IDEATION

Public restrooms have always intrigued me. Their ubiquity in modern spaces suggests that restroom users' needs should be well addressed by the available facilities. However, public restrooms are often inefficiently designed and aesthetically unpleasant, making them decidedly uncomfortable for users.

The idea for Bestrooms had already begun to take root in early 2019, when I first set out to research the design history of public restrooms. The volume of research available was less than impressive at first - however, some digging revealed a wealth of recent scholarship on the subject.

My research was supplemented by visual brainstorming: I experimented with different signage ideas, mocked up fixtures and layouts, and took notes on interesting features of the restrooms I visited on a daily basis.



RESEARCH

Research for Bestrooms began with a multifaceted problem. Public restrooms are an universal necessity, but many users' needs are poorly addressed by the restrooms they visit. These needs may be divided into three categories: privacy, hygiene, and accessibility. Nested within each of these classifications lie a number of other concerns. For example, accessibility not only entails wheelchair-friendly architectural design, but also understandable and inclusive signage. In order to practice proper hygiene, the user must be provided with the tools (for example, well-placed trash cans) they need to leave the restroom as clean as they found it.

But how might empathetic solutions to the needs described above be suggested to the decision-makers behind restrooms? In answer to this question, Bestrooms offers a VR visualization of a set of public restrooms, contrasting common design issues with the solutions suggested by myresearch. My own interest in the

emerging technology of VR, as well as my passion for three-dimensional digital design, makes Bestrooms a project well worth my time and enthusiasm.

While the fall semester of 2019 saw a significant amount of study done to define the research question, Spring 2020's research honed in on the details required to build a solution. This tangible research began with a review of prior studies, articles, and anecdotal accounts concerning the design of public restrooms. To this purpose, scholarly articles were found through a combination of Google Scholar and the Auraria Library online database. Books and non-scholarly sources were found and evaluated through Google, prior to purchase and/or reading.

Study of Bestrooms' central design problem turned up a great deal of clarifying information. Privacy's complex relationship with the gendering of restrooms was one of the areas in which preexisting research was most abundant.¹ Some studies make the radical suggestion that the practice of sorting and segregating restroom users by sex or

gender should be ditched entirely, eliminating the issues associated with assigning genders to users through the use of prescriptive signage and exclusive space planning.^{2 3 4} Gender inclusivity in restroom labels, pictorial signage, and even architecture is an attractive possibility.⁵

However, some users perceive mixed-gender restrooms as threats to their safety and privacy. These perceptions are discussed in researcher Terry Kogan et al.'s article on the safety questions posed by non-segregated facilities.⁶ But mixed-gender facilities are not as infeasible as they may seem. As an example, the public restroom in Santa Monica's Tongva Park maintains the privacy and dignity of its users without segregating them by sex.⁷ Inclusive toilets in Sweden take this notion one step further by incorporating convenient in-stall handwashing stations.⁸ Danish design firm UiWE approaches a similar issue by offering more convenient and equal urinal options with the PeeBetter project.⁹

On the other hand, convention and existing standards must also be respected when designing restrooms. A harsh reality confronts anyone looking to make major changes to an established system of design (for example, man/woman pictograms in restroom signage): conventions hold a great deal of power as ingrained parts of the society from which they came.¹⁰ But even conventional signage may be poorly implemented, causing confusion among users.¹¹

Even ADA requirements, some of which are rather complex, have a tendency to be left by the wayside during the space planning process.¹² An article by Sheila Schneider emphasized the importance of the user-expert: a user who has experience navigating the complexities of spaces not designed with them in mind.¹³ This article would have an effect on my choice of subject matter expert during the primary research phase.

Problems with less impact on social justice also occur frequently in the arena of public restrooms. Unfortunately, some facilities are designed for accessibility alone, with no interest in user comfort beyond what is necessary to avoid litigation.^{14 15} Hygiene and general user comfort affect, and are affected by, nearly every other issue with restroom planning.

But the problems that have been built into restrooms from their inception are not without their analysts.^{16 17} Some researchers even suggest solutions to problems like paper towel waste, users' tendency not to wash their hands, lingering odors, and unsatisfactory accessibility for the disabled and elderly.¹⁸

19 20 21 22

The next phase of secondary research served to inform the crafting of a solution to Bestrooms' design problem. From here, I explored a variety of VR design methodologies. During my search, I encountered Thomas Hilfert and Markus Koenig's helpful article on the fast prototyping possibilities afforded by head-mounted VR devices like the Oculus Rift.²³ Architectural visualizations using the

Unity game engine are not uncommon, given the engine's relatively smooth learning curve and its versatility across platforms.^{24 25}

Ian Bogost's *Persuasive Games* also proved useful as a review of diverse interactive design philosophies. Bogost details a number of ways in which gamelike simulations may be used to persuade and inform users. He cites auto manufacturer Volvo's *Drive for Life* as a positive example of an "advergame," a gamelike simulation designed to persuade consumers of Volvo cars' value. *Drive for Life* uses contrasting positive and negative level states to drive home the importance of the brand's signature safety.²⁶ Bogost also describes myriad alternative psychological methods of encouraging specific behaviors through games.²⁷

Secondary research is insufficient to address a problem with such a complex network of impacts, however - so primary research for Bestrooms began in late summer of 2019 and continued throughout the spring 2020 semester. Two brief walkthroughs of a single small

restaurant's restroom kicked off this season's period of primary research. These walkthroughs revealed more subjective opinions on aesthetic than they did on function, and so this method was retired in favor of more productive ones.

Preliminary user surveys were distributed throughout the year of 2019, with their focus narrowing as the project's true research needs were determined during the fall semester. 2019's initial three surveys collected a small amount of demographic data from their 26 respondents. Most of those who reported their age were between 18 and 24 years old. Respondents reported their preferences regarding gendered restrooms, flush mechanisms, and handwashing habits. One of the surveys collected qualitative data on user priorities when choosing a restroom, informing the direction of later research.

A few notable conclusions drawn from these preliminary surveys were that users 1) prioritized cleanliness very highly, 2) felt aesthetic was important to the restroom experience, and 3) had widely varying views on the salience or even safety of

gender-neutral restroom facilities. One of these surveys asked users to choose between toilet/urinal icons and man/woman pictograms - 9 of 14 respondents chose the latter. However, this question was not accompanied by an image. In a later, improved survey, users would be asked to make the same choice between signage schemes, this time with a visual example of what each would look like.

This refined survey allowed users to rate a series of images on a scale of one to five in terms of effectiveness and clarity. Conventional man/woman pictograms were more unanimously preferred over other options, with non-gendered urinal/toilet symbols coming in as a close second. Text-only signs with "men," "women," and "unisex" language were also well received, with a majority of users rating them at a 4 out of 5. A text-only sign labeled "anyone" was not so unilaterally well received. Traditional Mars/Venus symbols were found quite confusing by respondents. Finally, triangle/circle forms paired with "men" and "women" text were least well-received.

A survey on interior aesthetics was distributed simultaneously with the signage survey described above. This survey was designed with the aim of selecting an aesthetic theme for the restroom visualizations to be included in the final project. Image-based and informed by cursory secondary research on common public restroom finish options, the survey garnered 15 responses in total. A light grayscale color scheme was preferred by almost half of all respondents, surpassing warm colors, cool colors, and a strongly-contrasting combination of black, brown and white.

Over half of the survey's respondents preferred round toilets over elongated/oval ones, with no respondents favoring square toilets. Partial-trough sinks (individual basins recessed into a shared countertop) were preferred by just over half of all respondents, with full trough (no separation between faucets; shared basin) coming in second, and separately-mounted sinks coming in third.

Which stall partition finish is most visually appealing? *

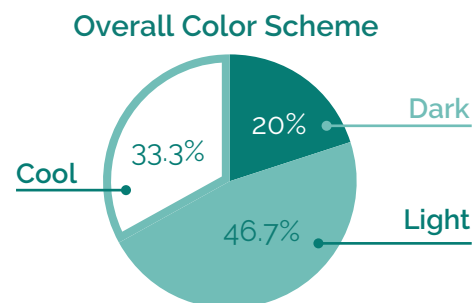
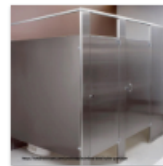
☐ Dark Matte



☐ Light Matte



☐ Stainless Steel



Questions and answers from my survey on aesthetics.

Dark matte-finish stall partitions were preferred over light matte and stainless steel finishes. Common restroom flooring finishes include poured epoxy and tile, so I offered respondents a choice between

gray epoxy, brown epoxy, light tile, and dark tile. Nearly half of all respondents preferred dark tile, with gray epoxy coming in second, light tile coming in third, and brown epoxy last with only one vote.

While anyone might serve as an example of a public restroom user, some view the entire restroom experience through a specialized lens. A few of these individuals served as my subject matter experts.

Maria Buszek, the first individual I consulted, is an art and design historian and a gender studies scholar at CU Denver. She also reviewed my spring 2019 research regarding Bestrooms' central design problem. Both of my sessions with Buszek demonstrated that aesthetic is important, but only when it entwines with function and hygiene. Architects and space designers tend to focus on the most public parts of their buildings, ignoring the restroom thanks to its reputation as a forgettable space.

Buszek confirmed that digital animation could be used to describe the function and qualities of various materials, fixtures, signage/etc. where such things are not as easy to communicate verbally. She also suggested floor-to-ceiling walls as a means of mitigating the privacy concerns associated with mixed-gender restrooms, and shared her opinion that trash receptacles should be placed between sinks and near vestibule doors for ease of access.

A professor of design at CU Denver, Carrie Osgood is experienced in using design to communicate sensitive or taboo topics. As a designer, she is also skilled in data visualization. An informative hour with Osgood demonstrated that hygiene should come first, as this is the reason restrooms exist to begin with. She confirmed that accessible stalls should be near the main entryway to the restroom, and suggested the use of mirrors to create the illusion of space. Osgood also encouraged me to give non-gender-related problems more weight in the overarching scheme of the project, as these issues apply to all users.

Andrew Rotz is a facilities manager at Skaggs School of Pharmacy at Anschutz. He is experienced in the ins and outs of managing multi-user restrooms for public facilities. Rotz's insight as a facilities manager helped clarify that ADA standards should always come first when suggesting restroom renovations or new designs. Hygiene should also be a high priority when selecting materials for fixtures and surfacing - ceramic tile and white surfaces are preferable over other options due to how easy they are to keep clean. Plumbing for toilets and other high-flow fixtures should share a central wall where possible. Rotz also encouraged me to highlight the financial consequences of ADA noncompliance to motivate decision-makers.

Mackenzie Leiter is a space planner for the CU Denver campus. Her perspective on restrooms from an architectural standpoint was useful to my research. Leiter's review of my layout mockups further encouraged me to ensure compliance with ADA space requirements. She clarified that the difficulty of maneuvering a wheelchair around current sink users in the narrow corridor between

sinks and stall doors may be one reason for the fact that accessible stalls are rarely placed near vestibule doors.

However, Buszek, Osgood, Rotz and Leiter were not the only people I consulted for individual advice. I also sought out two design media experts for mentorship and feedback on the direction of my project as it developed.

Jeanne Bacque, my first design mentor, is a creative director and brand identity designer. She works across a multitude of media ranging from screens to office interiors, exercising her skill as a diplomatic and straightforward communicator. Both of my meetings with Bacque encouraged me to relate my solution directly to the audience to prevent them from losing interest on account of its taboo nature.

Bacque encouraged me to consider plumbing limitations when designing restroom layouts. She suggested that trash cans should be placed next to main vestibule doors, and that soap dispensers should empty into sink basins. Bacque also shared her experience that classic,

time-honored interior design is generally aesthetically preferable to trend-chasing design, as it will remain appealing for longer. Finally, she offered advice as to how to structure future primary research, and how to frame my solution for an audience of decision-makers.

Bryan Leister, my secondary design mentor, is a professor of digital design and illustration at CU. His experience in design for immersive media (Unity in particular) proved useful in informing the technical aspects of my solution. Leister advised me to base digital prototype layouts and asset sizes on real-life scaling guidelines.

All further research was completed as part of the prototyping and testing cycle. Due to changing circumstances resulting from the 2020 COVID-19 pandemic, only housemates were consulted for in-person feedback and guidance during this process, further informing aesthetic and the function of the final interactive executable.

In summary, both primary and secondary research suggests the creation of a VR experience for installation and use in a shared physical environment such as a tradeshow or gallery exhibition. This choice is motivated by my own training as a 3D designer, and by my interest in VR as a valuable method for interior space visualization. While this project will not immediately solve the problems plaguing today's public restrooms, it aims to generate understanding and empathy for the users' diverse needs in all those who experience it.

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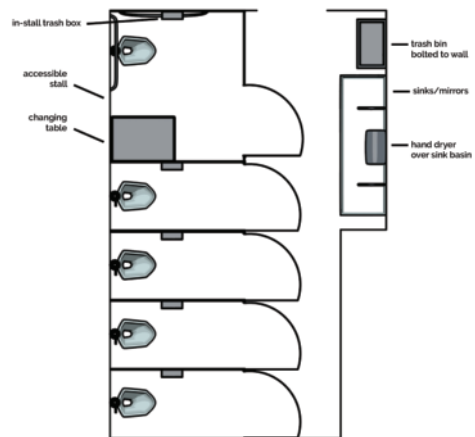
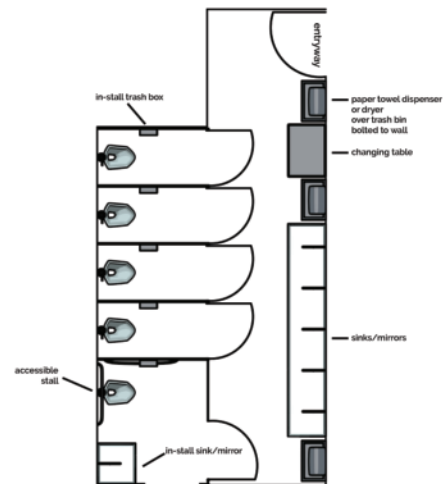
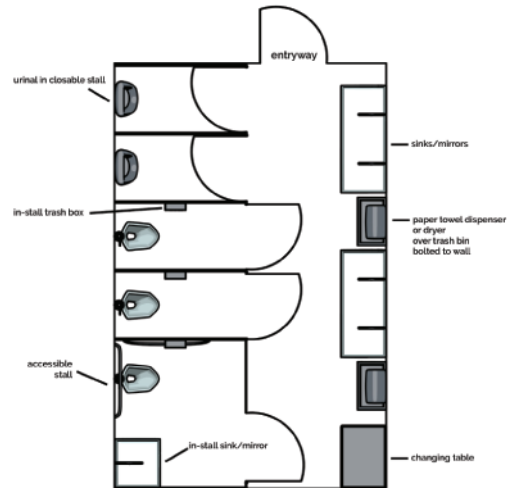
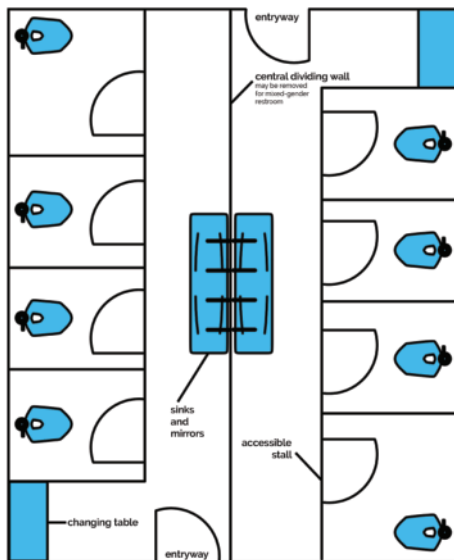
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ITERATION

Having solidified some of the basic details of my restroom redesigns through research, I moved on to design several layout alternatives. In total, I created 13 layout options for experts to review and provide feedback on. These layouts helped outline the assets I would need to create.

Below, an image of the first layout created for this round of revisions may be seen. To the right, three of the layouts from which I derived a final solution are included.

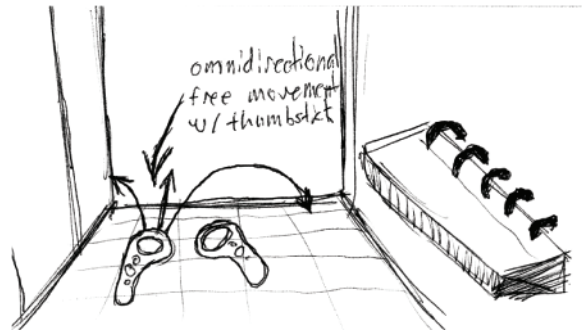


HONING IN

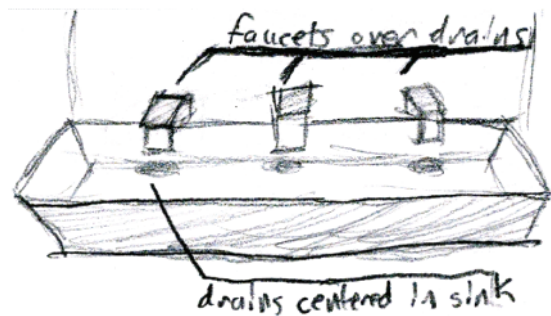
A platform, method of locomotion, and other basic mechanics were chosen during this time. Storyboards were drawn up, evolving as the project did to guide the development of 3D assets and the final VR executable.

Alongside storyboards and layout templates, an abundance of 3D assets were crafted in Cinema 4D. These pieces would evolve as the project continued, better matching the results of my research.

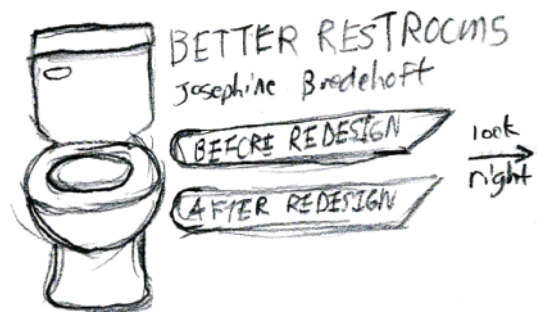
Illustrator was used to craft UI elements ranging from buttons to decorative sprites. When complete, each asset was imported into Unity and placed as planned.



Player Movement UI



Highlighted Sink With Description

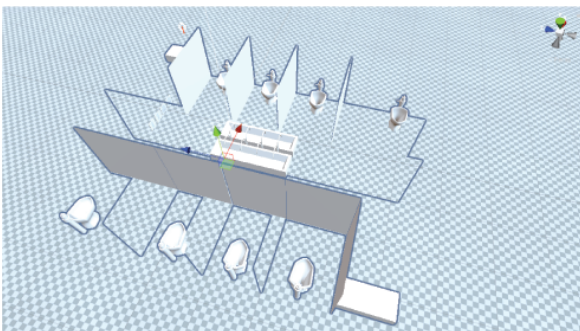


Starting Menu Scene Select

PROTOTYPING



The artist testing an early iteration of Bestrooms.

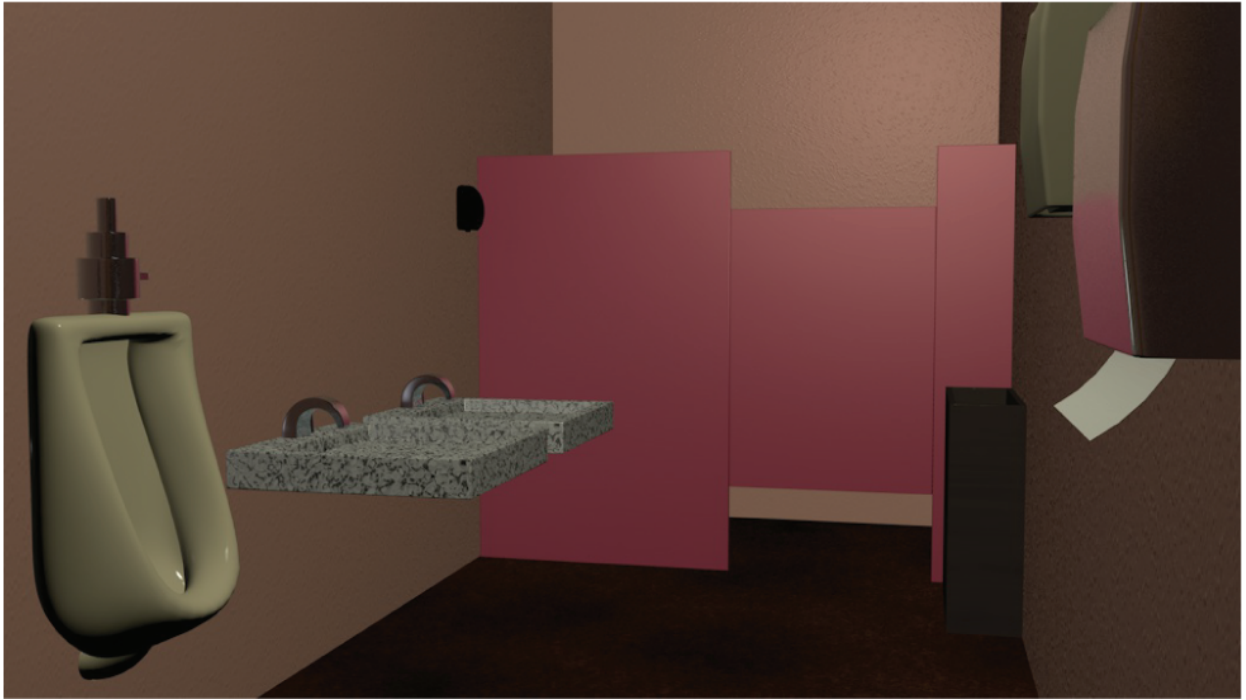


An early layout, imported into Unity.

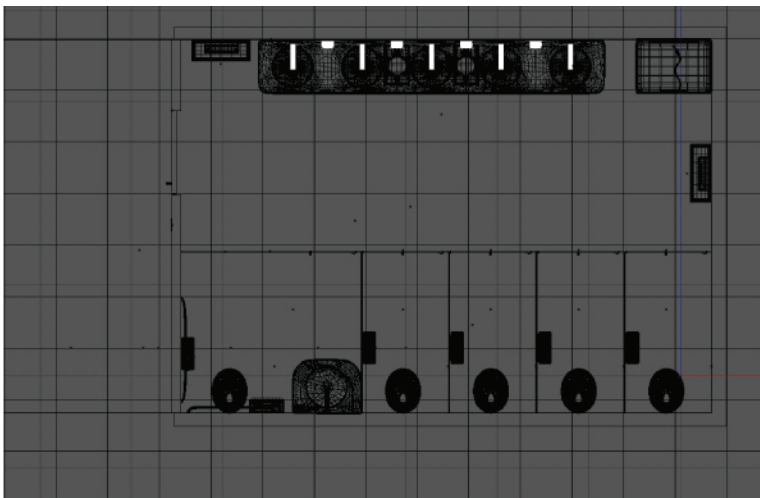


An early test of VR mechanics in Unity.

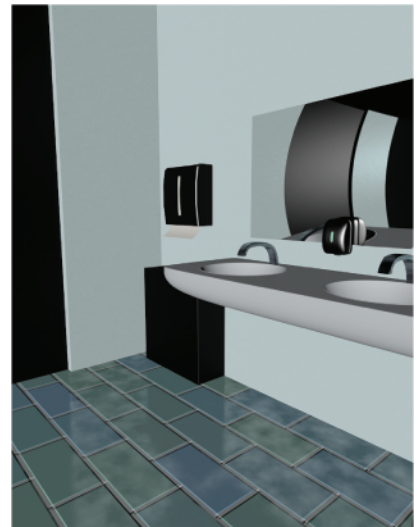
PROTOTYPING



A materials test for the poorly-designed restroom scene.



Overhead view of the improved restroom scene.



A materials test for the improved restroom scene.

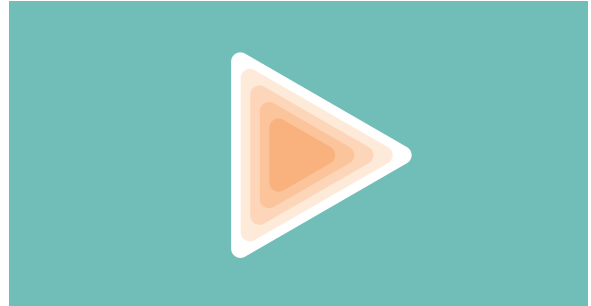
EXECUTION

Original models were imported into Unity from Cinema 4D. Materials and textures were added to these models, and a user interface built upon Oculus' interaction framework.

After rigorous prototyping and testing conducted by the artist and her housemates using an Oculus Rift S headset and controllers, the final Bestrooms executable was complete. With object colliders, tooltips, and interaction menus in place, the Unity scene file was built out as a standalone file for Windows-based systems.

Bestrooms' final deliverable is comprised of one set of restrooms with the positive characteristics indicated by my research, and one featuring poor design.

The images on the next four pages include views of both the positive and negative restroom scenes included in the executable.



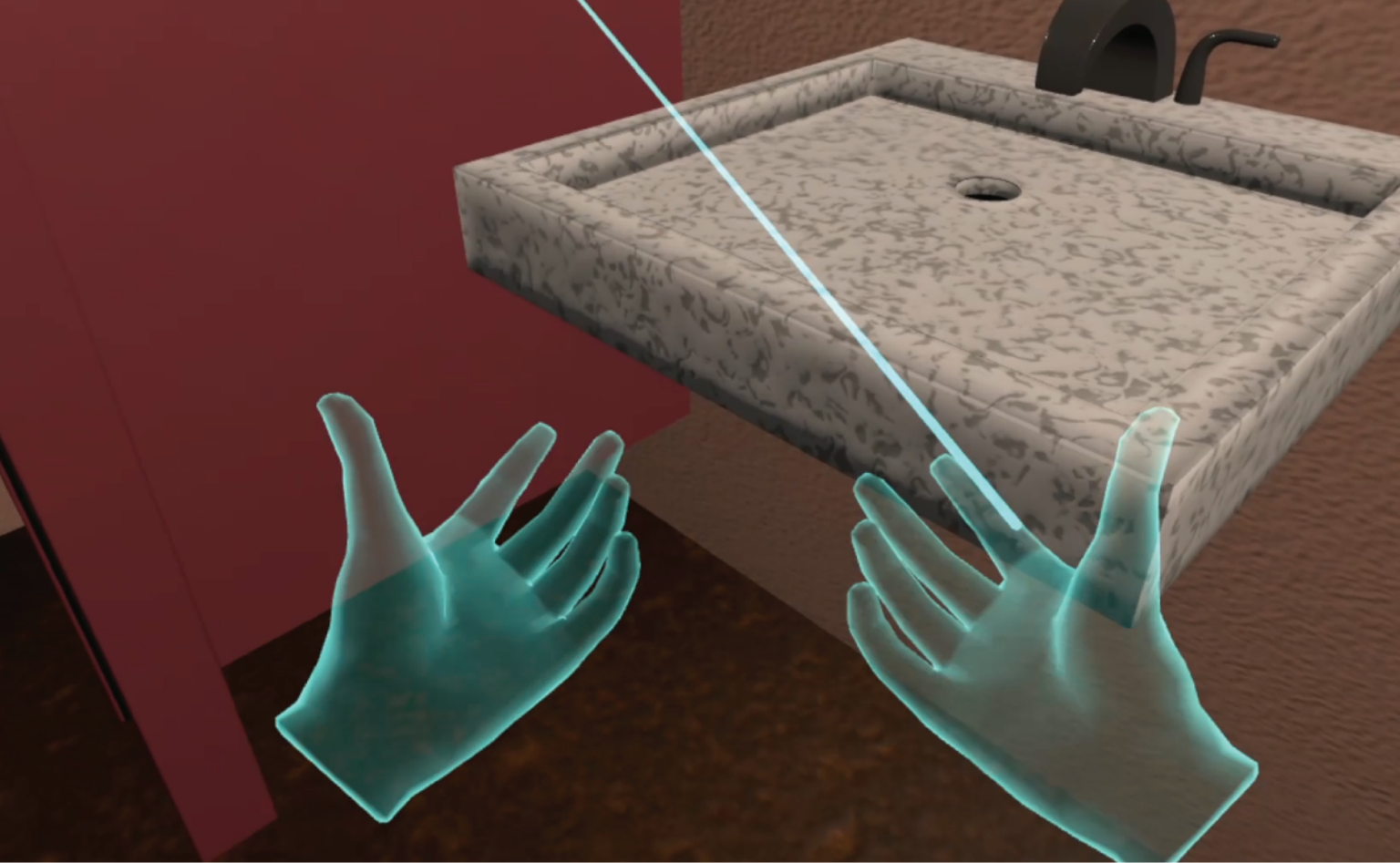
Five-Minute Video Demo

<https://youtu.be/E0tu53BH5-o>



Downloadable Experience

<https://josephinebredehoft.itch.io/bestrooms>



Dark toilet seats hide
dirt and moisture.







press Esc key
to exit VR

push left thumbstick
forward to move

press A to select
a menu item

instructions

look right to select a restroom

Small trash bins
are placed in each stall.

High-capacity
dispensers with
maintenance w
check tissue lev



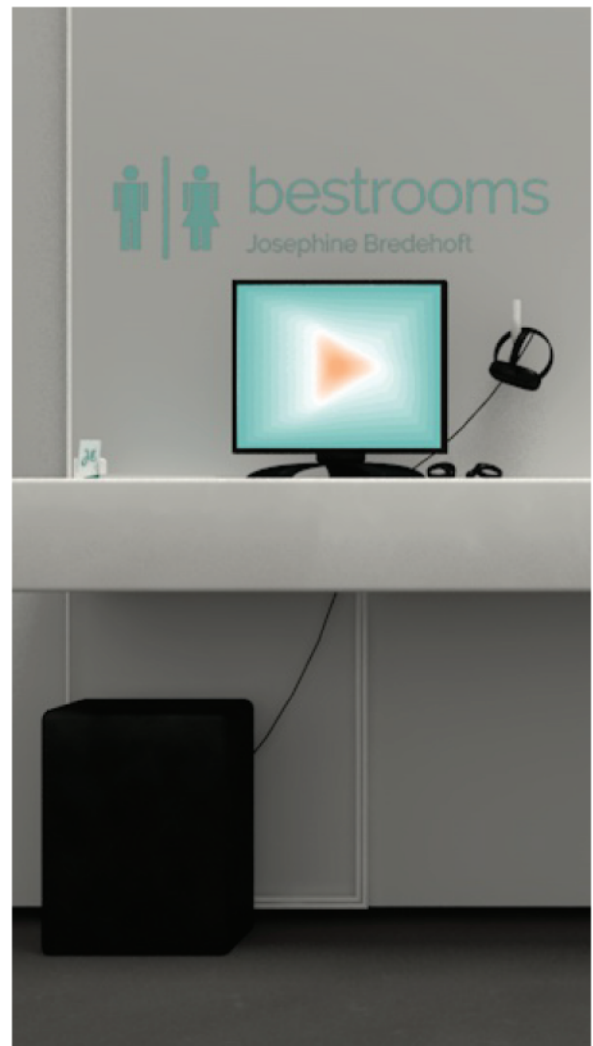
GALLERY EXHIBIT

This piece's gallery installation is comprised primarily of a VR experience, with ancillary print materials and a screen display included as support. Supporting the exhibition's physical elements, a shelf approximately 8' in length is mounted to a movable 12' wall. The left half of this shelf holds a 16" Dell monitor, one copy of the process book, a white business card holder, and both handheld VR controllers.

White gaffer's tape secures a single power cable to the wall and conceals its presence, following the cord's length from the ceiling to the floor. Three outlets on the end of this lead deliver power to the computer and its monitor through additional cords. From the back of the PC, a display cable and power line run back up through a hole in the shelf to provide power and connect the monitor with the computer. Both of these cables are also concealed and held to the wall with gaffer's tape. The cord connecting the VR headset to the computer is also routed

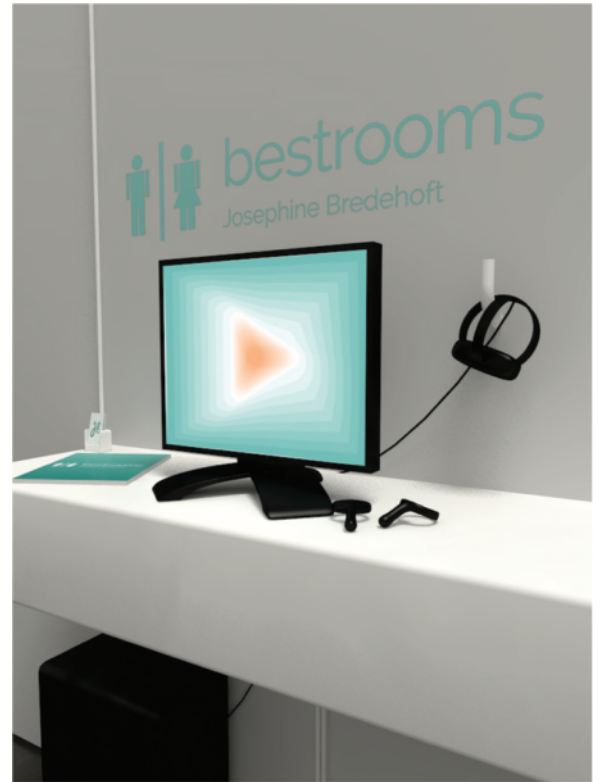
through the hole in the shelf to the PC below, but is not taped to provide users with a comfortable range of movement.

Hanging from a strong metal hook screwed into the wall, an Oculus Rift headset waits for use. Immediately above the monitor, a removable vinyl sticker approximately 36" by 21" in size indicates the names of exhibition and artist.



INSTALLATION

These digital renderings, set in design professor Bryan Leister's recreation of the Denver Redline Gallery's interior, provide an example of what the project's hardware and print materials would look like in an exhibition setting.



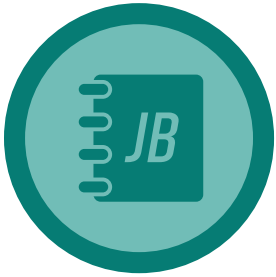
ABOUT THE ARTIST

I produce brand-aligned motion design in a multidisciplinary context, rapidly adapting my skillset to satisfy the identity demands of today's media market.

jb

By channeling my intense enthusiasm for three-dimensional motion through everything I make, I infuse my clients' films and presentations with energetic sophistication. I bring the unseen beauty within my clients' realms of practice to the surface in an accessible, exciting way. I combine familiar forms from the natural world with imagined strangeness to produce a sense of wonder in the audience.





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