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### Utilizing Mobile Technology to Improve Accessibility for Museum Visitors with Autism

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THE ROCHESTER INSTITUTE OF TECHNOLOGY

COLLEGE OF LIBERAL ARTS

UTILIZING MOBILE TECHNOLOGY TO IMPROVE ACCESSIBILITY

FOR MUSEUM VISITORS WITH AUTISM

A THESIS SUBMITTED

IN PARTIAL FULFILLMENT OF THE

BACHELOR OF SCIENCE DEGREE

IN MUSEUM STUDIES

DEPARTMENTS OF PERFORMING ARTS AND VISUAL CULTURE AND HISTORY

BY

FELICIA DIANNE SWARTZENBERG

APRIL 2019

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## **Abstract**

What if museums could provide an app that makes interaction easier for visitors with autism and allows them to enjoy the museum any day of the week like their neurotypical counterparts? This research discusses how museums can utilize downloadable apps for personal devices to provide easily accessible resources for children on the autism spectrum and their families to use so they can have a more inclusive and sensory-friendly museum experience. To determine the feasibility of this, I worked in collaboration with an app developer, Peter Laurin, to create a prototype-app called *SenseEase: Strong Museum* for the Reading Adventure Land exhibit area at the Strong National Museum of Play in Rochester. The app caters to children ranging from four to twelve years of age, and aims to help prepare them and their families for their museum visit and help them cope with the overwhelming sensory stimulation that occurs in this particular museum environment. To evaluate the effectiveness of the app, I conducted two rounds of user testing, one with a general audience and one with my target audience for the app, and found that *SenseEase: Strong Museum* was a well-received and effective aid for children on the autism spectrum and their families navigating the unfamiliar and overstimulating environment at the museum.

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## **Introduction**

In an ideal world, museums function as public institutions that welcome visitors of all ages, backgrounds, and abilities. However, until the Americans with Disabilities Act (ADA) passed in 1990, most public spaces, including museums, did not cater to all audiences; they only served people perceived as being of able mind and body. As a result of the ADA and the efforts of disability rights activists, now, most public spaces, facilities, and institutions in the United States are more conscious of including people of all physical and mental abilities.

Many museums have made efforts to improve their accessibility options, including creating programming for people on the autism spectrum that is aimed at creating a more sensory-friendly experience. However, no museum is perfect and there are opportunities for improvement in every museum's accessible programming options. The options available for an organization the size of the Smithsonian Institution are far greater than museums of smaller magnitude. However, low budgets do not eliminate the need for accessible options, they simply pose challenges: how can one create an accessible experience without spending money on early museum openings, sensory-friendly gear like noise cancelling headphones, or hiring someone to train staff on how to work with individuals on the spectrum?

One method of approaching this question could be to provide an app that makes museum interactions easier for visitors with autism and enables them to enjoy the museum any day of the week like their neurotypical counterparts. This research discusses how museums can utilize downloadable apps for personal devices to provide easily accessible resources for children on the autism spectrum and their families to use so they can have a more inclusive and sensory-friendly museum experience. To determine the feasibility of this, I collaborated with an app developer, Peter Laurin, a senior game design and development student at Rochester Institute of Technology, to create a prototype-app called *SenseEase: Strong Museum* for the Reading

Adventure Land area at the Strong National Museum of Play in Rochester, N.Y. The overall goal of the app is to assist the museum in providing a comfortable, positive museum experience for visitors on the autism spectrum by giving visitors a hand-held tool to help them prepare for their visit and distract from the overwhelming sensory stimulation that occurs on site in this particular museum environment. My focus is particularly on visitors ranging from four to twelve years of age, as that is the general age range of visitors that the Strong Museum attracts. Once the app was completed, I conducted two rounds of user testing, one with a general audience and one with the target audience of children on the autism spectrum and their families, to collect feedback on the effectiveness of the app. After reviewing the feedback, I observed that users found that this app and its contents were a highly effective tool that helped them successfully navigate and have a positive experience at the museum.



## Literature Review

### Americans with Disabilities Act

When establishing the ADA, Congress recognized that “physical and mental disabilities in no way diminish a person's right to fully participate in all aspects of society, but that people with physical or mental disabilities are frequently precluded from doing so because of prejudice, antiquated attitudes, or the failure to remove societal and institutional barriers.”<sup>1</sup> The act was drafted and passed to accomplish the following:

- (1) To provide a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities;
- (2) To provide clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities;
- (3) to ensure that the Federal Government plays a central role in enforcing the standards established in this chapter on behalf of individuals with disabilities; and
- (4) To invoke the sweep of congressional authority, including the power to enforce the fourteenth amendment and to regulate commerce, in order to address the major areas of discrimination faced day-to-day by people with disabilities.<sup>2</sup>

Since the passage of the Americans with Disabilities Act, there have been several revisions and additions to the document. One revision of particular importance for museums came on September 15, 2010, when the Department of Justice revised the regulations for Titles II and III of the ADA and adopted enforceable accessibility standards.<sup>3</sup> This revision was titled “ADA Standards for Accessible Design.” These standards set minimum requirements for newly designed, constructed, or altered public and commercial facilities with the intention of making public spaces easily accessible for individuals of all abilities.<sup>4</sup> For museums, this meant that they

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<sup>1</sup> ADA: Americans With Disabilities Act of 1990, Public Law 101-336. § III. 108th Congress, 2nd session (July 26, 1990), <https://www.ada.gov/pubs/adastatute08.htm#12101b>.

<sup>2</sup> ADA: Americans with Disabilities Act of 1990.

<sup>3</sup> ADA: Standards for Accessible Design, Department of Justice (September 15, 2010), [https://www.ada.gov/2010ADASTandards\\_index.htm](https://www.ada.gov/2010ADASTandards_index.htm).

<sup>4</sup> ADA: Standards for Accessible Design.

needed to reevaluate not only their building floor plan, but their exhibition designs as well.

While many of these changes can be costly in terms of renovation, the result of allowing all visitors to enjoy a space regardless of ability is a more than worthy outcome.

While the ADA and related legislature have been very helpful in terms of making change in public spaces for people with disabilities, relying on law alone to mandate these changes is insufficient. Minimal compliance with the law can mean that institutions will miss out on the opportunity to create an accessible and inclusive space that would enhance the visitor experience for all types of audiences. Taking action simply because the law dictates what should be done can result in thoughtless accommodation when institutions should be actively devising unique and comfortable ways to include people of different abilities.

In her undergraduate thesis *Accessibility Practices & the Inclusive Museum: Legal Compliance, Professional Standards, and the Social Responsibility of Museums*, museum studies professional Ruth Starr explains that often much of the motivation museums have for institutional change is complaint-driven.<sup>5</sup> This means institutions assume compliance with ADA laws and accessible design until a complaint is issued by a visitor.<sup>6</sup> Most, if not all, public spaces comply with the legal obligation to be accessible, but often—regardless of intent—it seems that these actions toward accessibility rarely exceed the bare minimum.

As articulated by Starr, assumed compliance has seemingly resulted from limited and vague goals that public and cultural institutions are expected to meet in order to become more accessible and provide reasonable accommodations.<sup>7</sup> Vague, undefined goals can become

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<sup>5</sup> Ruth Erin Starr, “Accessibility Practices & The Inclusive Museum: Legal Compliance, Professional Standards, and the Social Responsibility of Museums” (Bachelor’s thesis, Rochester Institute of Technology, 2016).

<sup>6</sup> Starr, “Accessibility Practices & The Inclusive Museum: Legal Compliance, Professional Standards, and the Social Responsibility of Museums.”

<sup>7</sup> Starr, “Accessibility Practices & The Inclusive Museum: Legal Compliance, Professional Standards, and the Social Responsibility of Museums.”

problematic due to the varied interpretations of what “reasonable accommodation” means for individual institutions. A large, well-funded institution may have a different definition of what is reasonable than a smaller, volunteer-run institution. Similarly, museums in some communities may have higher standards for what qualifies as reasonable accommodation than other communities.

To attempt to address or overcome differing interpretations of what constitutes as “reasonable” access and accommodation, the American Alliance of Museums (AAM), the national accrediting body for museums in the United States, has adopted their own *Characteristics of Excellence*, a document detailing the core standards for all accredited museums.<sup>8</sup> This document includes several key points that further clarify what museums should be thinking about when developing reasonable accommodations and access for the museum: the museum must identify the different demographics and communities it serves and use that knowledge to guide decisions on how the institution serves the public; the museum must understand “the characteristics and needs of its existing and potential audiences” and utilize this knowledge as it creates exhibitions and interpretations; the museum must show “a commitment to providing the public with physical and intellectual access” to museum resources; and the museum must utilize methods that are appropriate for its audience, educational goals, and resources.<sup>9</sup> Putting emphasis on the needs and desires of the visitor can help museums evaluate what reasonable accommodations are, forcing the museum to think past assumed compliance and observe their audience. Asking the question “What does my community need?” can provide

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<sup>8</sup> American Association of Museums, “Characteristics of Excellence,” (1993), <http://www2.aam-us.org/resources/ethics-standards-and-best-practices/characteristics-of-excellence>; Since this document has been published, the American Association of Museums has rebranded and now goes by the title “American Alliance of Museums.

<sup>9</sup> American Association of Museums, “Characteristics of Excellence, (1993).

much more insightful answers than asking “What do I need to do in order to comply with the ADA?”

In the years since the passage of the ADA, museums have worked diligently to ensure that their facilities and exhibition spaces are able to be seen and appreciated by everyone regardless of their physical limitations. One example of this is the development and adoption of universal design. Universal design focuses on “the physical, cognitive, and social inclusion of visitors with disabilities in museum experiences,” and, to achieve this inclusion, the Center for Universal Design published formal principles of universal design and principles for universal learning.<sup>10</sup> These principles of universal design and learning are not only helpful for those with disabilities, they can be helpful for anyone. For example, ramps are essential for people who use wheelchairs or other assistive walking devices, but they can also be really helpful for families who have a baby stroller or older people who may feel more comfortable or have an easier time using a ramp than walking up stairs. The Boston Museum of Science has employed the universal design approach since the 1980s and continues to ensure that each exhibit and space within the museum is “designed with inclusion in mind.”<sup>11</sup> In addition to being transparent with their reports and planning for inclusive design,<sup>12</sup> the museum also provides visitors with a detailed list of their accessible services, including transportation, interpreters, and specific tips for visitors with autism or similar developmental delays.<sup>13</sup>

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<sup>10</sup> “Universal Design for Museum Learning Experiences: Resources for museum professionals on employing a universal design approach for exhibits, programs, and evaluation,” Boston Museum of Science, accessed Nov. 30, 2018, <https://www.mos.org/UniversalDesign>.

<sup>11</sup> “Universal Design for Museum Learning Experiences: Resources for museum professionals on employing a universal design approach for exhibits, programs, and evaluation.”

<sup>12</sup> See the Universal Design Plan for Exhibit Design & Development provided by the Boston Museum of Science, [https://www.mos.org/sites/dev-elvis.mos.org/files/docs/misc/MOS\\_UD\\_Plan.pdf](https://www.mos.org/sites/dev-elvis.mos.org/files/docs/misc/MOS_UD_Plan.pdf).

<sup>13</sup> “Accessibility,” Boston Museum of Science, accessed Nov. 30, 2018, <https://www.mos.org/accessibility>.

Abiding by outlines set forth by the ADA, universal design and individual museum programs are a great start toward ensuring all visitors can enjoy a museum experience. However, there is still room for improvement, particularly in serving individuals with mental disabilities or developmental delays, like autism spectrum disorder. While these visitors may not need what one might consider traditional accommodation, like needing a certain size text or an elevator or ramp to travel floor to floor, they still have needs that museums must meet for them to truly enjoy their museum visit.

### **Living with autism**

For many individuals on the autism spectrum, simple stimuli encountered in everyday life can result in catastrophic and overwhelming feelings that are both physically and mentally exhausting. In his book, *Autism Discussion Page on the Core Challenges of Autism: A Toolbox for Helping Children with Autism Feel Safe, Accepted, and Competent*, behavior and autism specialist Bill Nason explains that people who are on the autism spectrum have difficulty with registering, integrating, and processing sensory experiences in all areas of life.<sup>14</sup> These issues can materialize in many ways, the most common being: fragmented or distorted perception; hyper or hyposensitivity to sensory stimulation; sensory defensiveness; difficulty integrating one's senses; mono processing; delayed processing; sensory overload; and modulating arousal level.<sup>15</sup> All of these issues make it difficult for an individual with autism to interact with the world and other people, particularly in environments that have a plethora of sensory stimulation, such as loud noises, flashing lights, or large crowds.

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<sup>14</sup> Bill Nason, "Part III: Sensory Issues in Autism," in *Autism Discussion Page on the Core Challenges of Autism: A Toolbox for Helping Children with Autism Feel Safe, Accepted, and Competent* (London: Jessica Kingsley Publishers, 2014), 129-196.

<sup>15</sup> Nason, *Autism Discussion Page on the Core Challenges of Autism*, 129-130.

For someone with distorted perception, the brain cannot integrate the many details of a social situation, leaving the individual confused by a never ending stream of overwhelming stimuli.<sup>16</sup> For an individual with sensory defensiveness, the increased sensitivity to certain stimuli can cause discomfort or pain, and they often try to escape a situation that is overwhelming them.<sup>17</sup> When one is bombarded with too much stimulation that is too intense to process, one might suffer from sensory overload, which causes extreme emotional distress. Sensory overload is what most parents, caregivers, and other guardians try to avoid. For people who are neurotypical, their brain can filter out external stimuli, such as background noise, so the individual can focus on the task at hand. This filter does not function effectively for those who are on the autism spectrum, causing their brain to be bombarded by too much stimulation.<sup>18</sup> This bombardment prompts the brain to go into survival mode, meaning it prioritizes protecting itself from overwhelming stimuli over anything else. When a person on the autism spectrum reaches this level of stimulation, they can shut down and become unresponsive so their brain can escape the overload, or they can have an emotional outburst or act out to escape the triggering stimuli.<sup>19</sup>

Although communicating with others is often difficult for people on the spectrum, there are some who have stepped forward to describe how their unique sensory perception affects their lives and interactions. Many people—including Temple Grandin, Donna Williams, Sean Barron and others—have provided written books and articles describing their life experiences. In these biographical accounts, common themes of their childhood are “fear, confusion, pain and the arduousness of life” due to a lack of understanding of the world around them.<sup>20</sup> Most

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<sup>16</sup> Nason, *Autism Discussion Page on the Core Challenges of Autism*, 130.

<sup>17</sup> Nason, *Autism Discussion Page on the Core Challenges of Autism*, 132.

<sup>18</sup> Nason, *Autism Discussion Page on the Core Challenges of Autism*, 139.

<sup>19</sup> Nason, *Autism Discussion Page on the Core Challenges of Autism*, 139.

<sup>20</sup> Shirley Cohen, *Targeting Autism: What We Know, Don't Know, and Can Do to Help Young Children with Autism Spectrum Disorders* (Berkeley: University of California, 2007): 24-40.

neurotypical children would find a way to tell an adult when their emotions start to get out of control, but one particular theme that has been echoed by many individuals on the spectrum is a difficulty interacting with others; this means that communicating their feelings to avoid spiraling into overwhelming anxiety or fear may not be possible. Furthermore, humans, while guided by societal rules, are fairly unpredictable. One day someone can be friendly to you, another they could be standoffish. For someone on the spectrum, this unpredictable behavior is often upsetting and can induce anxiety.<sup>21</sup> Combining the unpredictability of humans with the individual's difficulty communicating makes dealing with hyper or hypo-sensitivity to stimuli even more arduous and can leave one feeling overwhelmed and isolated.

People alone can be overwhelming, but when you add them into a situation which has unfamiliar environmental stimuli or requires social interaction and communication, the individual's state of mind can become significantly worse. Not only can all of this stimulation cause intense emotional distress, but being aware of having these sensitivities can be incredibly alienating. Donna Williams, an Australian writer and artist who was diagnosed with autism as a child, described her experience as nothing short of difficult:

I had just come from another classroom where I had been tortured by sharp white fluorescent light, which made reflections bounce off everything. It made the room race busily in a constant state of change. Light and shadow dancing on people's faces as they spoke turned the scene into an animated cartoon. Now, in this noisy classroom, I felt I was standing at the meeting point of several long tunnels. Blah-blah-blah echoed, bouncing noise wall to wall. I looked at the cheerful, placid faces of others; clearly I was the freak.<sup>22</sup>

In a world full of sensory information, it can be difficult navigating social situations like going to the grocery store, sitting in a classroom, or visiting a museum. There is no simple

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<sup>21</sup> Cohen, *Targeting Autism*, 27-28.

<sup>22</sup> Cohen, *Targeting Autism*, 32.

escape from these stimuli in public, and often escape may not be a viable choice in the case of school or other social outings. So, many people with autism spectrum disorder have to learn how to cope with these overwhelming feelings. Due to the wide spectrum and varied ways autism affects individuals, there may never be one type of therapy or tool that works for everyone. So, in order to accommodate everyone, museums and other public institutions should look to multiple methods and tools of inclusion when designing an exhibition or providing accessible resources.

### **Improving accessibility for individuals with autism in the space of a museum**

Museums are educational institutions meant to serve the public and their community. As with all educational institutions, it is important to ensure that each potential student is being served to the best of the institution's abilities. For some audiences, this could mean making sure no jargon or uncommon terms are used in text and display panels within an exhibit. For others, this means utilizing different accessible methods of learning, such as providing braille on text panels, providing captioning for any video or audio playing within an exhibit, or making sure that the spaces provided are physically accessible to visitors who may use a wheelchair or other assistive devices. For individuals with autism, it means making efforts to ensure that the visitor can have the most comfortable and sensory-friendly visit possible.

Museums across the country have been implementing specific programs aimed at creating a safe and enjoyable environment for individuals on the autism spectrum. One of the most common methods of inclusion is the early entry approach, which was implemented in 2011 by the Smithsonian Institutions in the form of "Morning at the Museum." This program allows early access to the museum for individuals on the autism spectrum and, during this time, the



museum provides sensory-friendly activities for all ages.<sup>23</sup> One of the first museums to develop accessible programming specifically for individuals with autism and other similar developmental delays, the Smithsonian collaborated with families and experts to see how they can better accommodate visitors on the autism spectrum in their museums.<sup>24</sup> In addition to the special activities, the museum also dims the lights and dampens sounds within exhibits in an effort to ensure that these elements will not trigger an overwhelming emotional response.<sup>25</sup>

Another museum that has implemented excellent inclusive programming for individuals with autism is the Walters Art Museum in Baltimore, Maryland, which has offered early entrance “Sensory Mornings” for people with developmental delays since 2010.<sup>26</sup> The museum provides early entry, first-person social narratives—documents that describe expected behavior and interaction at a museum or given place—to help prepare individuals for their museum visit, and opportunities for visitors to craft, do yoga, or take a break in dimly lit areas.<sup>27</sup> By collecting feedback and data at the end of each of their “Sensory Morning” events, the museum is able to continually improve their offerings.<sup>28</sup> From this data, they found that 48% of the participants were first time visitors. This proves that the inclusive event allowed visitors to attend the museum who may not have felt comfortable or welcomed during normal museum hours.<sup>29</sup> One visitor told the museum, “I cannot tell you what an event like this means to a family with a special needs child. It was so nice to be someplace where people understood that [our child] has

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<sup>23</sup> Aditi Shrikant, “How Museums Are Becoming More Sensory-Friendly For Those With Autism,” *Smithsonian*, January 5, 2018, <https://www.smithsonianmag.com/innovation/how-museums-are-becoming-more-sensory-friendly-for-those-with-autism-180967740/>.

<sup>24</sup> Shrikant, “How Museums Are Becoming More Sensory-Friendly,” 2018.

<sup>25</sup> Shrikant, “How Museums Are Becoming More Sensory-Friendly,” 2018.

<sup>26</sup> Shrikant, “How Museums Are Becoming More Sensory-Friendly,” 2018.

<sup>27</sup> Shrikant, “How Museums Are Becoming More Sensory-Friendly,” 2018.

<sup>28</sup> Ashley Hosler, “Museum Access for All: Engaging Children with Autism Spectrum Disorders,” in *Engagement and Access: Innovative Approaches for Museums*, ed. Juilee Decker (London: Rowman & Littlefield, 2015), 27-34.

<sup>29</sup> Hosler, *Engagement and Access*, 31.

different needs and different reactions to things. It was great to have so many ways to engage him.”<sup>30</sup> It is evident from the positive response the Walters Art Museum received about their “Sensory Morning” program that the museum, and museums elsewhere, are missing out on an otherwise untapped audience. By simply providing one event or accessible services, museums can expand their audience to include visitors on the autism spectrum and ensure that the institution is serving the community in its entirety.

The Intrepid Sea, Air, & Space Museum in New York City also offers a good deal of programming and materials to ensure people on the autism spectrum, or with similar developmental delays, can enjoy their museum experience. In addition to providing early entry days, they also provide a number of informational materials for families and individuals to utilize before their visit, such as a social narrative, sensory guide, visual vocabularies, videos, and virtual tours of the museum.<sup>31</sup> Staff at the Intrepid also have tangle toys and noise cancelling headphones available for individuals who need them so they can distract or distance themselves from the overwhelming stimulation.<sup>32</sup> Charlotte Martin, Senior Manager of Access Initiatives at Intrepid Sea, Air & Space Museum, is part of an access team at the museum that works to ensure it is “physically, emotionally, and intellectually accessible to all audiences.”<sup>33</sup> Martin and her team have created varied types of programming for individuals with autism, and other disabilities, and they continue to improve their offerings based on community and visitor feedback. For Martin, making sure that visitors of all abilities are welcome at the Intrepid is of

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<sup>30</sup> Hosler, *Engagement and Access*, 32.

<sup>31</sup> “Online resources: Plan your visit,” Accessibility Resources, Intrepid Museum, last modified 2018, <https://www.intrepidmuseum.org/education/accessibility-resources>.

<sup>32</sup> Shrikant, “How Museums Are Becoming More Sensory-Friendly,” 2018.

<sup>33</sup> Charlotte Martin, “Museums in Motion Today,” in *Museums in Motion: An Introduction to the History and Functions of Museums*, ed. Edward P. Alexander, Mary Alexander, and Juilee Decker (London: Rowman & Littlefield, 2017), 306-307.

top priority, embodying the spirit of the *Characteristics of Excellence* set forth by the American Alliance of Museums:

My approach is to be ready for anything and anyone. When I head out to greet groups, I am armed with bags loaded with touch objects, images, and supports for movement activities. I never want the reason a visitor didn't "get" something to be because I didn't provide an opportunity to communicate in the way that works for this individual. My lesson plans tend to be stuffed with caveats about adjustments that educators can make as they learn more about the participants.<sup>34</sup>

In addition to early entry, a common and useful tool that museums provide are social narratives and sensory guides. As briefly mentioned above, these tools can be useful for families and individuals as they are planning their visit. A social narrative provides general expectations and behavior required for a museum visit, and parents of children with autism can utilize this information to plan their visit and practice expected behavior at the museum<sup>35</sup> When combined with a sensory guide, which shows what types of sensory stimuli may be present in different areas of the museum, families can plan the best route for their child so as to avoid sensory overload to the best of their ability.<sup>36</sup>

The reason many of these programs are so successful is that most museums craft them with the help and input from members of the autism community—from advocacy organizations to traditional visitor feedback from individuals or families of individuals on the autism spectrum.<sup>37</sup> Drawing directly from the *Characteristics of Excellence* established by the American Alliance of Museums, the museums are working to gain an understanding of what this specific

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<sup>34</sup> Martin, *Museums in Motion*, 307.

<sup>35</sup> Intrepid Sea, Air & Space Museum, "Social Narrative," Intrepid Museum Accessibility Resources, last modified 2018, <https://www.intrepidmuseum.org/education/accessibility-resources>.

<sup>36</sup> Intrepid Sea, Air & Space Museum, "Sensory guide," Accessibility Resources, Intrepid Museum, last modified 2018, <https://www.intrepidmuseum.org/education/accessibility-resources>.

<sup>37</sup> Aditi Shrikant, "How Museums Are Becoming More Sensory-Friendly For Those With Autism," *Smithsonian*, January 5, 2018, <https://www.smithsonianmag.com/innovation/how-museums-are-becoming-more-sensory-friendly-for-those-with-autism-180967740/>.

community needs and then utilize their feedback to ensure that they are providing both an enjoyable and educational experience for each visitor.

While these early entry days and pre-visit materials are highly useful, they are not the single perfect answer for inclusivity. For early entry, the flaw is obvious: one can only attend the museum on certain days if sensory-friendly accommodations are necessary for one's enjoyment and comfort. The sensory-friendly days are beneficial, as they increase the sense of community among parents, families, and individuals with autism, but this does ultimately separate the autism cohort from the mainstream community. Fostering a community of people who share similar challenges and experiences is highly important, so rather than rendering this method of inclusion completely obsolete, museum professionals and researchers should look to how they can improve and expand the programs they already provide. Sensory guides and social narratives are a great starting point, as they can help individuals navigate around potentially triggering stimuli during a traditional museum visit. However, a pre-written guide may not be helpful in the moment when stimuli start to become overwhelming and sensory overload is on the horizon, particularly when it comes to stimuli coming from other visitors rather than the museum itself. If individuals had a pocket-sized tool that enabled them to navigate the stimuli in a museum and offered activities that could help an individual cope with these overwhelming feelings, the two aforementioned hurdles could, in theory, be surpassed with relative ease.

### **Using technology to mediate education in the space of a museum**

Scholarly studies in the field of psychology and education point to the utility of technology as an educational tool for individuals on the autism spectrum. Given the limitations many people on the spectrum have with face-to-face interaction and communication, technology

can be used as a mediator to assist in various educational situations. From learning about daily tasks, like the importance of brushing one's teeth, to classroom learning, using technology as a means to facilitate education can help overcome some of the issues children with autism may face in a traditional classroom or educational environment. Finding different methods of mediating education in an environment that involves direct communication between the instructor and the instructed can greatly enhance the quality of learning for individuals on the autism spectrum.

One study, published in 2014, looked at interactive technologies that were beneficial for people with autism and explained that computers can help support the sensory filtering process by only displaying relevant information on the screen.<sup>38</sup> The study also observed that computers can be more predictable when it comes to interaction; they can offer a chance to be uninhibitedly repetitious, offer opportunities to create a routine, and are consistent in how they function. All of these features can help create a more comfortable experience for people on the spectrum who often feel anxious around unpredictable elements and seek security.<sup>39</sup>

Another study from 2016, conducted by faculty in the department of informatics in special education at the Federal University of Rio Grande, took this research further and found that while computer mediated education was very helpful, the use of touch and mobile devices were significantly more user-friendly than the traditional laptop.<sup>40</sup> According to the study:

The interaction with the tablet showed a more friendly and intuitive use, since it is used more naturally, using fingers to touch the screen. The tablet can be used anywhere and in any position, which is good for students who are hyperactive.<sup>41</sup>

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<sup>38</sup> Julie A. Kientz et al, *Interactive Technologies for Autism* ed. Ronald M. Baecker (Morgan Claypool Publishers, 2014), 1-56.

<sup>39</sup> Kientz et al, *Interactive Technologies for Autism*, 8.

<sup>40</sup> Lucila Maria Costi Santarosa and Debora Conforto, "Educational and Digital Inclusion for Subjects with Autism Spectrum Disorders in 1:1 Technological Configuration," *Computers in Human Behavior* 60, (2016): 293-300.

<sup>41</sup> Santarosa and Conforto, *Computers in Human Behavior*, 293.

With a laptop, one uses their fingers to control a mouse, which controls a small cursor on the screen. For someone with difficulty integrating different sensory perceptions—specifically, integrating sight and touch to understand the relationship between the mouse and the cursor—using a mouse may be frustrating or may not even make logical sense to the user.<sup>42</sup> With touch screens, one uses their finger to control what happens on a device, making the connection between one’s action and the outcome of what is produced on screen more concrete.

Diving deeper into the topic, one study published in the *Journal of Medical Systems* researched what exact methods of touch interaction seemed to produce the most positive and user-friendly experience for individuals with autism. This study looked at Human-Computer Interaction models and determined that the most favored forms of interaction for individuals on the autism spectrum were keystroke interaction, tapping interaction, and touch interaction.<sup>43</sup> They tested three apps requiring different types of interaction and observed twenty-one individuals on the autism spectrum utilizing the apps to gather data.<sup>44</sup> In addition to identifying the best and most preferred types of interaction, they were able to collect information regarding ideal app design, specifically icon size and shape. They found that size of the icons within the app interfered with their study results and went further to identify the ideal shape and size of icons for individuals with autism: a square that is 144 X 144 px.<sup>45</sup> Studying and referencing all of this information can be helpful when designing and creating apps for individuals on the autism

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<sup>42</sup> Santarosa and Conforto, *Computers in Human Behavior*, 293.

<sup>43</sup> Quezada et al., “Usability Operations on Touch Mobile Devices for Users with Autism,” *Journal of Medical Systems*, 41 no. 184 (2017): 1-11.

<sup>44</sup> Quezada et al., *Journal of Medical Systems*.

<sup>45</sup> Quezada et al., *Journal of Medical Systems*; The measurement (px) stands for pixels, a common form of measurement when using digital design tools.

spectrum. It is also important to understand that features in common apps such as sudden flashing lights or sound effects can affect individuals on the autism spectrum in a negative way.

One app that has been successful in accommodating the needs of individuals on the autism spectrum is MagnusCards, an app inspired by creator Nadia Hamilton's brother, Troy. Troy has autism and Nadia has dedicated much of her life to helping individuals with special needs, which includes creating this app.<sup>46</sup> MagnusCards features digital card decks which contain social narratives that help guide the users through daily activities, including brushing their teeth and going to the grocery store.<sup>47</sup> For \$60 per year, users gain unlimited access to the app and are able to create new cards within the app, allowing them to tailor the experience to a specific individual.<sup>48</sup> As of 2015, there were more than 650 users, and that number has surely grown in the years since.<sup>49</sup> The app is useful for people of all ages and abilities, providing twelve categories of card decks with options to customize them.<sup>50</sup> Most of these categories deal with real-world problems, such as cleaning, entertainment, money management, and personal care.<sup>51</sup>

The idea of having a pocket handbook for social interaction and everyday activities can be incredibly useful when applied to a museum setting. In a study published in the *Journal of Museum Education*, Damian Maher observed how students interacted with an iPad being used for a classroom assignment within the space of a museum. The students, teacher, and Maher all

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<sup>46</sup>“MagnusCards: An Autism Life Skills & Transition Support Tool,” Magnus Cards, accessed Oct. 14, 2018, <https://magnusmode.com/magnuscards-an-autism-life-skills-transition-support-tool/#about-section>.

<sup>47</sup> “MagnusCards”

<sup>48</sup> Terry Pender, “Startup’s digital cards helps people with special needs navigate daily life,” *The Record*, Feb. 21, 2015, <https://www.therecord.com/news-story/5440793-startup-s-digital-cards-helps-people-with-special-needs-navigate-daily-life/>.

<sup>49</sup> Pender, *The Record*, 2015.

<sup>50</sup> “MagnusCards: An Autism Life Skills & Transition Support Tool,” Magnus Cards, accessed Oct. 14, 2018, <https://magnusmode.com/magnuscards-an-autism-life-skills-transition-support-tool/#about-section>.

<sup>51</sup> “MagnusCards”

found that the iPad supported and enhanced learning within a museum.<sup>52</sup> Maher also found that, despite the consensus that the iPad enhanced learning, the presence of apps and games on the iPad distracted students while at the museum.<sup>53</sup> While games will likely always be a source of distraction, this is no reason to ban or exclude iPads and personal devices from museum education. Rather than work against the constant desire for entertainment that exists in young people of all abilities, the museum could use these forms of entertainment to enhance knowledge about an exhibit.

Utilizing games for educational purposes in museums is not a new concept; museums around the world are using digital games to enhance the visitor experience. One successful example of this is *The Voyage*, a game developed by The Australian National Maritime Museum in collaboration with Roar Films in Tasmania, Screensound Australia, and Screensound Tasmania.<sup>54</sup> *The Voyage* allows the user to experience what it was like to take the historic journey from London to Van Diemen's Land—now known as Tasmania—to transport British convicts to the island to work.<sup>55</sup> The players are rewarded based on the number of healthy convicts they deliver to the British colony.<sup>56</sup> Based on historical data, such as documented ship paths, medical records, and other documents relating to the convicts being transported, the players are able to learn about the great transportation of convicts from Britain to Australia in the 1800s in a way that can be more entertaining than the traditional text panel or diorama.<sup>57</sup> While

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<sup>52</sup> Damian Maher, "Connecting Classroom and Museum Learning with Mobile Devices," *Journal of Museum Education*, 40 no. 3 (2015): 257–267.

<sup>53</sup> Maher, *Journal of Museum Education*, 257-267.

<sup>54</sup> L. Kelly & A. Bowan, "Gamifying the museum: Educational games for learning," *Museums and the Web Asia 2014*, ed. N. Proctor & R. Cherry, accessed Nov. 15, 2018, <https://mwa2014.museumsandtheweb.com/paper/gamifying-the-museum-educational-games-for-learning/>.

<sup>55</sup> Kelly and Bowan, *Museums and the Web*.

<sup>56</sup> Kelly and Bowan, *Museums and the Web*.

<sup>57</sup> Kelly and Bowan, *Museums and the Web*.



there is still much room for research and exploration of this topic, according to researchers, thus far the Australian National Maritime Museum has found success with the game and sees a high educational potential for this type of activity in an educational sphere, particularly for museums.<sup>58</sup>

Utilizing digital games that are specific to a topic or area of a museum can be highly useful in engaging a twenty-first century audience, but it also has great potential for increasing accessibility for some visitors. Often, when a person with autism becomes overwhelmed with stimuli, the only available option is to leave and remove themselves from a situation. If an app could provide resources to help alleviate stressed caused by overwhelming stimuli, perhaps individuals would not need to remove themselves completely. They could simply put on their headphones, listen to some calming music, and play relaxing and educational games relating to the museum and its exhibitions. With an app like this, one could, in theory, navigate the museum at one's own pace without having to worry about approaching a sensory overload.

To summarize, by creating a museum-specific app to mediate education, museums can increase digital accessibility options for individuals with autism. The app could contain sensory-friendly entertainment options, such as games or music, helpful tools to navigate the museum, such as maps or sensory guides, and offer other useful resources that can help ease social interaction for individuals on the autism spectrum. If a general template was created that could be modified for each individual museum's needs, museums across the country could use the app to increase their accessible offerings for visitors on the autism spectrum and enable these individuals to attend the museum at times of their choice, not just during sensory-friendly days.

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<sup>58</sup> Kelly and Bowan, *Museums and the Web*.

## Research Methodology

To complete this project, it was necessary to research possible methods of development and begin the development of the app simultaneously. After doing preliminary research on assistive technology developed for individuals on the autism spectrum and on similar, preexisting approaches for accessible technology within both local and national museums, I brought my findings to Peter Laurin, a senior game design and develop student at RIT and the app developer on this project, and he began coding the app layout. Throughout the development process, we consistently held meetings to ensure that the new information and findings I came across in my research was applied to the app, so as to enhance the quality of its design and content.

Once the prototype of the app was completed, I held two rounds of user testing. The first was with a general audience off-site, and the second was with our specific target audiences—individuals on the autism spectrum and their families—on site at the Strong National Museum of Play.<sup>59</sup> Following both of these rounds of user testing, participants filled out a Google Forms survey online to give their feedback on the quality and effectiveness of the app (Fig. 1 and Fig. 2). In addition to the survey, after I conducted the user testing with the target audience, I held follow-up interviews with each participating family to ask more in-depth questions about their previous museum experiences, as well as to elaborate on the feedback they had given on the user testing survey they completed after their museum visit.<sup>60</sup> Using the information collected from

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<sup>59</sup> Between the two rounds of user testing, the first being with a general audience, we took feedback and made changes to the app before conducting the second round of user testing. We did this to ensure that the user testing we conducted with our target audience would be with the best version of our app, both in respects to content and design.

<sup>60</sup> I chose not to conduct in-depth interviews with those participating in the first round of user testing. Their input was intended to help Peter and I refine the app before deploying with our target audience. Moreover, they did not comprise of my target audience for the app, children on the autism spectrum aged 4-12-years-old.

each round of user testing, I then evaluated the current prototype and compiled a list of improvements and changes to implement in future iterations of this app-concept.

## **App Development Methodology**

### **Developing the Concept**

Seeing someone you love miss out on opportunities because of their disability can be infuriating, but, when these feelings are channeled effectively, can also be inspiring. The idea for *SenseEase* began with this feeling.

My younger cousin, Leo, was diagnosed with autism spectrum disorder when he was about 2-years-old. Since his diagnosis, my uncle and the rest of my family have done everything in our power to ensure that he has the same positive experiences as his neurotypical peers. He has been sledding, played on a Slip n' Slide, and even went on a short Christmas tour at a museum to meet Santa Claus. All of the efforts we made to get him involved with the community and other children were successful, until one Christmas when we found our first glaring roadblock to his interpersonal interactions.

Around Christmas in 2017, we decided to take him to the Strong National Museum of Play, and it did not go well. There were more visitors than usual because of the holiday breaks, meaning larger crowds around interactive exhibits and, most importantly, more noise. After two difficult hours at the museum, Leo finally had enough and hit his threshold of sensory stimulation. He was trying to enjoy himself, but the noise and the other children moving around him pushed him over the edge and, ultimately, we had to leave.

In contrast to Leo's experience, I fondly remembered how, growing up, my other family members and I loved the Strong Museum. We had so many great memories there, and knowing

that Leo would not be able to make his own memories at the museum broke my heart, particularly because of my background in museum studies. However, instead of accepting defeat and never bringing Leo to the museum again, I started thinking. What changes could I make to the museum experience that would enable Leo to have fun at the museum? How could I make museum experiences more manageable for him? Thus, the initial ideas that would become *SenseEase* were conceived.

### **Choosing a medium**

When it came to choosing a medium, a mobile app to be used on a cellphone seemed the most obvious choice for a number of reasons. First, and most importantly, a mobile app allowed for more flexibility when it came to utilizing the app. Most people carry their phones in their pockets or purses, making the device easily accessible during a museum visit; the same cannot be said for other devices like laptops or tablets.

When walking through a museum, it is unlikely that anyone would be carrying a laptop with them because they are large and not as easily used when one is moving from exhibit to exhibit. If this digital tool was to be created via a website, where visitors would need to access the content via a computer, it would render much of the site-specific content within the app useless. Additionally, if a child is on the verge of sensory overload and an emotional outburst, taking time to open a laptop, connect to WiFi, and navigate the website would take too much time and concentration. A similar argument can be made for tablets. While they are smaller and more mobile than a laptop, not all visitors may want to carry their tablet around a museum.<sup>61</sup>

Another influencing factor behind my choice in medium was a study published in the journal, *Computers in Human Behavior*. Through their research, Lucila Maria Costi Santarosa

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<sup>61</sup> Our current design can work on any Android device that is able to download mobile apps, but it is optimized for cellphone-use.

and Débora Conforto found that touchscreens were preferred by individuals on the autism spectrum over laptop computers, which can be inaccessible for some individuals on the autism spectrum because the functions of the mouse, keyboard and screen may not be intuitive due to difficulties with sensory processing.<sup>62</sup> In their case studies, they found that the children involved had difficulty connecting the movement of their hand to the cursor on the screen when using a laptop, but when using the touch screen, they had no issues interacting with the provided content.<sup>63</sup> They concluded that a touch screen is a more effective method of interaction because the tablets are “operated with the use of a data input device which is very natural to humans: fingers.”<sup>64</sup> They also found that the instantaneous response of a touch screen tablet was easier to facilitate interaction, as one simply needs to press one button to turn on the tablet and one to open the app rather than having to follow the multiple steps it takes to turn on a laptop and access information on a website.<sup>65</sup>

### **Initial design**

I began thinking about the logistics of this in the summer of 2018, beginning with some minimal background research about different apps that my little cousin enjoyed and how I might adapt the methods employed by those apps to create my own. At the beginning of this process, as is always the case, *SenseEase* had lofty goals. Initially, the idea was to create one, catch-all app that could help visitors on the spectrum have a sensory-friendly experience at any given museum. While this would be wonderful in an ideal world, the idea was simply not realistic. Given the variations between types of content, the level of interactivity, and the general setting

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<sup>62</sup> Santarosa and Conforto, *Computers in Human Behavior*, 298.

<sup>63</sup> Santarosa and Conforto, *Computers in Human Behavior*, 298.; The study also noted that this would be ideal for users with autism who also have other physical disabilities, as touch screens are generally easier to physically interact with.

<sup>64</sup> Santarosa and Conforto, *Computers in Human Behavior*, 298.

<sup>65</sup> Santarosa and Conforto, *Computers in Human Behavior*, 298.

or environment of the museums just in the Rochester area, it became clear that one app would never be capable of serving different institutions across the United States, or the world for that matter.

Throughout August and September 2018, I began to narrow down my goal from an unattainable deliverable to a feasible, year-long project. After discussing my ideas with my museum studies classmates and my research methods professor, Dr. Tamar Carroll, I decided to focus on creating an app for a single museum that had the potential to be recreated and adapted for other institutions. This left me with a decision: what museum should I use for my case study?

To decide which museum would be the best environment to prototype *SenseEase*, I looked back on Leo's experience and seriously considered the Strong Museum. However, before I made the decision, I interviewed representatives at the Strong Museum and two other local institutions and discussed their accessibility options for individuals on the autism spectrum: Cathy DeBellis, the Director of Public Programs at the Strong National Museum of Play; Kathryn Murano Santos, the Senior Director of Collections and Exhibitions at the Rochester Museum and Science Center; and Marlene Hamann-Whitmore, the McPherson Director of Academic Programs from the Memorial Art Gallery (Fig. 3).<sup>66</sup> Overall, these museums were conscious of the need for more accessible and sensory-friendly options for visitors on the autism spectrum, but the museums were still in the early development stages of having regular programming catering to this specific audience. However, the Strong National Museum of Play was the furthest along in terms of developing sensory-friendly programming and ensuring that all staff members knew how to assist individuals on the autism spectrum and their families through training with Autism Up, a local autism awareness group. After these interviews and internal

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<sup>66</sup> These interviews were conducted in October and November of 2018. See Fig. 3 for the full article.

reflection on both my research and personal experiences, I decided that the Strong National Museum of Play would be the ideal environment to test this sensory app for three reasons: the interactive nature of the museum's exhibits, their preexisting autism-specific programming, and the often loud and unique nature of the museum's environment as a whole.

The Strong Museum is unlike any traditional museum, often seeming borderline chaotic because of the museum's younger clientele. However, the playful noisiness and constant streams of children that come through their doors are exactly what the Strong wants. Their mission is to "explore play and the ways in which it encourages learning, creativity, and discovery and illuminates cultural history." In order to explore play, play must be encouraged; and that is exactly what they do.<sup>67</sup> While this loud, playful environment attracts hundreds of children every week, it is not the ideal environment for those on the autism spectrum. The large crowds of parents and children, the sudden and uncontrollable noises, and being surrounded by strangers and their unpredictable behaviors can trigger severe emotional outbursts. Often, for children on the autism spectrum, once their sensory threshold is reached, as previously discussed, the only option is to remove the child from the triggering environment and give them time to return to their emotional baseline; which, while necessary, is not ideal for museums who want to share their collections and experiences with all visitors of all ages and abilities.

In addition to the unique and chaotic environment, the Strong Museum made a good candidate for this prototype because of its preexisting resources for individuals on the autism spectrum and their families. The museum also provides: noise-cancelling headphones, which are available for visitors at their front desk; quiet areas for visitors who may need a break from the sensory stimulation; and "social stories," or social narratives—pre-visit materials which provide

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<sup>67</sup> Strong National Museum of Play, "Mission," The Strong National Museum of Play, 30 Jan. 2019, accessed 12 Feb. 2019, <https://www.museumofplay.org/about/mission>.

a visual walkthrough of the museum and shows what one can expect during a visit through photos, video, or text—which parents can use to help familiarize their children with how to navigate the museum.<sup>68</sup> One of the newest additions to the Strong’s accessible offerings is the Sensory-Friendly Sunday program. Throughout the year, the museum hosts sensory-friendly events that are exclusively for individuals with autism or other similar developmental delays (Fig. 4). This allows for individuals on the spectrum to come to the museum before it officially opens and to explore the exhibits in a calmer environment. They dim the overhead and exhibit lighting, they lower the volume of interactive exhibit elements, and, ultimately, provide a space for children and parents to explore the museum at their own pace among others who share similar experiences without fearing judgement.<sup>69</sup> Due to the Strong’s existing resources, I would be able to consult with the museum and build on these resources when curating content for my app.

Once I made my decision to focus on the Strong Museum, it was time to flesh out exactly what my app would provide. I wanted to incorporate soothing elements that my cousin Leo used, such as soft music and games, but I needed to find more resources that would be helpful for children on the autism spectrum and their parents. I began by looking at the accessibility resources available on the Strong Museum website, particularly their social stories, so I could determine what supportive-materials I should include in the app beyond my games and music (Fig. 5). To get a more comprehensive understanding of what I might need to include in the app,

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<sup>68</sup> Felicia D. Swartzenberg, “Are Museums Accommodating Visitors on the Autism Spectrum?”

<sup>69</sup> Felicia D. Swartzenberg, “Are Museums Accommodating Visitors on the Autism Spectrum?,” Atavist, 12 Dec. 2018, feliciadianne.atavist.com/asd\_accessibility.; The Strong Museum always strives to promote a judgement-free environment for their institution. However, the point of providing a space exclusive to people on the autism spectrum and their caregivers is to help ease public interaction. Regardless of where they are, when people on the spectrum reach sensory-overload and have emotional outbursts it can draw attention and be met by judgement from those who do not have experience with or know anything about autism spectrum disorder. When surrounded by other parents who understand and share those fears, it can be comforting and help parents feel at ease even if their child does have an emotional outburst.



I expanded my research and looked at methods used by the Intrepid Sea, Air, and Space Museum Complex, an institution that has made many great strides toward accessibility for individuals on the autism spectrum (Fig. 6). Additionally, I looked at the sensory-friendly app that was developed for the Shedd Aquarium in Chicago as an example of what I should be striving for when creating the design and content for my app (Fig. 7). I also looked at other apps that are similar in nature, even if they were not created for a museum space, such as Magnus Cards, to see what features and functions were available.

After completing my preliminary research, I decided I needed to include the following in my app: games, upbeat and soothing music, a sensory guide, a social narrative, a list of programming, and an explanation of what the app is supposed to accomplish. I also, at this point, amended the prototype's title to read, *SenseEase: Strong Museum*, to show the connection between this iteration of the app and the institution we modeled it after.

### **Connecting with an app developer**

In terms of actually programming the app, there were significant deficits in my personal skillset that were vital to creating the app. Mainly, I had none. With the assistance of my primary adviser, Dr. Juilee Decker, I was able to connect with Peter Laurin. Peter was a student in Dr. Decker's Museums and the Digital Age class and, when approached about the project, he was eager to join the *SenseEase: Strong Museum* team as the app developer.

Peter and I had our first official meeting in early September 2018, where we discussed the feasibility of the app I had theoretically designed. With his guidance and knowledge, we determined that it would be most feasible to focus on a single exhibit area within the museum if we were to develop a quality prototype.

To help us choose a specific area of the museum to focus on and develop ideas for what types of games we would include, Peter and I visited the Strong Museum on September 30, 2018. During our site visit, we evaluated each exhibit with three things in mind: what is the level of chaos in this particular area, what area would make the best use of a digital experience, and what games within the existing exhibits might adapt well to a digital interface without completely changing the experience as a whole? We chose these questions based on the information I had obtained from interviews with Rachel Rosner, the Director of Education and Support at Autism Up (Fig. 8).<sup>70</sup> Rosner heavily emphasized two necessities: having ample accommodations for individuals on the autism spectrum in areas that are typically very chaotic, and having those accommodations be as similar as possible to the experiences any other neurotypical child would have; or, in other words, ensuring that while they are having a slightly different experience, they would not be considered as “different” from their peers in a negative way.

We listened for the noisiest rooms, but also made sure to choose an area where an app-facilitated experience would make sense. For example, while the miniature Wegmans and large Sesame Street play area is loud and crowded, the interactions visitors have with these exhibits simply cannot be digitally manufactured due to their hands-on, physically interactive nature. They are all very tactile and are far more exciting when experienced in person. Ultimately, we agreed on creating the app around the Reading Adventure Land area on the first floor of the museum because it was quite loud but had several interactive elements that could be effectively translated into a digital format (Fig. 9).

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<sup>70</sup> Autism Up is a local autism support organization that helps provide a “Multi-Sensory Learning Environment for individuals with autism” and their families or caregivers. See Fig. 8 for more details about the organization.

The last question we asked ourselves was what games within the exhibits we might take inspiration from; which was possibly the most exciting aspect of our on-site research. To make our decision, we interacted with the different game offerings to see which would be feasible for us to recreate, enjoyable for our audience of children on the autism spectrum ranging from four to twelve-years-old, and applicable to the area we decided to focus on. After a few hours of fun, playful research, we settled on a goal of three games for the app: a character-matching game in which the user would flip over two cards at a time to find the matching pairs; an alphabet matching game where the user is shown a letter and a two to three photos and they must choose which photo contains a character or an object that starts with the letter being shown; and a spelling game where the user is shown a photo and a partially spelled-out word and they need to choose the remaining letters needed to finish spelling the word. The general ideas for the games were modeled after games that are actually featured throughout the museum, but they are not exact replications.

Additionally, as we walked through the museum, I took preliminary notes that would help me create a sensory guide for the museum. In each exhibit area of the museum, I noted the prominent sensory-stimuli, potential sensory triggers, and areas where there was little or no overwhelming sensory input, like rest areas or reading nooks. Using this information, and more information gathered from later visits, I created a slideshow detailing what sensory stimuli to expect in each area of the museum so parents could learn where to avoid or where to go when their child needs a break, and a social narrative that would help parents and children learn what behaviors are expected at the museum.

Due to various software set-backs, time, and resource restraints, we decided to change our goal for the prototype and chose not to include any games at this stage of development.

Rather than rushing to push out an app and a game, we wanted to focus on creating a fully functional app design without any bugs. Creating an app interface and a fully functional game was simply not possible within our given timeframe with only one app developer on our team.

### **Creating the app**

After our initial visit, it was time to sit down and determine the exact content of the app. Once Peter and I agreed on a feasible design, we held regular meetings to discuss the evolution of: *SenseEase Strong Museum*. The first decisions we made were in regard to the general aesthetics of the app, such as color schemes and icon design. We chose a light blue for the app background color, because that color is associated with Autism Awareness Month, and rainbow-colored icons, because the Autism Awareness Ribbon is a puzzle-piece pattern that is made up of different colors of the rainbow.<sup>71</sup> For icon size and design, we decided to create square icons that measured to 144 x 144 pixels with printed text explaining the function of the icon.<sup>72</sup> We also decided, based on a study published in the *Journal of Medical Systems*, to have all of the app functions be triggered by tapping motions rather than sliding motions, as tapping was found to be a more intuitive form of interaction for individuals on the autism spectrum.<sup>73</sup>

When it came to the development software, Peter and I decided to use Android Studio, which Peter had experience in.<sup>74</sup> Android's platform was chosen for its easily accessible publishing software, which, in turn, allowed for easily accessible user testing opportunities. Additionally, I had access to two android devices, a smartphone and a tablet, to use for user

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<sup>71</sup> Autism Society, "The Autism Awareness Ribbon," Autism Society, accessed Feb 13, 2019, <http://www.autism-society.org/about-the-autism-society/history/autism-awareness-ribbon/>.

<sup>72</sup> Quezada et al., "Usability Operations on Touch Mobile Devices for Users with Autism," *Journal of Medical Systems*, 41 no. 184 (2017): 8.

<sup>73</sup> Quezada et al., *Journal of Medical Systems*, 6-9.

<sup>74</sup> Since we chose to use Android Studio, we also used JavaScript to code our interactive elements as it is the default code language in this particular development software.

testing, making this software a good choice.<sup>75</sup> While this prototype can only operate on Android devices, this concept and template can be adapted to develop an iOS-compatible version of the app.

When creating the wireframe of the app, we began by setting up an empty project within the Android software and an emulator to run a virtual android device on the PC so we could view how the wireframe would look on a mobile device. I began by making a sketch for what the home screen should look like, and Peter created the layout of the screen in an XML file, a metalanguage similar to HTML.<sup>76</sup> He began by setting up the main toolbar at the top of the page, and then he proceeded to bring the sketched design to reality by adding the six icons labeled as follows: Music, Sensory Guide, Social Story, Settings, For Parents, and Games (Fig. 10).<sup>77</sup> Before proceeding to the next step in the development process, Peter tested the code in the emulator to ensure that the design layout matched our original sketch.

After making the basic wireframe, Peter began to add the functionality to the home screen. He made the icons clickable so they would open to their respective pages and tested each function in the emulator to ensure that all of them worked as expected. After this was completed for each individual page, he created a downloadable Google Drive file that was ready for user testing.<sup>78</sup>

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<sup>75</sup> Since we did not register this app on the Google Play store, it was ideal to have it pre-downloaded on my devices for the second round of user testing due to security issues regarding downloading apps from unregistered or unknown sources. For the first round of user testing, due to the number of participants, most of them downloaded the app onto their own device, which is not typically best-practice.

<sup>76</sup> XML is a metalanguage, similar to HTML, which allows users to define their own customized markup languages.

<sup>77</sup> While we had made the decision to not develop games for this prototype, we chose to leave the option in our interface design so we could have a template that encompassed my full vision for this app, which, with more time and resources, would include interactive games relating to the museum exhibits. The game icons are not functional.

<sup>78</sup> Note that this is not best practice in terms of sharing app-files. We chose this method of dissemination because we were unable to register the game with the Google Play store in time for our two rounds of user testing.

We finished the interface and individual page design in December 2018, and finished the fully functional app interface in early February 2019. The final iteration of the *SenseEase: Strong Museum* prototype included: a home screen; a functional music player with four songs; a social story for entering the museum and navigating the Reading Adventure Land exhibit; a sensory guide for the museum; information about the app itself; the museum's upcoming programs and the museum's hours of operation (Fig. 11).

## **User Testing Procedure**

To evaluate the functionality and effectiveness of this app, I conducted two rounds of user testing; the first with a general audience and the second with two families who have children diagnosed as being on the autism spectrum, my target audience. During the first round of user testing, Peter and I visited Dr. Juilee Decker's Visitor Engagement class, which consisted of twenty-two students from various colleges within the university, including: the College of Liberal Arts, the College of Engineering Technology; the B. Thomas Golisano College of Computing and Information Sciences; the College of Art and Design; the Kate Gleason College of Engineering; the College of Health Sciences and Technology; and the School of Individualized Study. Dr. Decker's class discusses visitor accessibility and interaction, so having her students test the first iteration of the prototype allowed us to gather feedback from people familiar with the subjects at hand, specifically museum studies and visitor accessibility. During their class time, students with Android devices were able to download the app via a Google Drive file and navigate the different pages at their own pace for about fifteen minutes.<sup>79</sup> After the

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<sup>79</sup> For students without Android devices, we had one tablet available for use and printed hand-outs of the sensory guide and textual information from the app so they could still participate.

class finished exploring the app, the students were instructed to complete a survey in which they evaluated the concept, design, functionality, and overall effectiveness as a tool (findings referenced in the following section).

During the second round of user testing, I was able to conduct the test on site at Strong Museum with two families: Roberta and Austin, who is ten-years-old, and Lindsay and Preston, who is seven-years-old.<sup>80</sup> As an incentive to be involved with this user testing, the families received free admission to the museum on the day of the visit. Each family was able to review the app before visiting the museum and utilize the interactive components of the app throughout their museum visit with a particular focus on Reading Adventure Land, given the prototype's focus. After they were able to use the app at the museum, each family filled out a visitor survey that detailed their experience with the app and its effectiveness. After reviewing their feedback, I followed up with each family and conducted individual interviews to ask about their previous museum experiences, get a more in-depth description of how this app affected their museum experience, and ask for more details as to why they did or did not consider this an effective tool and guide for the museum.

While this user testing pool may seem small, the choice was purposeful, as I wanted to engage in pre- and follow-up interviews with each family to get as much qualitative data about their previous museum experiences and how using *SenseEase: Strong Museum* affected their visit.

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<sup>80</sup> Both families requested that their last names be redacted from this public document.

## User Testing Findings

### First Round: General Audience

The results of the first test with a general audience, Dr. Juilee Decker's Visitor Engagement students, were generally positive (Fig. 12). The students found that the app installation speed was consistent with other apps they had experience with, they found the app fairly easy to navigate, and they thought the aesthetic and appearance of the app was a good fit for my target audience. When asked for possible improvements or additions, the students suggested: changing the name of the app, which was originally Project Ease, to something that sounded less professional and more kid friendly, like *SenseEase: Strong Museum*; changing the original music options we had on the app, which were a mixture of lullabies and nursery rhymes, to songs that were generally more calming, like classical and instrumental music; adding additional content, such as a floor map of the museum, an interactive map of each exhibition area with details about each individual exhibit, additional videos and multimedia content about the exhibits, the museum's hours of operation; and adding an option that allows you to provide direct feedback to the museum about the exhibit or the app itself.

In addition to having the class fill out the Google Forms survey, I visited the class the following day to seek additional comments and opinions about the app. During this meeting, students suggested: reorganizing the sensory guide and either implementing a grid-design, which would allow users to select areas of personal interest, or changing the order of the guide from being alphabetical to being in the order in which visitors would encounter them at the museum; providing a video walk-through or voiceover for the social story; verifying and adjusting the colors, if need be, to ensure that the design is accessible to those who may be colorblind; and separating the app into two sections, "Pre-visit" and "At the Museum," so the content needed to



prepare for the museum and the content meant to be used on site would be separate and their purposes would be clear.

After reviewing their feedback and before proceeding with the second round of user testing, Peter and I held a meeting and determined what suggested revisions would be feasible to implement before our next user testing date. We decided to adjust the design of the social story and sensory guide, change the available music to classical and instrumental options, and verify that the colors of the background and font within the app were distinct enough so those who are colorblind would not have an issue reading the text.

### **Second Round: Target Audience**

After each family visited the Strong Museum of Play, they filled out the online Google Forms survey (Fig. 13). After reviewing their survey responses, I held individual, in-person interviews with them to ask about their previous museum experiences, how the app would have been helpful if they had it during their previous visits, and to elaborate on the answers they gave on the online survey.

When I interviewed the first family to use the app, Roberta and Austin (age 10), and asked about their museum experiences, they were generally positive with a few negative memories scattered throughout their previous visits. Roberta, Austin's mother, noted that, most often, Austin's negative reactions were brought on by being in large crowds or lines, being in a certain place for too long and getting overwhelmed or tired, and when he was getting hungry. When asked about why something like this would be important for children on the autism spectrum and their families, she said "it would make things a lot easier and less stressful. Usually, when Austin gets upset, we go to another area of the museum or just leave. We might not have to leave if this app could help him work through those feelings instead."

When thinking of suggestions for improvements, Roberta and Austin felt that the following would be valuable additions to the app: changing the music to include genres that are more exciting, like Jazz or children’s songs, as Austin found the calming instrumentals boring; a section dedicated to the food options that are available at the museum so families can plan to bring lunches if necessary<sup>81</sup>; Bluetooth proximity beacon notifications to provide both general information about what is available in each exhibit and sensory information about what to expect in each area; games similar to “Tetris,” “Candy Crush,” and other puzzles for children on the older end of the four to twelve spectrum; counting videos or videos about different exhibits in the museum for children to use while waiting in line to help them practice being patient; and a reward system set up like a scavenger-hunt, where children can be offered prizes, such as a free ice cream or a five dollar gift card to the gift shop, if they travel and digitally “check in” at different exhibits at the museum to encourage children to explore more of the museum, rather than getting caught up in one or two areas.

When I interviewed the second family, both Lindsay, the mother, and Preston (age 7) gave overwhelmingly positive feedback about the app. They were particularly pleased with the social story and sensory guide. Lindsay expressed that if she had access to this type of resource during their other museum experiences, it would have helped alleviate some of the stressors they encountered during their visit. Similar to the triggers Austin experienced most often, Preston often acted out and was uncomfortable when faced with large crowds, when they had to do a lot of walking or if it was too hot or cold in a space—this is specific to their outdoor museum experiences—and when he got hungry.

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<sup>81</sup> Due to sensory issues, many individuals on the autism spectrum have limited diets and are picky about what they will eat.

For Lindsay and Preston, the feature on this app that helped them the most, and would have been helpful in their previous museum visits, was having access to information about quiet areas where they can go to when Preston needed a break or to get away from his sensory triggers. Lindsay emphasized this point many times both in the Google Forms survey and the interview, expressing that “it’s easy to forget about quiet spaces to escape to when your child is in the middle of a meltdown, and if we could plan what exhibits we wanted to visit ahead of time using the app, we would be more prepared for what we would see and it would not just be a free-for-all.”<sup>82</sup>

Lindsay and Preston did not have too many suggestions for improvements, but they did indicate that having additional photos and information of what the exhibit interior looked like would be helpful so families could get a better idea of exactly what to expect in each space, particularly for the short-term exhibits in the Strong’s Fidelis Care Gallery. They also suggested adding a video walkthrough option for the social story to provide a more in-depth, realistic picture of what families can expect when they go to the museum.

One suggested improvement that was expressed by both families was to offer an option on the app that allowed the user to choose content based on their age range. While the Strong Museum and, therefore, this app aims to cater to children of all ages, there are definite differences in taste and interest that are age-dependent. For example, Austin, age ten, did not like the idea of listening to children’s music, such as Baby Shark or other nursery rhymes, but expressed that the options should be provided for younger children like his little cousin. There would also be differences in the types of interactive games the varying age groups would like. A

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<sup>82</sup> Lindsay, interview by Felicia Swartzenberg, in-person interview, Rochester, N.Y., March 26, 2019.

four-year-old may enjoy a matching game, but a ten-year-old could find the simple game to be boring and it may not hold their attention.

Overall, the app was well-received by my target audience. With further work and improvements on this prototype, *SenseEase: Strong Museum* could be a very useful tool that the Strong Museum, or any other museum, could adopt to enhance their relationships with visitors on the spectrum and their local autism communities.

## **Future Development and Adoption**

When I first conceived of this project, my goal was to create a tool that could be used in any museum space that would help alleviate stress and provide a more comfortable visitor experience for children on the autism spectrum. While this goal was unattainable through the development of a single app, this prototype provides a template for other museums to adopt a similar tool for their own individual museum environments. By obtaining the template from Peter and I, any museum can create their own version of *SenseEase: Strong Museum*. While the cost of hiring an app developer may seem daunting, by presenting them with a preexisting design or code (which can be obtained from myself and Peter on a case-by-case basis) they would not need to dedicate as much time to the wireframe development.<sup>83</sup> Therefore, a museum would only need to pay for the costs of modifying the template to fit each individual museums' needs and inputting or creating content that is site-specific to the museum.<sup>84</sup>

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<sup>83</sup> Our design is purposefully simple and easily adaptable so other institutions can adopt and individualize our basic interface design. Furthermore, because the colors and interface are not necessarily specific to Strong Museum, an institution would not need to change the overall design if they chose to adopt this digital tool and are happy with the current design.

<sup>84</sup> I created or collected all of the content that is available on the app and Peter designed the interface of the app. So, in terms of content, a staff member would be able to create most things and the developer would only need to create games or any additional multimedia feature that is outside of the staff's skillset.

If a museum were to consider adopting this app template, I would recommend further development to implement a number of suggestions that my user testing participants gave in their feedback. Particularly, I would recommend: providing different content options, in terms of games and music, for different age groups so, regardless of their age, children will be interested and engaged with the app; adding additional music that is a mixture of calming instrumentals, upbeat modern music, and fun children's songs, as the calming instrumental alone was not well received by the younger participants; implementing a grid-design for the social story and sensory guide so people can pick and choose what sections they want to see rather than having to scroll through the entire slideshow of material; providing a video walkthrough as an additional method of consuming the social story content, which allows for better and more in-depth visuals than a simple photo; including a section on the For Parents page dedicated to the food options that are available at the museum so families can plan to bring lunches if necessary; creating content for Bluetooth proximity beacons that provide both general information about what is available in each exhibit and sensory information about what to expect in each area; and providing counting videos or videos about different exhibits in the museum for children to use while waiting in line to help them practice being patient.

## **Conclusion**

Historically, museums have put maintaining a beautiful and pristine collection as their top priority. Today, the professional community has shifted from collections-focused to community-focused mindsets because museums have come to recognize that an institution that does not serve the public is not an effective, or even necessary, institution. In her book *The Social Work of Museums*, Lois Silverman explains: "As the climate of accountability worldwide has pressured museums to justify their worth, it is not surprising, but rather inevitable, that they

are acting upon a growing awareness of their broadest potential: what we might call the social work of museums.”<sup>85</sup> An important part of meeting societal standards for accessibility and maintaining the “social work of museums” is ensuring that the museum and its collections are accessible to all visitors regardless of backgrounds, ages, abilities, and beliefs.

Most, if not all, museums in the United States—and globally—have made efforts to ensure they serve all types of visitors. Some, like the Rochester Museum and Science Center, develop programming and change their exhibit designs to become more accessible on site. Others, like the Strong National Museum of Play, work with local advocacy organizations that represent various populations in need of accessibility accommodations to ensure that they are serving their community and meeting people’s needs effectively. Some have even joined larger initiatives in the museum professional world to ensure both their institution and other local institutions are doing all they can to implement more accessible policies that are sensitive to the needs of their communities. Organizations like the Museum Access Consortium and the Chicago Cultural Accessibility Consortium bring museum professionals together to discuss topics related to accessibility and how individual institutions and staff can become more accessible for all types of visitors.<sup>86</sup> The formation of organizations like this both propagates the importance of accessible programming and highlights the validity and necessity of these resources by showing how community members positively react to them.

In terms of accessibility programming and resources for individuals on the autism spectrum specifically, many museums are still in the early stages of even developing resources;

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<sup>85</sup> Lois H. Silverman, *The Social Work of Museums* (New York: Routledge, 2010), 14.

<sup>86</sup> Chicago Cultural Accessibility Consortium, "About Us," CCAC, accessed March 20, 2019, <https://www.chicagoculturalaccess.org/about-us>; Museum Access Consortium, "About MAC," Museum Access Consortium, accessed March 20, 2019, <https://macaccess.org/about-new/>.

but that does not make these resources any less necessary than accessibility ramps for people in wheelchairs or providing translations for those who do not speak English. However, there are inclusive solutions that can complement separate programming for individuals on the spectrum. While sensory-friendly days can be very helpful when first introducing a child to a new museum environment, a by-product of this exclusive safe space is that it essentially segregates the population of visitors on the autism spectrum from the rest of museum visitors. By utilizing an app like *SenseEase: Strong Museum*, autistic museum visitors would not feel excluded and could enjoy the museum at any time like their neurotypical counterparts. This app would not be able to completely replace sensory-friendly days or other resources for individuals on the spectrum, as both of these are incredibly valuable in their own right, but it would be an addition that would make people feel less like a “special” guest, and more like a regular visitor.

Overall, the results of the user testing conducted with the app’s target audience was highly positive, and both families felt that the app has great potential to help children on the autism spectrum and their families navigate chaotic or unfamiliar museums; particularly the social story and sensory guide. They found the app’s design and content easily navigable and intuitive to use, they felt the app helped them have a more comfortable and sensory-friendly experience at the museum, and they felt the app provided helpful content that their child could use when they began to feel overwhelmed or stressed. Most importantly, they indicated that they would recommend this app to other parents who have children on the autism spectrum—and parents of young children in general—as they felt it contained helpful information and interactive content. After reviewing all of the user testing feedback, I have concluded that a mobile application can indeed help visitors with autism have a more comfortable, positive, and accessible museum experience.

In the words of museum studies scholar Susan Davis Baldino, “inclusion benefits autistic students by eradicating inequities. Perhaps, more importantly, it benefits all students, autistic and non-autistic, by expanding individuals’ experiences of difference in ways that diminish prejudice.”<sup>87</sup> By providing a digital tool that allows visitors on the autism spectrum to be engaged and included like their neurotypical counterparts, museums will benefit from two desirable outcomes: their institution will become a welcoming and less intimidating space for individuals on the autism spectrum and their families will feel comfortable attending the museum more often; and, by allowing for more people on the spectrum to visit and be visible in their museum space, other museum visitors will be made aware that there are visitors with different abilities and, in theory, stereotypes or prejudices they had about individuals on the autism spectrum may be erased.

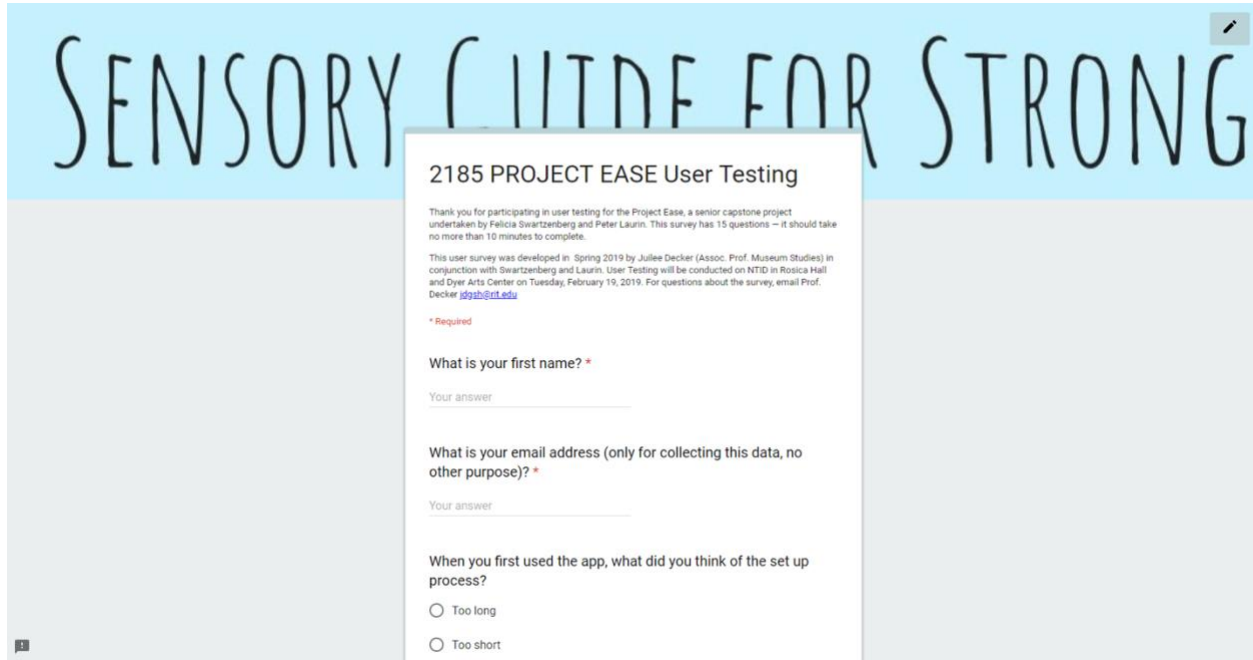
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<sup>87</sup> Susan Davis Baldino, “Museums and Autism: Creating an inclusive community for learning,” in *Museums, Equality and Social Justice*, edited by Richard Sandell and Eithne Nightingale, (New York: Routledge, 2012), 172.



## Appendix – Images and Photographs

**Fig. 1:** A screenshot of the Google Forms survey given to the Visitor Engagement students. See the full survey here: <https://forms.gle/7g4t98FpxzW9sVHV8>.



The screenshot shows a Google Forms survey titled "2185 PROJECT EASE User Testing". The background features the text "SENSORY GUIDE FOR STRONG" in a large, hand-drawn font. The survey content includes a thank-you message, a description of the project, and three questions:

**2185 PROJECT EASE User Testing**

Thank you for participating in user testing for the Project Ease, a senior capstone project undertaken by Felicia Swartzberg and Peter Laurin. This survey has 15 questions – it should take no more than 10 minutes to complete.

This user survey was developed in Spring 2019 by Juliee Decker (Assoc. Prof. Museum Studies) in conjunction with Swartzberg and Laurin. User Testing will be conducted on NTID in Rosica Hall and Dyer Arts Center on Tuesday, February 19, 2019. For questions about the survey, email Prof. Decker [jdecker@ntid.edu](mailto:jdecker@ntid.edu)

\* Required

**What is your first name? \***

Your answer \_\_\_\_\_

**What is your email address (only for collecting this data, no other purpose)? \***

Your answer \_\_\_\_\_

**When you first used the app, what did you think of the set up process?**

Too long

Too short

**Fig. 2:** A screenshot of the Google Forms survey given to the two families who participated in user testing. See the full survey here: <https://forms.gle/67ZPZcjkUYfVvk7J3A>.

The screenshot shows a Google Forms survey titled "Sense Ease: Strong Museum - User Testing Evaluation". The background features the text "SENSORY GUIDE FOR STRONG" in a large, hand-drawn font. The survey content includes a thank-you message, a description of the project, and three required questions. The first question asks for the parent's name, the second for the child's name, and the third asks for a preference on how to be referred to in a thesis paper. The "First name" radio button is selected.

**Sense Ease: Strong Museum - User Testing Evaluation**

Thank you for participating in user testing for the Sense Ease, a senior capstone project undertaken by Felicia Swartzberg and Peter Laurin. This survey has 22 questions – it should take no more than 10-15 minutes to complete.

This user survey was developed in Spring 2019 by Julie Decker (Associate Professor of Museum Studies) in conjunction with Swartzberg and Laurin. User Testing will be conducted at the Strong National Museum of play between March 8 and March 18, 2019. For questions about the survey, email Felicia Swartzberg at [fd9410@st.edu](mailto:fd9410@st.edu).

\* Required

**What is your first and last name (parent)? \***

Your answer: \_\_\_\_\_

**What is your first and last name (child)? \***

Your answer: \_\_\_\_\_

**In my thesis paper, would you prefer me to refer to you and your child by your first names, or by a different identifier (ie, Parent 1 and Child 1, Parent 2 and Child 2)? \***

First name

**Fig. 3:** A screenshot of an article written by the author about accessibility for visitors at three large museums in Rochester, N.Y. Read the full article here:

[https://felicidianne.atavist.com/asd\\_accessibility](https://felicidianne.atavist.com/asd_accessibility).

# Are museums accommodating visitors on the autism spectrum?



Felicia D. Swartzenberg

You walk into a room and you're instantly overwhelmed. The lights are too bright, you're accosted by unfamiliar smells and there are too many people making too much noise.

Your first instinct is to escape from the sensory overload your brain is feeling, but you're away from home and can't retreat to any familiar safe spaces. You want to leave, but for one reason or another flight isn't an option. You're trapped, so you have a meltdown.

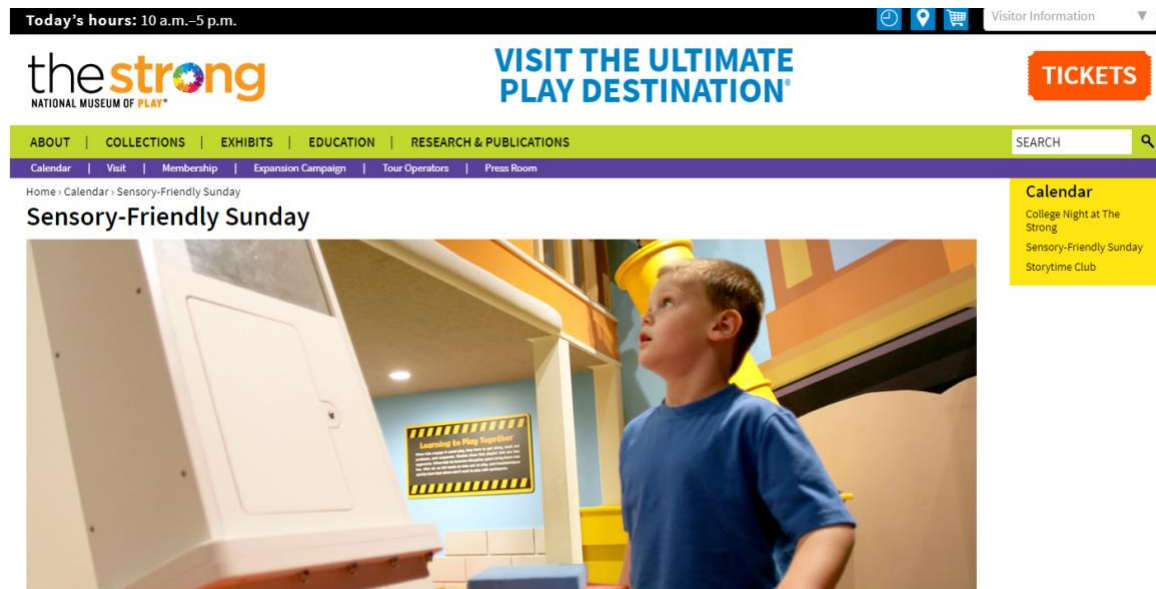
This can be an everyday occurrence for individuals on the autism spectrum.

When public spaces don't make accommodations or provide resources for those who are easily over or under stimulated, it can be difficult to have a positive experience wherever you go.

According to Rachel Rosner, the director of education and support at Autism Up, a local autism support organization, there are 10,000 people on the autism spectrum within the five-county area. Annually, there are roughly 450 to 500 new diagnoses across the county.

**Fig. 4:** A screenshot of the Strong National Museum of Play’s website which features information about their Sensory-Friendly Sunday program. For more information, go to:

<https://www.museumofplay.org/calendar/sensory-friendly-sunday>.



**July 28, 2019**

**9 a.m. to 12 p.m.**

Enjoy The Strong before it opens to the public at an exclusive event designed for children with special sensory, developmental, or physical needs. Explore the museum in a comfortable and accepting environment that features fewer guests, light and sound reduction, extra visual safety signage, and designated quiet areas that include sensory friendly toys. Also enjoy story readings and a free visit to the relaxing *Dancing Wings Butterfly Garden* before noon.

\$16 for non-members; \$11 for members. Space is limited to 250 guests. Children must be accompanied by an adult. Registration required. Tickets are not refundable and not eligible for any other discounts. Complimentary passes and member guest passes may not be used for this event. Tickets will not be sold at the door. Museum Social

**Fig. 5:** A screenshot of the Strong National Museum of Play’s Social Story. For more information and a list of the Strong’s Social Stories, go to

<https://www.museumofplay.org/visit/accessibility>.

# Getting Ready to Visit the Museum

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I am going to visit the National Museum of Play.

My adult will park the car. We will walk from the car to the museum’s front door. There are other cars driving around in the parking lot. I will stay close to my adult.



When I enter the museum, I will walk past a carousel, a museum store, and an old-fashioned diner.

I will get in line near the admissions desk. There may be other people waiting in line, too. I will be patient.

**Fig. 6:** A screenshot of the Intrepid Sea, Air and Space Museum’s website which features details about their accessibility resources. For more information, go to:

[https://www.intrepidmuseum.org/education/accessibility-resources.](https://www.intrepidmuseum.org/education/accessibility-resources)

**INTREPID**  
SEA, AIR & SPACE MUSEUM COMPLEX

BUY TICKETS

Select Language

Advanced Search

Plan Your Visit | The Intrepid Experience | Education | Groups | Host an Event | Kids & Families | Give and Join

## ACCESSIBILITY RESOURCES

SCHOOLS & TEACHERS | FAMILIES | TEENS & YOUTH LEADERSHIP | COLLEGE STUDENTS /COLLEGE GROUPS | CAMPS | ACCESS PROGRAMS & ACCESSIBILITY RESOURCES | COMMUNITY OUTREACH

**ONLINE RESOURCES | ON-SITE RESOURCES | SPECIALIZED PROGRAMS | COMMUNITY ADVISORS**

The Intrepid Sea, Air & Space Museum provides specialized programs and resources to support and enhance the experience of all visitors, including those with disabilities, their peers and families.

**Online Resources: Plan Your Visit**

**Social Narrative**  
The Social Narrative provides an illustrated, step-by-step guide on what to expect during a visit to the Museum. Use the



**Fig. 7:** A screenshot of the Shedd Aquarium’s website which features information about the museum’s sensory-friendly app. For more information, go to:

[https://www.sheddaquarium.org/plan-a-visit/visitor-guide/Accessibility/sensory-friendly-app/.](https://www.sheddaquarium.org/plan-a-visit/visitor-guide/Accessibility/sensory-friendly-app/)

The screenshot shows the Shedd Aquarium website's navigation and content. At the top, there is a dark blue navigation bar with the Shedd Aquarium logo on the left and links for 'Login', 'SUPPORT US', 'MEMBERSHIP', 'DONATE', 'BLOG', 'SHARE', a search icon, a calendar icon showing '31', a location pin icon, and a 'GET TICKETS' button. Below this is a secondary navigation bar with 'Plan a Visit (Open today 9 to 6)', 'Animals & Care', 'Conservation & Research', 'Learning Experiences', and 'About Us'. The main content area is divided into three columns. The left column is a 'Plan a Visit' sidebar with links: 'Reserve Tickets Now', 'Ticket Prices', 'Gift Certificates', 'Shedd Hours', 'Group Visits', 'Getting to Shedd', 'Visitor Guide' (with sub-links for 'Shedd Spotlight: Top Videos and Stories', 'Today at Shedd', 'Upcoming Shedd Events', 'Tips for a Great Visit', 'Shedd Audio Guides', 'Accessibility', 'Sensory Friendly App', 'Exhibits', 'Experiences', 'Washed Ashore', 'Dining & Shopping', 'Around Town'), 'Plan a Private Event', 'FAQs', and 'Policies'. The middle column is titled 'Sensory-Friendly App' and features three screenshots of the app: 'Wild Reef' (a video guide), 'Schedule' (a list of exhibits with checkboxes), and 'COMMUNICATIONS' (a grid of icons for 'It's too loud', 'I need help', 'I'm nervous', 'I feel happy', 'I'm hungry', and 'I like this'). The right column is a 'PLAN A VISIT' call-to-action box with the text: 'We can't wait for you to meet our 32,000 amazing animals and explore the world's oceans, rivers and reefs — right in the heart of Chicago. [Learn more.](#)' Below this are sections for 'GETTING TO SHEDD' and 'WHAT'S COMING UP'.

**Plan a Visit**

Reserve Tickets Now

Ticket Prices

Gift Certificates

Shedd Hours

Group Visits

Getting to Shedd

Visitor Guide

Shedd Spotlight: Top Videos and Stories

Today at Shedd

Upcoming Shedd Events

Tips for a Great Visit

Shedd Audio Guides

Accessibility

► Sensory Friendly App

Exhibits

Experiences

Washed Ashore

Dining & Shopping

Around Town

Plan a Private Event

FAQs

Policies

**Sensory-Friendly App**

**PLAN A VISIT**

We can't wait for you to meet our 32,000 amazing animals and explore the world's oceans, rivers and reefs — right in the heart of Chicago. [Learn more.](#)

**GETTING TO SHEDD**

**WHAT'S COMING UP**

**For guests who require sensory support**

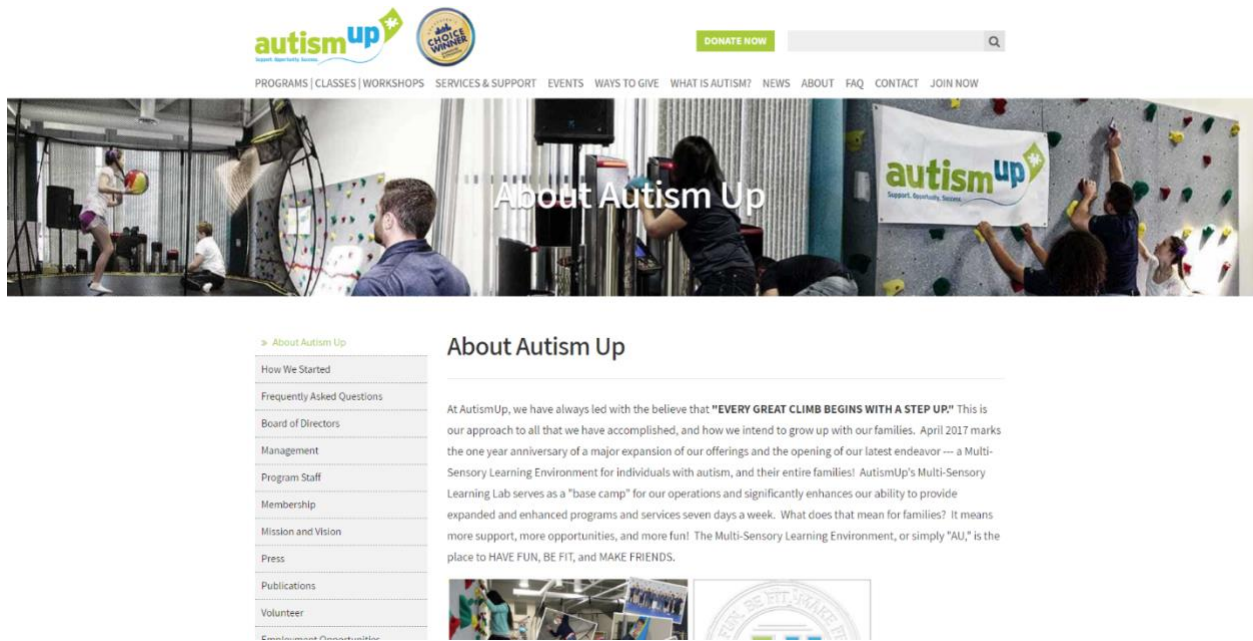
Prepare for your visit with Shedd Aquarium’s sensory-friendly app. Designed for guests with autism and sensory-processing disorders in mind, the app helps make Shedd more accessible to all guests. Video social guides offer information on individual exhibit spaces, including photos, tips on temperature and noise levels. The app also includes a visual schedule, communication tools, sensory-friendly maps and more tips to plan your visit, set expectations and ease anxiety.

Click on the links below to download the app:

[iTunes](#)

[Google Play](#)

**Fig. 8:** A screenshot of the “About” page on Autism Up’s website. For more information, go to: <https://autismup.org/about-us>.

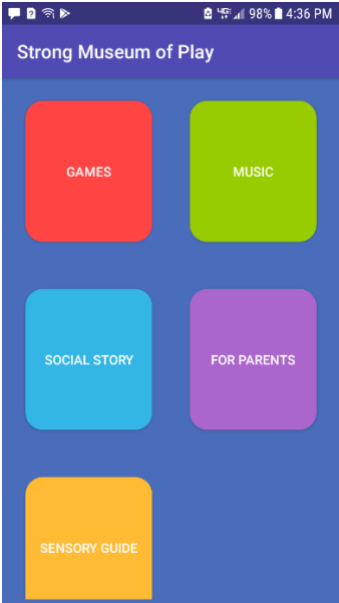




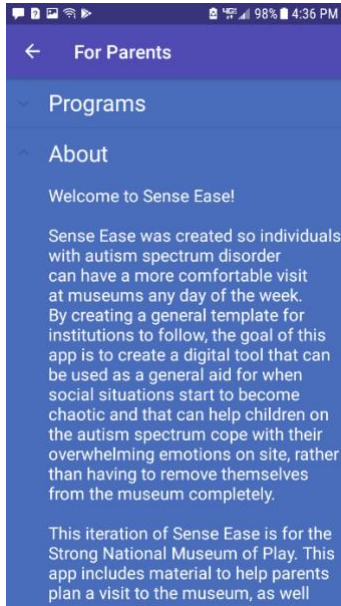
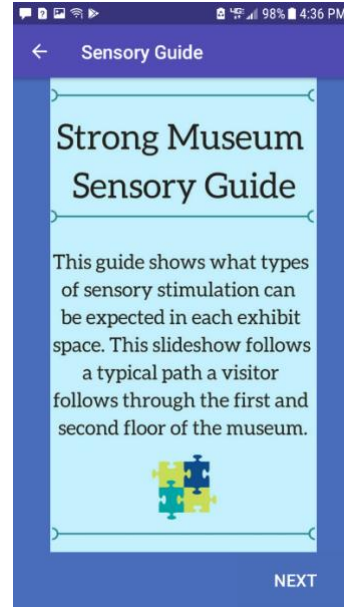
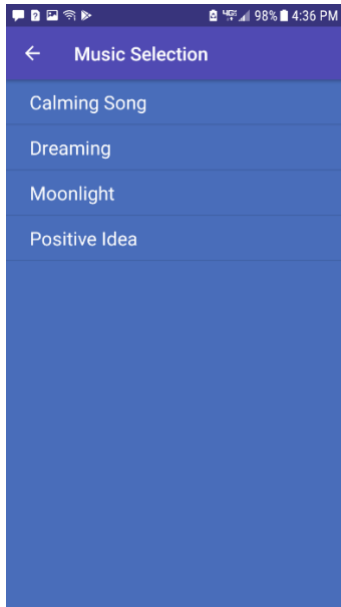
**Fig. 9:** The Reading Adventure Land exhibit at Strong National Museum of Play in Rochester., N.Y. Photo by author, October 8, 2018.



**Fig. 10:** The home screen of *SenseEase: Strong Museum*.



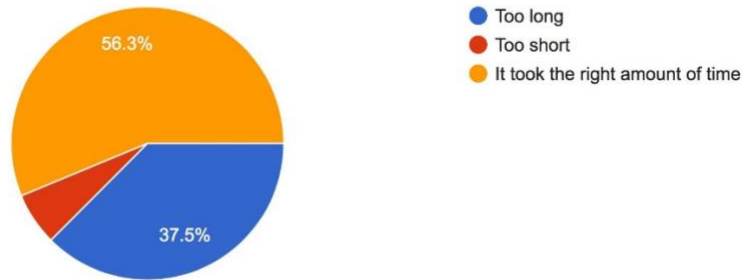
**Fig. 11:** Top, from left: Music page Social Story main page; Sensory Guide main page. Bottom: For Parents page.



**Fig. 12:** Screenshots of data from the first round of user testing data with Dr. Juilee Decker's Visitor Engagement class.

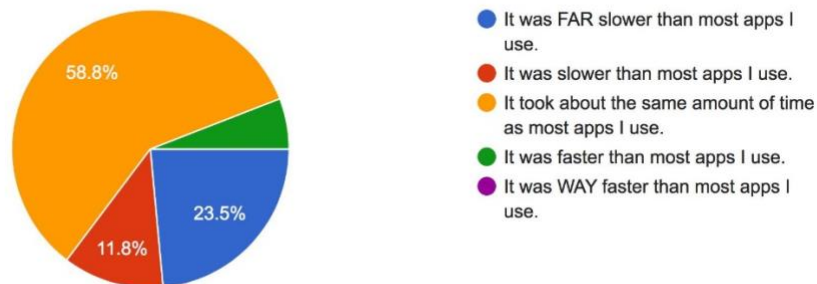
When you first used the app, what did you think of the set up process?

16 responses



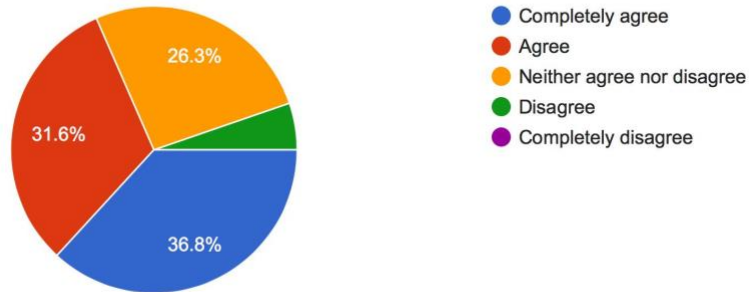
What was the speed of the installation process like?

17 responses



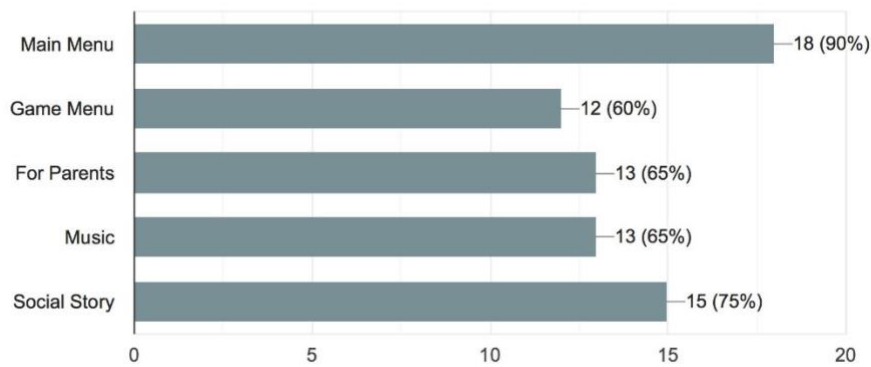
### I found the app easy to navigate.

19 responses



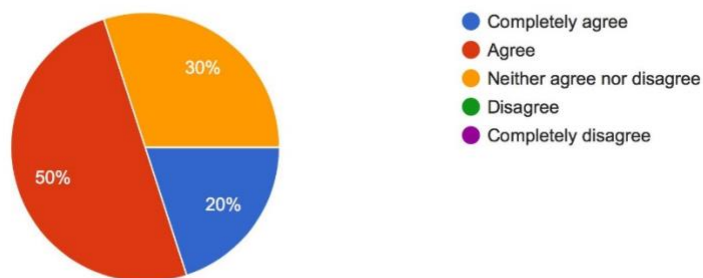
### Which screens did you use? (Check all that apply)

20 responses



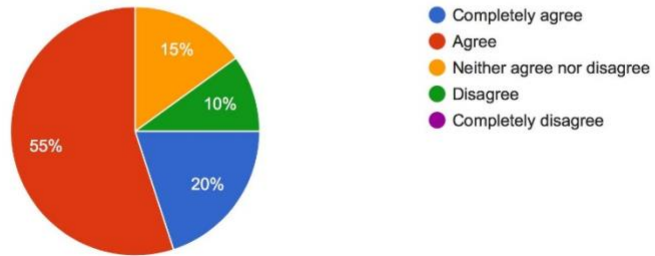
### I found the menu title and the purposes of each menu understandable.

20 responses



Using the app helped increase my understanding of how an app can assist visitors in experiencing a museum.

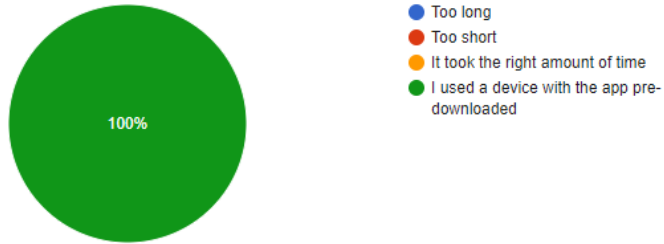
20 responses



**Fig. 13:** Screenshots of data from the second round of user testing with my target audience, Roberta and Austin, and Lindsay and Preston.

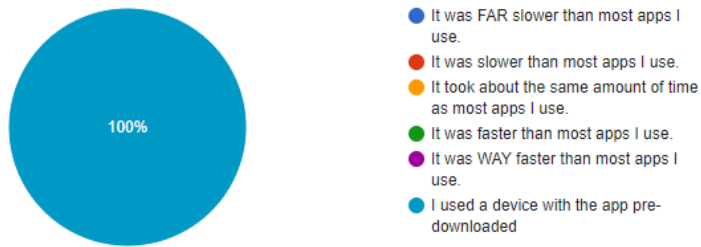
When you first used the app, what did you think of the set up process?

2 responses



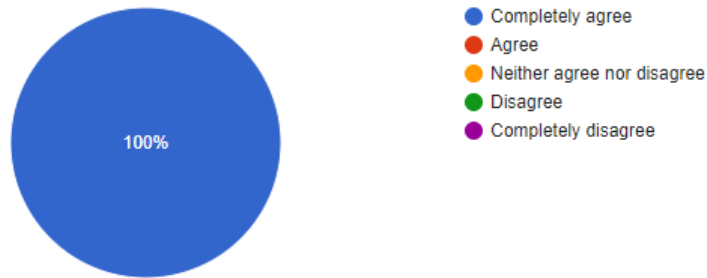
What was the speed of the installation process like?

2 responses



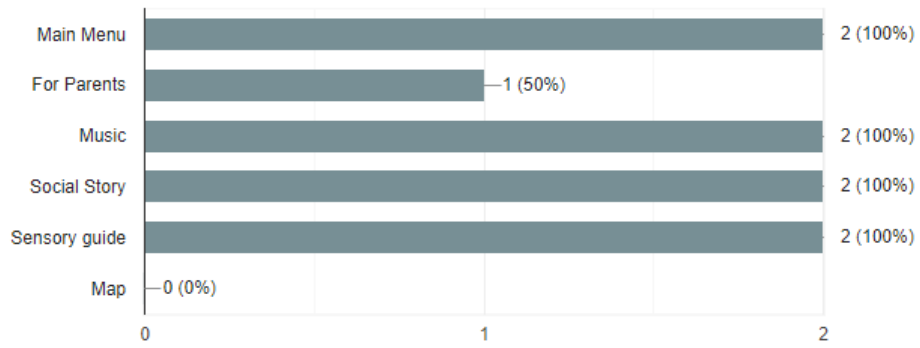
I found the app easy to navigate.

2 responses



Which screens did you use? (Check all that apply)

2 responses





I found the menu title and the purposes of each menu understandable.

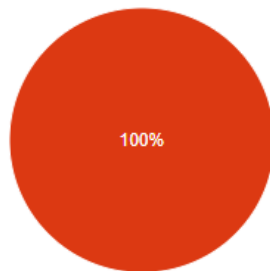
2 responses



- Completely agree
- Agree
- Neither agree nor disagree
- Disagree
- Completely disagree

I felt that using this app enabled me and my child to have a more comfortable or sensory-friendly museum experience.

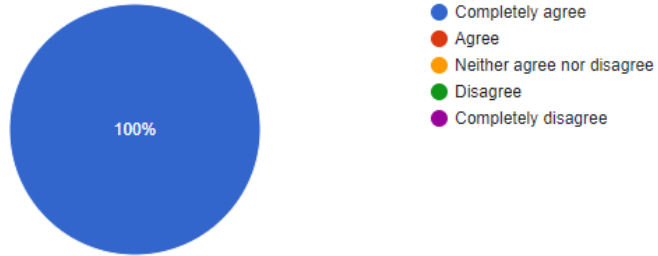
2 responses



- Completely agree
- Agree
- Neither agree nor disagree
- Disagree
- Completely disagree

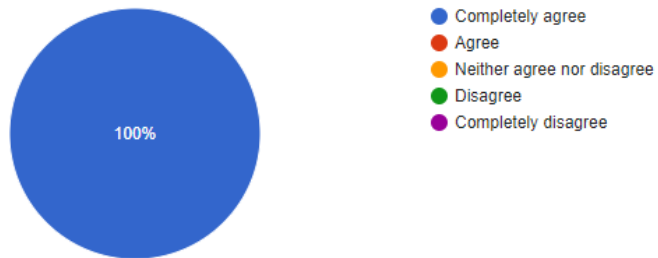
Did you think that the social story was an effective tool for navigating the museum?

2 responses



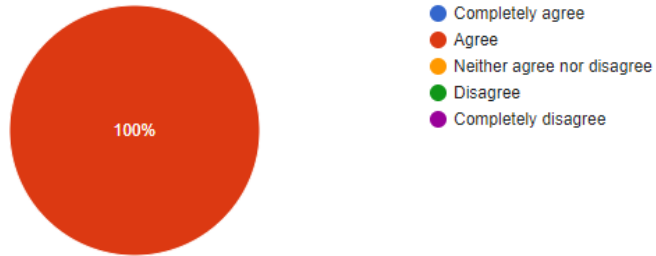
Did you think that the sensory guide was an effective tool for navigating the museum?

2 responses



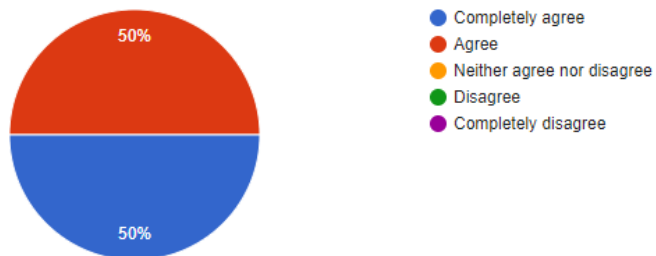
Did you think that the music options included in the app were good choices for when my child is feeling distressed, angry or overwhelmed?

2 responses



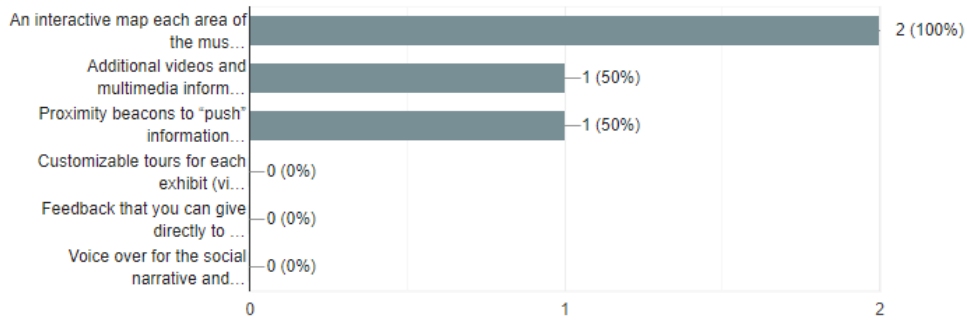
Did you think that the "For Parents" tab contained useful information that helped me navigate the app?

2 responses



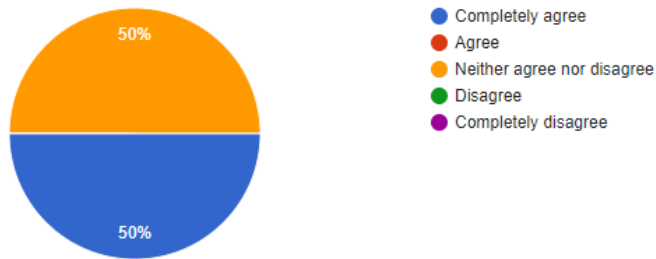
Which of the following features would you add to this app? (You may choose more than one).

2 responses



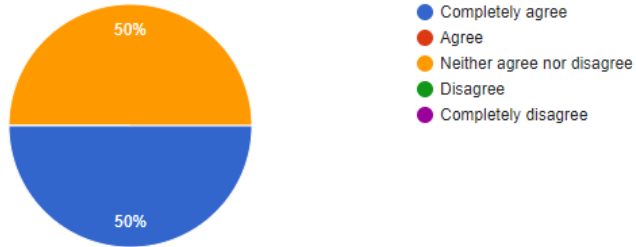
"Sense Ease: Strong Museum" is a memorable app name.

2 responses



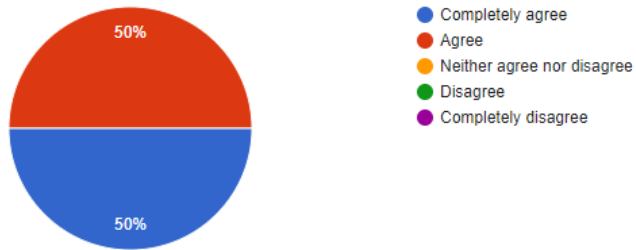
The app name, "Sense Ease: Strong Museum," adequately describes the app and its purpose.

2 responses



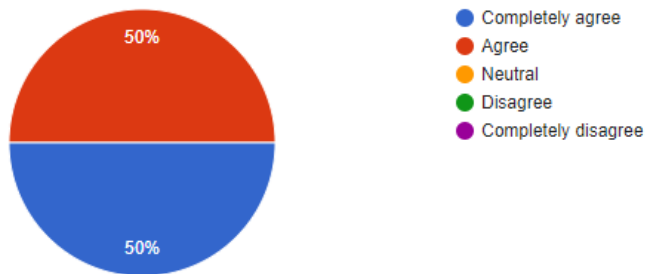
I like the color and the appearance of the app.

2 responses



I would recommend this app to other parents who have children on the autism spectrum.

2 responses



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