# Prism, a Game to Promote Autism Acceptance Among Elementary School Students

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**Abstract.** Prism was developed to help neurotypical children aged 8 to 10 empathize with their peers who have autism. It is a digital game for the children to play, paired with a discussion framework for instructors that takes the children through the game and how it relates to the children's everyday life. In this paper we describe the development of the game and discussion framework, iteratively working with the stakeholders and interacting with a subject matter expert to create the full experience within 15 weeks.

**Keywords:** Autism acceptance · Games for behavior change
Games for empathy

## 1 Introduction

At Beech Bottom Primary School in West Virginia, USA, neurotypical students (students without autism) frequently interact with classmates who have autism. While the children take many classes separately, there are occasions where they take the same class, and many areas where they meet – like during recess or parties. Teachers note that the differences in behavior between the two groups give rise to misunderstandings and difficulties in cooperation. Previous efforts in promoting empathy in neurotypical students involved conversations with the children about autism, sometimes aided with videos. Instances of teasing and mild bullying persisted, however, and the teachers were concerned about the long-term impact of such behavior left unchecked.

Our team of Carnegie Mellon graduate students from the Entertainment Technology Center was tasked with developing a functioning prototype in a 15-week period that could effectively engage neurotypical children with the subject matter and engender empathy for their peers with autism. Our client was interested to see whether an interactive experience would be more effective in getting through to the children. We worked closely with a subject matter expert (SME), Michelle Lubetsky, who is an Educational Consultant at the Allegheny Intermediate Unit (Pennsylvania, USA) to develop the experience. We built the game for web browsers and optimized for Google Chromebooks, later porting it to iOS and Android devices for increased accessibility at schools.


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## 2 Related Work

Autism acceptance and empathy has been promoted through a variety of media. Before we committed to a digital game, we explored the work that had already been done in this area, discussing pros and cons with our SME. Given that we had a 15-week period to create the full prototype, we had only a short span of time to look at other work, focusing on types of interactive experiences we could pursue for our project, or media targeted specifically at our users, like children's books. We met bi-weekly with our SME to keep the experience focused on its goals.

**360° Video.** Projects employing this media to engender empathy for autism usually simulate the experience of sensory overload to help viewers understand it. Some videos we looked at were the *Autism TMI Virtual Reality Experience* [1] and *The Party* [2]. These applications do not address difficulties with communication and social skills that are typically observed in individuals with autism.

**Games.** The game *Auti-Sim* [3] allows you to navigate through a playground as a child, focusing on the experience of sensory overload. There are some comments on the game webpage that express positive reception, but other comments emphasize that it is not representative of all autistic experiences. As autism is a wide spectrum, a game set in the real world was a risky endeavor. We also learned to watch for tone, as there are comments and reviews of the game that call it "creepy" or "horrifying". We wanted to ensure that players of our game do not fear or pity their peers with autism.

**Installations.** An interactive digital poster by BBDO for Autism Speaks [4] addressed the difficulty that children with autism have with making eye-contact. It was used for advertisement purposes and tackled only that one symptom.

**Augmented Reality.** Heeju Kim created *An Empathy Bridge for Autism* [5] using a smartphone augmented with a specially designed app to simulate autistic vision, earphones to emulate the sound and disposable candy that hinders pronunciation. The creator used low cost materials to address various symptoms of which neurotypical people may not be aware.

**Mobile Apps.** *The Autism Discovery Tool: Sensory from Within* mobile app [6] dealt with seven senses: vision, hearing, touch, taste, smell, balance and proprioception. The app address both strengths and challenges in these areas. While the platform of a mobile app lends itself well to our users and the wide range of senses provided good coverage, the app functioned as a tool which may not be engaging for children.

**Books and Videos.** There is a variety of material directed at children through these media. Books like *My Friend With Autism* [7], or the videos *My Autism and Me* [8], *What's up with Nick?* [9] and episodes of *Sesame Street* [10] depict everyday with advice for children on how to navigate them. We also watched episodes of the television show *Mister Rogers' Neighborhood* [11] for insight into constructing a simple story for children and mapping it back to a larger lesson.

## 3 Design

To flesh out our goals for the player of the game, we used Sabrina Culyba's framework for developing transformational games [12]. The "barriers" we identified i.e. the reasons neurotypical children at the school had trouble empathizing with their autistic peers, were two-fold. First, from the perspective of a neurotypical student, it often seems that there are no apparent stimuli that cause the unusual and sometimes frightening behaviors that their peers with autism exhibit. Second, neurotypical children can have a hard time understanding that their peers with autism must perform conscious social problem-solving on a regular basis to effectively communicate. Extrapolating from these barriers, we developed the goals for the players of our game as follows: First, the game helps the player understand the phenomenon of sensory overload. Second, it helps them understand the difficulty in daily communication that their peers with autism face. And third, the players should understand how they can take actions to be a better friend.

As an informal test, we met with a small group of students at our client school, where we used card sorting with some pictures of different games to understand their preferences. The children expressed a preference for open-world games set in natural settings over more realistic, industrial-like settings. Brainstorming with exploration as a core driver, we arrived at the idea of a having an open-world game set in a forest. We then laid a plot over this structure to make the design address our goals better. The player plays as a nocturnal animal, the fox, who experiences a form of sensory overload in the daytime, and who must communicate with animals unfamiliar to it. This pairs the sensory overload with a series of social interactions, addressing our first two goals. We moved our third goal outside the game, where a teacher leads a discussion about the traits observed in the animals and how it relates to everyday life. We also met with some children a second time, where we asked them for stories about their friends, to help us construct a more relatable narrative. Many stories about friendship revolved around playing together, helping someone who was hurt, or helping someone find a lost object. This helped shape the plot to meet our learning goals (Table 1).

We iteratively tested for development at multiple primary schools, using built-in Google Analytics to evaluate our design choices. We followed all child safety protocol measures as required by the schools with which we worked, as well as CMU's human subject guidelines.

## 4 Implementation

### 4.1 Visual and Auditory Distortion

The distortion was in effect during the daytime, which is when the fox would experience a form of "sensory overload." It occurs at regular intervals and the fox must howl to soothe itself. Developing in Unity3D (for WebGL browser deployment, and then iOS and Android apps), we used the bloom filter in combination with grain, depth of field, chromatic aberration and a slight vignette. Initially, we simulated blurry vision, but our SME advised us to instead simulate it as sensitivity to bright light (Fig. 1). For

**Table 1.** Structure of the plot with associated learning goals

| Game plot | Gameplay | Learning goals |
|---|---|---|
| The fox meets the owl and the wolf who bring news of the flood and ask the fox to seek help to save the forest | Cutscene, introduction to dialogue selection mechanic | |
| The bear needs honey before she agrees to help | Soothe visual distortion to read dialogue | Difficulty attending to an auditory message if highly stimulated |
| A stag and a doe are worried about their lost baby fawn, who is obsessed with fireflies | Select appropriate dialogue options to guide the fawn back | Deliver monologues about a favorite topic rather than allow reciprocal communication |
| The owl discusses how challenging the daytime can be | Cutscene | Normalizing difficulties, highlighting strengths |
| An injured boar needs some berries, honey and wheatgrass. The rabbit can help but doesn't seem to be listening | Interacting with the rabbit prompts wheat-grass to appear in her mouth 30 s later | Have difficulty multi-tasking, i.e., talking or listening while doing something else; may need to do one thing at a time |
| The fox meets a moose who seems unwilling to talk | Repeated interactions encourage non-verbal communication | Desire social interaction, but has difficulty knowing how to initiate and maintain a friendship |

the auditory distortion, we used curve smoothing. Since the WebGL platform does not support threads, we were unable to use FMOD for audio playback and mixing, so we created two separate tracks (normal and distorted) and switched between them using the Web Audio API.

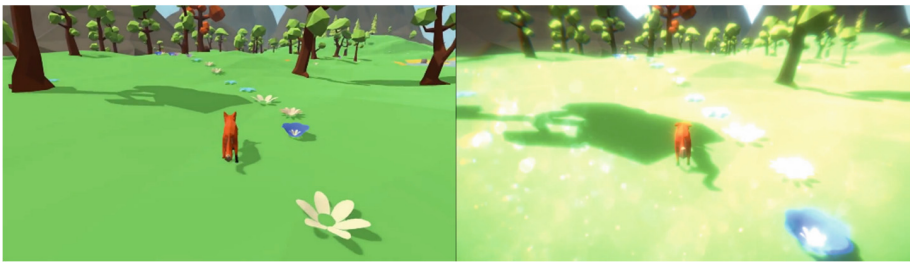

**Fig. 1.** Daytime vision – when soothed and distorted.

### 4.2 Navigation and Controls

Based on the children's familiarity with games like Minecraft, we initially used a combination of mouse and keyboard for controls. However, this proved to be too difficult for all children to use, so we made the controls keyboard-only, using arrow keys and the spacebar. The players could use the H key to access the Hints menu, and the F key to howl to alleviate distortion. When porting to mobile devices, we changed the F key-press to shaking the device. We added a delay to the effect of the soothing taking place. It created the desired effect of the children repeatedly trying to soothe the fox, without being prompted to do so, seeming effective in simulating the frustration of a sensory overload. The delay in soothing was adjusted based on testing, to make sure that the players were not frustrated enough to stop playing the game.

### 4.3 Dialogue and Hints System

In lieu of using voice acting, an effort was made to keep the reading level of the dialogue simple using a readability checker [13]. We avoided filling the dialogue box with long lines of text, preferring to break them into smaller sentences.

We found that adding environmental cues for each animal helped the players orient themselves in the world. Consequently, we used a large red tree, fireflies, a pond and large rocks as markers for each animal. A hints menu was added in to provide the players with a visual indicator of progress and gameplay hints. We also added on-screen hints and context-sensitive dialogue hints.

### 4.4 Discussion Framework and Teacher Resources

In the development of the discussion framework for teachers, we worked closely with our SME who has experience conducting workshops with children for autism acceptance. An accompanying document presents the framework for each animal interaction, consisting of a quick overview of the plot, the learning goal and the questions to be asked. Prior to conducting the workshop, the teachers can watch a series of playthrough videos on our website [14], if they do not wish to play the game.

## 5 Use in Classrooms

Our client, Beech Bottom Primary, conducted the full workshop with their class of fourth-grade students. The students responded favorably to the post-game discussion, relating the animal scenarios to their real-life experiences. The teacher pointed out that a child known to exhibit some insensitivity on the subject previously took a surprising initiative in the conversation post-game. They theorized it was because he was fond of playing games and looked upon the topic of discussion more favorably when it was presented to him in relation to a game. We also tested the game and workshop at a school that had not seen previous iterations of the game, and without the team physically present in the room. The game was well received and many students took

initiative in the post-game discussion. In all tests, the children play the game for 30–35 min, with the follow-up teacher-led workshop running for 25–30 min.

## 6 Next Steps and Conclusion

Next steps include empirical validation that the game meets its learning goals through formally coding discussions and careful experimental procedures regarding the game plus teacher-led workshop. Our goal with this project was to create a fully-functional working prototype in 15 weeks. We found that our animal world triggered topic appropriate conversations in our pilot tests with two schools. Most efforts in autism acceptance that we examined explain the condition using some version of real-world simulation. However, our unique metaphorical approach also worked well to stimulate conversation. The use of forest animals engaged our players and perhaps made it easier for them to understand the existence of different behaviors. As our developmental focus was the optimization of the game, further research efforts can investigate best-case practices for the post-game discussion.

## References

1. Autism TMI Virtual Reality Experience – YouTube. https://youtu.be/DgDR_gYk_a8. Accessed 10 June 2018
2. The Party – YouTube. https://youtu.be/OtwOz1GVkDg. Accessed 10 June 2018
3. Auti-Sim. https://gamejolt.com/games/auti-sim/12761. Accessed 10 June 2018
4. BBDO & Autism Speaks – YouTube. https://youtu.be/UqHrRIwlVm4. Accessed 10 June 2018
5. An Empathy Bridge for Autism. https://vimeo.com/172758926. Accessed 10 June 2018
6. Spectrum Idea Lab Inc. http://www.spectrumidealab.com/. Accessed 10 June 2018
7. Bishop, B., Bishop, C.: My Friend with Autism, 1st edn. Future Horizons Inc., Arlington (2002)
8. My Autism and Me. http://www.bbc.co.uk/newsround/15655232. Accessed 10 June 2018
9. What's up with Nick? – YouTube. https://youtu.be/mtRYKjucDHk. Accessed 10 June 2018
10. Sesame Street: Meet Julia – YouTube. https://youtu.be/dKCdV20zLMs. Accessed 10 June 2018
11. Mister Rogers' Neighborhood Videos. http://pbskids.org/video/mister-rogers/. Accessed 10 June 2018
12. Culyba, S.: The Transformational Framework. Unpublished manuscript (2018). Slide deck of early version available at: https://www.slideshare.net/SeriousGamesAssoc/sabrina-haskell-culyba. Accessed 10 June 2018
13. Readability and keyword density analysis. https://readable.io/. Accessed 10 June 2018
14. Project Prism. https://www.etc.cmu.edu/projects/prism/. Accessed 2018