

VIRTUAL EXPERT GUIDED SERIOUS ROLE-PLAYING GAME FOR LEARNING COMMUNICATION WITH AUTISTIC PEOPLE

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ABSTRACT

Role-play games have been developed to help individuals with autism spectrum disorders to learn social interactions with others. However, there is a lack of role-playing games that teach people without autism the necessary communication skills to engage and interact effectively with autistic people. This research aims to harness the latest technological advances in mobile computing, serious games and human-computer teaming technologies to create a virtual expert guided serious role-playing game to help people learn how to communicate with autistic people. It provides a virtual expert guided experiential and cognitive learning tool, consisting of instruction, play, review, and discussion, that helps achieve enhanced learning outcomes while enabling an independent-learning workflow. By making it available for both iOS and Android devices, it has the potential to help spread the awareness of autism and help create a more inclusive environment for autistic people at schools, universities, and communities.

KEYWORDS

Mobile Learning, Experiential Learning, Role Play, Serious Games, Autism Spectrum Disorder, Virtual Reality

1. INTRODUCTION

More than 200,000 students with autism spectrum disorders (ASD) will arrive on campuses around the United States over the next decade (Borrell, 2018; Pinder-Amaker, 2014)). However, periods of transition are particularly difficult for high school students with ASD entering a postsecondary setting (Wei, et al, 2013). Providing appropriate support to these students is essential to assisting students to achieve a higher quality of life, increased productivity, positive social interactions inside and outside of the classroom, and decreased reliance on subsequent or perpetual disability services post-graduation (Geller, et al, 2009; Goldstein, et al, 2008).

Programs such as The RASE initiative (Rando, et al, 2016) provide transition coaching services that team a coach with a student with an autism diagnosis to assist the adjustment period from high school to college. The transition coaches are experienced juniors, seniors, or graduate students without an autism diagnosis; and, if being properly trained and sufficiently prepared, they can effectively help students with ASD in key competency areas: time management and organization, resiliency, advocacy, social skill development and study skills/technology use (Rando, et al, 2016).

However, training student coaches and other care providers to engage with clients with ASD is challenging. For example, the coaches have been socialized throughout their lives to be especially polite and verbose when dealing with a topic that is difficult to discuss (for example – hygiene concerns or feedback on a problem). On the other hand, students with ASD prefer direct, action-based statements that are clear indicators of the expected behavior on their part (Milestones, 2021), such as “I need you to take a shower every day. You can choose the time, but it must be once a day”. Another example is the need for a coach to engage in open-ended questions than a yes or no answer with the client, but the open question also has to be clear and not too broad. For example, it is better to say, “Tell me about one thing you are particularly proud of from high school.” versus “Do you like Sci-Fi shows?” or “What do you do for fun?”. The first is a yes or no answer and the second is too general. As is the case in many social, behavioral, and health science education, it requires much role-play or real-play practice along with expert guidance for transition coaches to make improvements in their proficiency. Unfortunately, due to the limited availability of the professional standardized client and instructional experts, transition coaches currently have very limited opportunities to practice in an expert-guided role-play training session. As a result, because of inadequate training and a limited number of prepared candidates, these proven interventions, such as transition coaching services, are under-utilized in practices.

2. APPROACH

The primary aim and contribution of this research are to harness the latest advances in mobile computing, serious games, augmented/virtual reality (AR/VR), and human-computer teaming technologies to address the current challenge of coaching the transition coach to effectively interacting, engage, and build rapport with their student clients with ASD. By uniquely harnessing the built-in multi-modal capabilities of widely available and cost-effective iOS and Android smart devices, we have created and demonstrated a fully immersive first-person view experiential learning-based mobile serious role-play game through which the transition coach candidates can interact with the virtual standardized client with ASD under the guidance of a virtual expert instructor. Furthermore, our mobile serious game approach provides a more objective, accurate, and continuous assessment of trainees’ performance in real-time, without having to demand a potentially prohibitive amount of time and effort from the human expert trainers. The improved assessment of individual performance has the potential to provide evidence for the expert instructors to quickly modify specific exercises to maximize training outcome and scalability by identifying each individual’s progress and needs, thus supporting the more efficient evidence-based training curriculum.

2.1 Related Serious Role-Playing Games for Autism

Serious role-playing games provide a user experiential learning of the targeted skills and allow practices of a wide range and flexible combination of skill sets and scenarios without incurring potentially prohibitive costs and risks of real plays (Othlinghaus-Wulhorst, et al, 2020). It has been of particular interest and benefits for the training of social skills (Michael, et al, 2006; Daniau, 2016; Zheng, et al, 2021).

Serious role-playing games have also been created and used to support the social skill development of individuals with autism spectrum disorders (ASD) (Tang, et al, 2019; Kokol, et al, 2020; Grossard, et al, 2017; Wouters, et al, 2013). These serious games aim to teach social interactions and emotions to autistic people. However, there is a lack of such role-playing games in the market to help teach people without autism the necessary communication skills to interact effectively with autistic people.

3. DESIGNS AND DEVELOPMENTS

In this research, we aim to design and create a mobile serious role-playing game that encourages and enables everyone to (i.) learn and understand the behaviors of autistic people; (ii.) improve their communication skills to interact with them; and (iii.) be able to easily access the training using mobile devices, such as smartphones, tablets, iPads, etc.

3.1 Skill Acquisition Goals

In the current version of the game, we focus on helping the learner to acquire two important skills when interacting with autistic people:

- using direct, action-based communications.
- dealing with the nonverbal behaviors that could potentially interfere with the ongoing conversation.



Figure 1. Alice with ASD

3.2 Enabling Technologies

In this section, we will discuss the related technologies that help enable effective and efficient virtual role-playing.

3.2.1 High-Fidelity Virtual Character

Particularly, we investigate the level of hologram fidelity required to facilitate a smooth integration of Alice, the virtual character with ASD as shown in Fig.1, in a real-world setup to simulate a realistic encounter between the learner and Alice. The High-fidelity hologram may lead to a better perception of the virtual character in a static mode but at the cost of high computation that may produce potentially prohibitively long delays and result in degraded perception in a dynamic mode where contents need to be constantly updated on a mobile device. A particular adaptation effort is made to find the right balance to maximize the usability of these devices.

3.2.2 Embedded Virtual Expert to Guide and Review the Role-Plays

As pointed out by Zheng et al. (2021), serious games may improve social skills when used alongside in-person discussion. Serious role-playing games create a complex learning situation that warrants instructional support to facilitate experiential learning. Thus, serious games need to be used in tandem with instruction, play, review, discussion, and debriefing to help learners achieve the learning outcomes (Eng, 2021).

In this research, we have designed, created, and embedded Dr. Erika Parker, a virtual expert instructor, into the game flow. Figure 2 illustrates a review and discussion session led by the expert instructor to help the learner understand the difference between indirect speech and direct speech; moreover, how to convert an indirect speech statement to its corresponding direct speech statement. Such review, discussion, and guidance are made available through the entire training to help enhance the cognitive learning process on top of the experiential learning provided by the role-plays. The learner has the option to request more examples and discussion if needed. Therefore, it provides a comprehensive tool that enables the users with totally independent learning.

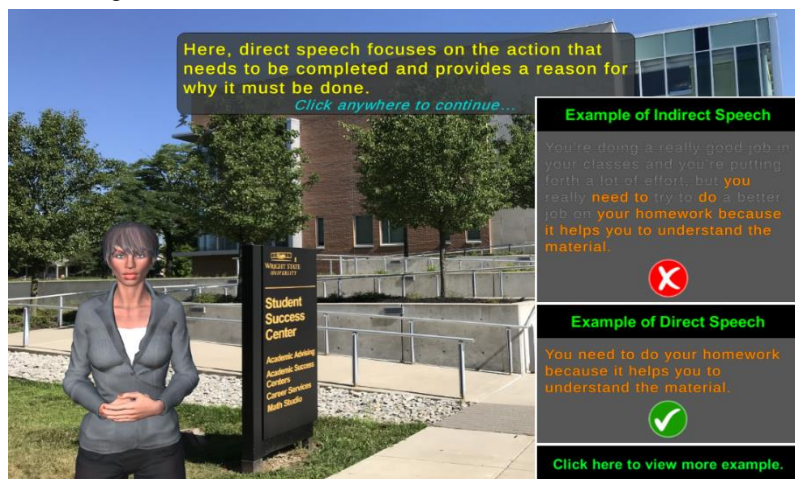


Figure 2. Prof. Erika Parker, the Embedded Virtual Expert, Provides Case Reviews via a Virtual Whiteboard

3.2.3 Mobile Game available for both iOS and Android Devices

A learner can download this serious role-playing app from the App Store (iOS) or Google Play (Android). The simulation can be completed at any time or place on a tablet or smartphone. These mobile devices, when coupled with the cloud provided services, provide multi-modal capabilities in addition to hologram visuals, such as voice, video, text, speech recognition, eye/gaze/attention tracking, or gestures to support multi-modal learning contents and interactions and multimodal assessments to maximize the learning outcomes. Therefore, it makes it significantly easier to access when compared to other delivery methods, such as VR goggles, laptop/desktop computers, etc. Thus, we believe it will make it easier for people without Autism to access resources and help that is required to learn how to communicate with autistic people.

3.3 Script Design for the Role Plays

We worked with the subject expert Heather M. Rando of the Raiders on the Autism Spectrum Excelling (RASE) program at Wright State University, to construct the script used in the training interaction. The role-play sessions were built to emulate the face-to-face setting of the student coach training sessions of the RASE program. In the role-playing setting, our virtual standardized patient, Alice, takes the role of a college student on the Autism Spectrum. Meanwhile, the user takes the role of one of the resident advisors. The game focuses on guiding the player through getting to know Alice while addressing behavior she might exhibit.

This role-play session emulates what might take place on the first RASE advising session. Before starting development on our role-playing game, a story board of events is created. The story board served to roughly visualize each possible route the player could take as shown in Figure 3. Additionally, this is the stage where we constructed the narrative we used throughout our development.

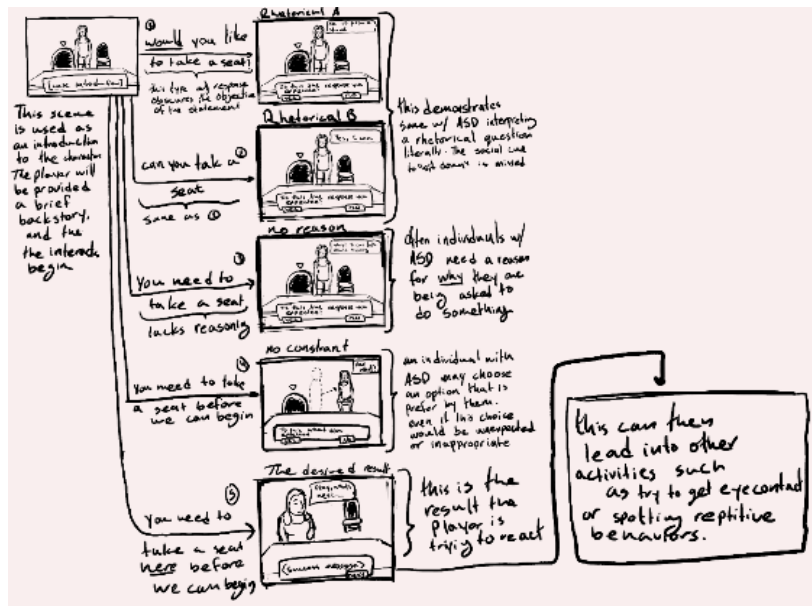


Figure 3. Hand-drawn story board

The script included the following key points:

- The possible choices the player can make.
- The various way our virtual standardized patient would respond to the user's action.
- The virtual expert's feedback on each choice.

3.4 Development Tools

A multitude of tools were used for building both the virtual characters and scenes. One such tool was Reallussion's Character Creator. Character Creator enables the rapid creation of realistic human characters. One can customize a character's clothes, hair, and physical features through its drag-and-drop menus, value sliders, and guided sculpting tools. These features allow for creating content rapidly.

The next tool used was Reallussion's iClone7. iClone7 is a powerful tool for animating characters created from Character Creator. Additionally, it provides tools for creating lip sync animations for dialogue. Moreover, iClone7 can automatically generate lip keyframes from audio. However, they still require manual touch ups before they appears more realistic.

Finally, Unity3D is used to tie everything together. It is the game engine that powers our application. It is used to script scenes, build environments, access the device microphone, and to render the virtual scene.

4. DEMO AND RESULTS

We have designed, created, and released a serious role-playing game that demonstrates the feasibility and robustness of such a mobile computing enabled independent learning/training solution. The following demo results in present samples and offers validations for our design.

4.1 Preview of the Game

When starting the application, the user will be welcomed by Prof. Erika Parker, the virtual expert instructor as shown in Fig. 4, who will guide and facilitate the entire training as the instructor of the contents, the reviewer of the plays, and the facilitator of the discussions. It is followed by the introduction of the learning objectives of this serious role-playing game. Then Alice, the standardized client with ASD and an 18 years old new college freshman, is introduced as shown in Figure 5.



Figure 4. The expert instructor - Prof. Erika Parker



Figure 5. Introduction of Alice

4.2 Direct, Action-based Communication

In this part of the game, the learner is taking the role of a college resident assistant who will meet with Alice in the office as shown in Figure 6. Scripted role-plays, as shown in Figure 7, are particularly designed and adopted to create a rich learning experience on how to communicate effectively in direct and action-based communication when interacting with autistic people. The learner can try different communication styles/options and then observe the corresponding response of Alice, thus supporting the cognitive learning process of the learner. To further enhance the learning, Prof. Erika Parker will provide an immediate review of the plays and facilitate the focused discussion on the communication strategy. Further roleplays may follow if needed based on the learner's performance and progress as shown in Figures 8 and 9.

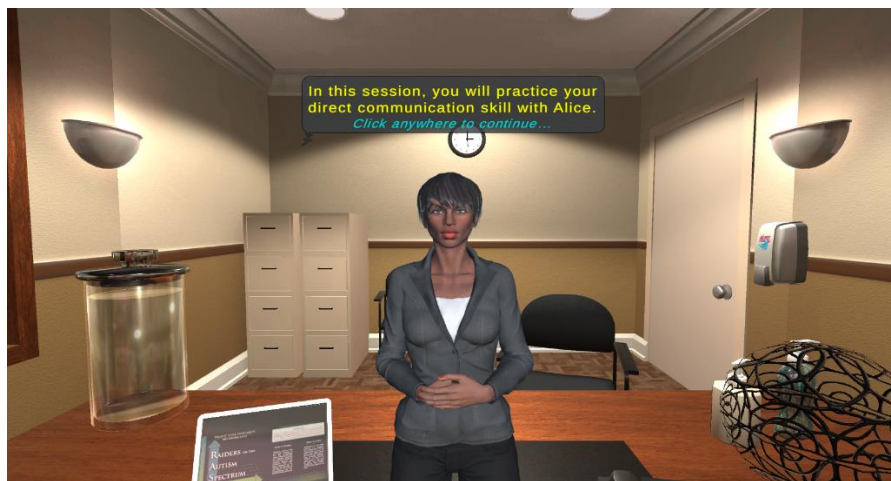


Figure 6. Direct Communication Training Module

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Figure 7. Scripted Direct Communication Role-Plays



Figure 8. Sample Role-Plays and Reviews in the Direct Communication Module

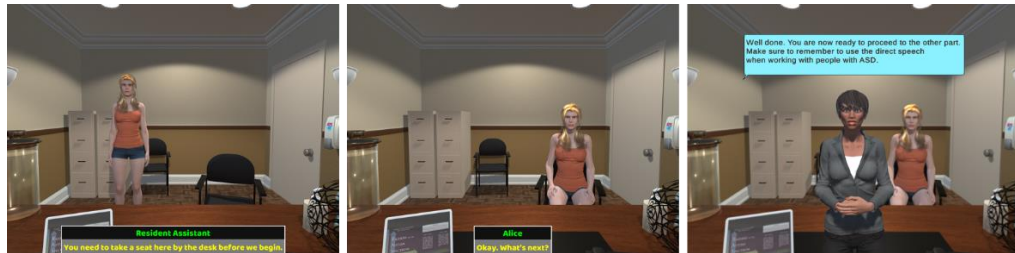


Figure 9. Sample Role-Plays and Reviews in the Direct Communication Module

4.3 Dealing with Nonverbal Interfering Behaviors during Conversation

In this part of the game, the learner is again taking the role of a college resident assistant who will meet with Alice in the office as shown in Fig. 10. The game takes full advantage of the graphical capabilities of a mobile device to provide the high-fidelity presentation of a range of subtle Nonverbal Interfering Behaviors for the role-plays. Scripted role-plays, as shown in Fig. 11, are designed to practice how to deal effectively with such Nonverbal Interfering Behaviors

in order to ensure a smooth and engaging conversation. The learner can try different intervention options and then observe the corresponding response of Alice. Prof. Erika Parker will provide an immediate review of the plays and a focused discussion on the intervention strategy. Further roleplays may follow if needed based on the learner's performance and progress as shown in Figures 12 and 13.

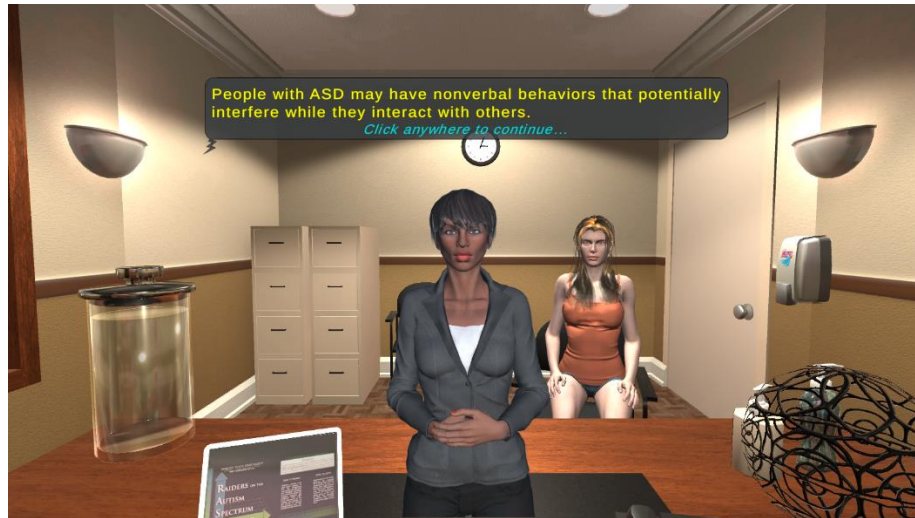


Figure 10. Nonverbal Interfering Behaviors Training Module

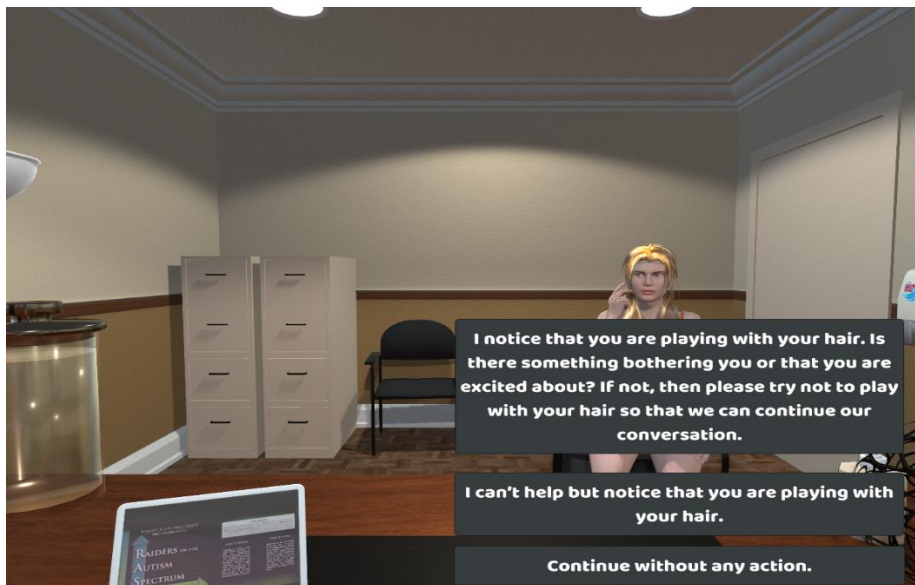


Figure 11. Scripted Nonverbal Interfering Behaviors Role-Plays

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Figure 12. Sample Role-Plays and Reviews in the Nonverbal Interfering Behaviors Module



Figure 13. Sample Role-Plays and Reviews in the Nonverbal Interfering Behaviors Module

5. CONCLUSION

An effective and practical solution that helps people to independently learn and practice with ease on how to communicate effectively with autistic people will significantly improve learning efficiency and outcome, and more importantly, help spread the awareness of autism and encourage more people to understand, engage and interact effectively with them. In this research, we have successfully designed and developed a mobile serious role-playing game as a learning tool that harnesses the latest advances in mobile computing, serious game, virtual reality, and human-computer teaming. It resembles a comprehensive expert-guided experiential and cognitive learning process consisting of instruction, play, review, and discussion that help achieve enhanced learning outcomes via an independent-learning workflow. The release of the game for both iOS and Android devices further expands the potential reach of this learning tool and helps spread the awareness of autism and help create an inclusive environment at schools, universities, and communities.

6. FUTURE WORKS

In the current version of this serious role-playing game, while the virtual characters: Prof. Erika Parker and Alice would speak to the user, the user can hear the voice or read the captions, but is limited to respond through a list of scripted dialogue buttons. When a button was pressed, the character representing the player would speak a pre-recorded line of dialogue as shown in Figures 6–8 of Section 4.2.

Figure 6 shows the player receiving instructions from the virtual expert Prof. Erika Parker who provides the user information about the current role-play session. Figure 7 then shows the options the player can pick to communicate to Alice. Finally, Figure 8 (left) shows the caption of the dialogue spoken by the player's character. This dialogue however is not spoken by the player. This created an asymmetric interaction. While the character would speak to each other, the players may feel being left out of participating in the actual conversation as their part of the dialogue is spoken for them. Therefore, future works may consider the use of AR and AI capabilities to provide richer multimodal content, interaction and assessment.

Furthermore, a trial study may also be warranted to establish a comprehensive understating of how such serious role-play games can help people improve communication with autistic people.

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