In Proceedings of the Workshop on Graphical and Robotic Embodied Agents for Therapeutic Systems (GREATS16)
at the 16th International Conference on Intelligent Virtual Agents, Los Angeles, September 2016

Virtual Training for Discrete Trial Trainers

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Abstract. It is important that teaching methods are implemented correctly for children with autism. An interesting alternative to a typical training environment is virtual training. An important aspect of proper training is to provide the trainees with the opportunity to practice their teaching skills while receiving feedback from a supervisor. Unfortunately, due to lack of resources, it is not always possible to provide trainees with these opportunities. An interesting training alternative is to provide hands on opportunities using a virtual reality (VR) setting. With affordable VR technology, a simple training setup allowing the trainee to interact with a virtual child is viable. The aim of the present work is to set up a virtual environment to train a special education teacher in applying a teaching method called discrete trial training. This is work in progress, where the first phase of the project focuses on supporting the method itself and a basic interaction with the virtual child. A comparison between the virtual and real training environments is planned in the future.

1 Introduction and Motivation

Behavior analysis based methods have proven successful for enhancing learning opportunities, improving skills, and decreasing challenging behavior in children with autism [4, 11]. Such methods however, need to be correctly implemented. Otherwise the risk of less progress and lower skill acquisition rates will increase [8]. It is therefore critical to properly train those individuals responsible for teaching and enhancing skills of children with autism [12].

An important aspect of proper training is to provide the trainees with the opportunity to practice their teaching skills while receiving feedback from a supervisor. Unfortunately, due to lack of resources, it is not always possible to provide trainees with these opportunities [12]. For example, a proper clinic might not be a part of a university setting, making practical training difficult for university students. An interesting training alternative is to provide hands on opportunities using a virtual reality (VR) setting. With affordable VR technology, a simple training setup allowing the trainee to interact with a virtual child is viable. Such a training environment however, needs to be further tested and compared against a real training environment.

The aim of the present work is to set up a virtual environment to train a special education teacher in applying a teaching method called discrete trial training. This is work in progress, where the first phase of the project focuses on supporting the method itself and a basic interaction with the virtual child. A comparison between the virtual and real training environments is planned in the future.

2 Related Work

2.1 Discrete Trial Training

Since children with autism often have a difficult time learning skills from observation or modeling, they require a more restrictive learning environment [13]. Researchers have examined different methods with the goal of enhancing learning opportunities for children with autism. One method, discrete trial training (DTT) has been studied extensively and is incorporated into many early intervention programs for children diagnosed with autism [12, 13]. DTT is characterized by highly structured teaching settings where skills are broken down into smaller units with multiple learning opportunities in a brief period of time [4, 3].

The main components of DTT are that first the teacher delivers a clear instruction, called a cue or discriminative stimulus, second, the child responds (either a correct or an incorrect response), and third, the teacher delivers an appropriate consequence. Throughout the teaching sessions the teacher delivers prompts. These prompts are then systematically faded out until the student is independent in the skill that is being taught. Data is collected and the child's progress is monitored throughout the sessions [13].

An example of skills taught in a DTT format is matching and discrimination skills, such as matching the word "car" to a picture of a car, or discriminating between different community helpers. These skills are important since they are prerequisites for many cognitive, communication, social, academic, work, and self-care skills.

2.2 Virtual Agents for Specialist Training

Ever since the virtual agent STEVE helped trainees grasp shipboard procedures in a virtual reality ship simulation [6], virtual pedagogical agents have proven their worth in a range of disciplines [5]. While effective as tutors, virtual agents have also taken on other roles in virtual learning environments to enhance training. For example, virtual patients have been around for awhile to help medical students practice various medical procedures, including diagnosis.

However, only with recent advances in embodied conversational agents [2], have these patients become fully interactive, supporting face-to-face conversations about their symptoms and feelings [9]. This increased social and psychological capacity has even produced virtual patients with psychological disorders, such as PTSD, for therapist training [7].

Virtual children have also been created as pedagogical play mates or learning-peers [1, 10], which in particular have shown potential as intervention for children with autism [14]. However, virtual children to train special education teachers in applying certain teaching methods have, to our knowledge, not yet been built and studied.

3 Approach and Implementation

In aiming for maximum transfer of skills to a real world setting, the virtual setting and the procedures trained are kept very close to the authentic source material. This includes immersing the trainee (the user) in the training environment using fully tracked VR [1].

The trainee sits at a virtual table, in front of a virtual child, who is their student. There are three objects on the table, placed on the trainee's left (see Fig. 1). Although it is possible to include more objects in training it is not relevant for the purpose of this project. Rewards, in the form of star stickers, and a data sheet (a form) are placed on their right. Some of the basic information about the child and their previous sessions have already been filled into the form. The trainee is meant to base the current teaching session on this information.

There are ten trials in one session. At the beginning of each trial the trainee places the three objects in a row in front of the child (objects A, B and C). In the first trial the objects should be arranged with A on the trainee's left, then B, in the middle, and C on the trainee's right. A target stimulus is an object that the child is supposed to correctly identify in each trial. Let's say the target stimulus for the first trial is object A. After the child has tried to identify A (see below), the second trial starts by removing all the objects from the table and rearranging them. The order is now C, A, B and B is the target stimulus. The rotation is repeated before each new trial. After each trial, the object on the far right is placed on the far left, while the other objects are moved one spot to the right.

The trainee begins the trial by making eye contact with the child, vocalizing the name of the target stimulus and pointing at the appropriate object. The virtual child responds by pointing at one of the objects (see Fig. 2). It is then up to the trainee to decide if the child's response was correct, in which case they should reinforce the behavior and log the information onto the data sheet accordingly. If the child's response is not correct then the trainee should remove all objects, placing them to the side, at their original position. Next the trainee should place the objects in front of the child again, in the same order as before their removal. This time the trainee should help the child point at the correct stimulus, taking their hand (selecting the hand) and leading it to the correct stimulus (selecting the stimulus). Now the response is correct and the behavior should be reinforced by giving the child a star sticker. If the trainee does not

[1] We are currently using the full release version of Oculus Rift (CV1) with the Unity game engine. We will incorporate Oculus Touch as soon as it becomes available, now we are using a 2D mouse to manipulate objects and select things.

Fig. 1. The beginning of a new trial: The trainee Sits across from the child, with three objects on one side (cards with pictures of a cat, a dog and a sheep), and on the other a data sheet to enter the results of each trial and a star sticker to give as a reward.

Fig. 2. The child points at the "cat" card during a trial, just after the trainee has provided the verbal prompt "A cat".

follow the proper procedure, there is an opportunity to present feedback through text, audio and highlighted objects (this is still under development).

The level of difficulty is configurable. There are four levels. At the first level the child needs to be manually guided by the trainee, but answers correctly every time the trainee's guidance is correctly executed. At the second level the trainee has to point at the target object to demonstrate the correct response (this is currently implemented by pressing a hand icon, see Fig. 2 above). The child will then answer correctly. At the third level the child is independent and only needs a verbal prompt to answer correctly (the verbal prompt currently implemented by pressing speech-bubbles, see Fig. 2 above). At level four the child no longer answers correctly. The trainee then has to log the errors accordingly. This level practices the procedure following a single or multiple wrong answers.

A particularly interesting aspect of the simulation is the precise control of the virtual child's behavior. While verbal interaction will be kept to a minimum in the early phase of the project, to avoid relying on relatively poor speech recognition for Icelandic, we plan to model a range of nonverbal behavior that covers typical situations. This includes different levels of attentiveness and cooperation.

4 Conclusion and Future Work

This is work in progress, and the screen-shots show an early prototype (see Fig. 1 and Fig. 2). Once the full training procedure is supported, testing will begin. First usability testing will be conducted to evaluate the quality of user experience in the virtual environment and identify potential problems with the interface itself. After the interface issues have been ironed out, user testing will be conducted to examine how well the virtual environment prepares a trainee for implementing DTT in a natural setting. This will be done by having a trainee rehearse the DTT method in the virtual reality environment and then implement the technique with another person. In addition, a comparison will be made between the virtual environment and different training procedures that are typically used in the special education field.

Data-gathering will involve recording the trainees' actions during the training. The trainees' actions could be subdivided into logging, the arrangement of objects, prompting, reinforcement, correct responses and incorrect responses. The data-gathering will be identical for both virtual and real-life training. The trainees' performance can then easily be evaluated and compared according to these categories.

There are many benefits of using a virtual training environment. One benefit is that with the virtual training environment there is no real danger when the trainee makes errors during the training. The system, as well as a human supervisor if present, can make sure that the trainees receive feedback after making errors without it impacting the child's progress. Another benefit of a virtual environment is the fact that it provides a more controlled environment than a real-world setting. With a controlled environment it is possible to manipulate the difficulty level for each individual by systematically increasing or decreasing the level of difficulty of training based on individual performance.

It is important that researchers continue to examine different ways in which virtual reality environments can be used when training teachers of children with special needs. Research should also be done on seeing how those same environments, for teacher training, could be used to directly benefit the children themselves, to supplement their learning.

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