

Toon-Chat: A Cartoon-Masked Chat System for Children with Autism*

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ABSTRACT

Children with Autism Spectrum Disorder (ASD) have social communication difficulties partly due to unusual visual processing strategy on human faces. However, their strategies are similar on cartoon faces as normal children. In this paper, we present Toon-Chat, a video chat system with virtual cartoon masks to help ASD children enhance communication and emotion comprehension skills. The system is tested in a series of ABA training lessons and the results are promising.

CCS CONCEPTS

- **Human-centered computing** → Mixed / augmented reality;
- **Social and professional topics** → *People with disabilities*;
- **Applied computing** → Computer-assisted instruction;

KEYWORDS

ASD, Video tracking, Facial performance, Augmented reality

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1 INTRODUCTION

Children with Autism Spectrum Disorder (ASD) have defects in concentration on human faces and perception of facial emotions which leads to negative effects on their social communication development [Rasche and Qian 2012]. Their difficulties in social interactions are partly due to unusual visual processing strategy on human face, although they have a similar strategy on cartoon faces with normal children. Prior research has shown promising results that cartoon characters [Rosset et al. 2008] and video chat systems [Mokashi et al. 2013] are beneficial to promote the study abilities and communication skills to children with ASD. In our research, we present Toon-Chat, an ASD training system with real-time video transformation from dynamic cartoon face to human face. Children with ASD can choose their favorite cartoon characters and talk with them in the screen, which are actually performed by their teachers on the other side. During training lessons, the cartoon mask on teacher's face fades out gradually and children with ASD will face their teachers without masks finally. The system was introduced in the form of a specific training lesson to an ASD training school.

2 TECHNOLOGY

Toon-Chat is a real-time video chat system based on video tracking and facial recognition. Arrays of points from the facial organs of the performer (eyebrows, eye balls, nose and lips as well as face shapes) can be extracted with Face++ API. We select 45 landmark points from the detected 83 key points on human face, and map them to corresponding points on faces of cartoon characters (Figure 1a). Landmark points on cartoon faces are set and adjusted manually in advance for the best expression. With different emotion expressions, facial movements of detected landmark points drive corresponding points on cartoon face synchronously. This dynamic cartoon face is covered onto performer's face in the screen as a cartoon mask, as is shown in Figure 1b.

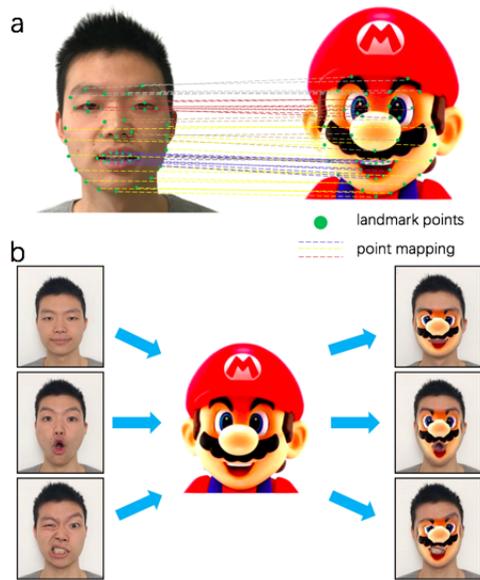


Figure 1: Landmark points mapping from performer's face to cartoon face help performers to express exaggerated emotions.

3 METHODS

Our system is running in multiple sessions. First, an autistic child and his/her teacher sit in front of a screen respectively in the same room. The child chooses a favorite character from a list of cartoon faces. Then system starts to trace teacher's face, extract landmark points and generate a cartoon face. On autistic child's screen, the cartoon face is covered over teacher's face as a mask. The autistic child could then interact and even play games with his teacher with specified cartoon mask. With the pleasant conversations going on, the cartoon mask on teacher's face fades out gradually and smoothly in several minutes without breaking the training interaction. Certainly, the time when the mask should disappear is up to the teacher. At the end, the child will face a real human face in the last several minutes of the conversation (Figure 2).

4 FIRST RESULTS AND OBSERVATION

We randomly invited 10 autistic children and their instructors from an autism school to participate in a 20-minute one-to-one training test by using our system. Training tasks include language conversation, hand-eye coordination, response to requirement, and emotional perception. They were conducted in the form of ABA (Figure 3).

We observed that 3 children with ASD could complete the dialogue on time without using our system. For the rest children, degree of task completion rises from average 35% to average 68%. And two of them could finish all tasks successfully with the system turning on. More interestingly, Feedback from teachers indicates that whether the children could complete tasks or not, their concentrations, willingness to participate and frequency of eye contact have been increased in varying degree with the assistance of Toon-Chat, even after the cartoon mask fades out. Results suggested our



Figure 2: A training lesson with Toon-Chat.



Figure 3: Toon-Chat in training lessons helps teacher communicate with children with autism.

system is a relatively effective approach in encouraging children with ASD to be more concentrated to observe and understand more emotional information from others.

5 FUTURE WORK

Considering screen as an obstruction in communication, we plan to cancel it in the future. Tangible masks might be better options for a face-to-face communication.

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