# Designing Virtual Peers for Assessment and Intervention for Children with Autism

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## Abstract

Our research focuses on the use and design of virtual peers (life-sized, computer-animated children) as intervention and assessment tools for the social and communication skills of children with social skills deficits, such as autism. To best design a virtual peer that simulates human interaction, we observe and analyze the behaviors of both typically-developing children and children with autism as they play with peers. Later, we apply these behavioral characteristics to the behavioral repertoire of the virtual peers. This analysis identifies the key design attributes of a virtual peer that best elicits the social and communication skills we are interested in evaluating and addressing during the assessment and treatment procedures.

## Keywords

Autism, virtual peers, intervention, assessment

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

Social competency is of critical importance in both present functioning and future development of a child. For some children, peer interactions are extremely

difficult to handle, and sometimes even impossible without supportive intervention. However, to provide an effective intervention, a child must first be identified and then get a specific assessment of his or her interaction skills with peers. Only then can a treatment be tailored to the needs of each child.

In the following sections, we describe some of the methods currently used to assess social and communication deficits and present an innovative approach using virtual peers (VPs) to address the need for specific skills assessment of peer interaction.

## Background

Autism is a developmental disorder characterized by three core features: impairments in communication, impairments in social interaction and restricted and repetitive behaviors and interests [1]. Children with High Functioning Autism (HFA) represent the less severe end of the spectrum. These children function within the average range of IQ and they do not have severe language deficits that often characterize ASD. Still, their communication and engagement with peers are in most part maladaptive. By elementary school age, many children with HFA attend mainstream educational systems and are expected to respond to and initiate social interactions with typically-developing (TD) children. To support such expectations, several social skills interventions have been developed. Some teach social skills using structured learning techniques with a therapist, video modeling techniques [5], and TD peers to model or scaffold behaviors for children with autism [4].

However, several limitations exist with these methods. First, TD children are not always available and willing to interact with children with autism. Second, once TD children become mentors, their behaviors are not natural anymore, and they become "small adults" rather than typical peers. Additionally, research show that the skills are not transferred to interactions with other children.

Furthermore, weak treatment effects of many social skills programs may be the result of assessment tools that fail to match identified skills deficits with treatment objectives [3]. In fact, effective interventions require an accurate assessment of a child's social and communication skills so that each intervention can be highly tailored toward the deficits of each individual [6].

Currently, questionnaires are a widely used method to evaluate social skills [6]. Although questionnaires have the advantage of gathering a lot of information inexpensively, a direct observation of skills is needed for intervention planning. Naturalistic observations, functional analysis of behaviors in a natural setting, address this need. However, they require training and multiple observations and therefore are extremely time-consuming. Thus analogous observations, structured observations designed to elicit target behaviors, are often used. Unfortunately, to use this technique for the assessment of peer interaction (using actual peers), children must comply with the planned experiment. In addition using children for assessment decreases the standardization of the assessment procedure. Therefore, there is a need for assessment which relies on observable behaviors, targets social skills with peers, and is less time-consuming [4].

## Virtual Peers: Assessment and Intervention

Our research hypothesizes that VPs can be used in both interventions and assessments to address the limitations presented above. For assessment, we are designing activities that use multiple VPs to simulate group interaction. The activities are designed to elicit social behaviors such as joining a game or maintaining an interaction so that these skills can be evaluated. For intervention, we are creating new tools to allow practice of skills needed in a peer interaction context. We are also developing a learning platform for reasoning about interacting these skills into appropriate contexts. We believe that by creating tools that enable children to control the behaviors of the VP while it interacts with another person we can achieve this goal.

The VP currently in use in our research studies, (Figure 1), can initiate stories, give backchannel feedback, respond to a child's input, and use nonverbal behaviors to show attention and encourage continued interaction. In previous research with TD children, literacy and social skills significantly increased after storytelling interactions with the VP [2]. For our current purposes we need to expand the VPs' abilities. The challenge is to build a more elaborate behavioral model for the VP. More specifically, we need to simulate group peer activity and build procedures that elicit reciprocal interactions.

## Research Methods

To achieve these goals. we observe children with ASD as well as of TD children, in a range of social contexts. We use these observations to simulate behaviors in VPs. An ongoing process of observation, evaluation, refining and redesigning characterizes our work. Presently, we are conducting two studies.
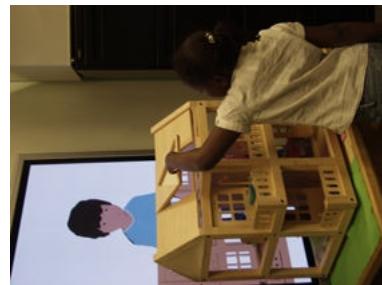
In one study, we observe TD children's free play in a group setting. Our goals for these observations are: (1) design new group activities for the VPs by identifying the activities and games that elicit the most reciprocal interactions among peers; (2) identify and simulate reciprocal behaviors characterizing these group activities; (3) deconstruct the social skills measures used in questionnaires into specific observable units of reciprocal social interactions.

In the second study, we observe behaviors of two groups, TD children and children with autism, in a semi-structured setting. Each group tells stories with a TD peer and a VP. After interacting with the VP, we directly ask children for feedback about the VP activity – how old the VP seems, whether or not it is enjoyable, and what they liked and disliked about it. Data is analyzed both quantitatively and qualitatively for narrative content, turn-taking behaviors, and topic management.

This 2x2 design (children with ASD v TD children; VP v TD peer) allows us to make several comparisons that contribute to the design of VPs:: (1) examine where children with autism differ most from TD children in this task so that we can target our intervention; (2) reveal skills children with ASD may use with the VP and are not using in interaction with their peers that can be scaffolded in an intervention; and (3) evaluate our behavior model of the VPs by identifying behaviors exhibited by TD children that the VP is lacking.

## Impact for Assessment & Intervention

Our current results suggest that children with autism approach activities with the VP with excitement and that their ability to contribute appropriately to the



Figure 1: Child interacting with a virtual peer.

conversation may improve over the course of the interaction [7]. These results certainly suggest that VPs may be useful as an effective intervention for children with autism, and improving their design to help advance skill generalization is extremely valuable.

VPs have not yet been used to assess the social and communication skills of children with developmental disabilities. VPs may address some of the complexities presented by current assessments because they are easy to control, consistent, and readily available. Thus, VPs may positively impact the effectiveness and accuracy of interventions and assessments available to children with developmental disorders like autism.

## Acknowledgements

## References

[1] APA *DSM-IV Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association, Washington DC, 1994.

[2] Cassell, J. Towards a Model of Technology and Literacy Development: Story Listening Systems. *Journal of Applied Developmental Psychology, 25* (1). 75-105.

[3] Gresham, F.M., Sugai, G. and Horner, R.H. Interpreting Outcomes of Social Skills Training for Students with High-Incidence Disabilities. *Exceptional Children, 67* (3). 331.

[4] Kalyva, E. and Avramidis, E. Improving Communication Between Children with Autism and Their Peers Through the 'Circle of Friends': A Small-scale Intervention Study. *Journal of Applied Research in Intellectual Disabilities, 18* (3). 253.

[5] LeBlanc, L.A., Coates, A.M., Daneshvar, S., Charlop-Christy, M.H., Morris, C. and Lancaster, B.M. Using Video Modeling and Reinforcement to Teach Perspective-Taking Skills to Children with Autism. *Journal of Applied Behavior Analysis, 36* (2). 253-257.

[6] Merrell, K.W. Assessment of Children's Social Skills: Recent Developments, Best Practices, and New Directions. *Exceptionality, 9* (1&2). 3-18.

[7] Tartaro, A. and Cassell, J., Playing with Virtual Peers: Bootstrapping Contingent Discourse in Children with Autism. in *International Conference of the Learning Sciences*, (Utrecht, the Netherlands, 2008), ACM Press.