Children with Autism and Technologies for Play

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Abstract
Play is fundamental to child development and particularly challenging area for many children with autism. Technology can be used to mediate and support play in children with autism, potentially enhancing both immediate quality of life and long-term developmental trajectories. However, to meet the full potential of technologies for play, we must go beyond this traditional therapeutic view of assistive and health technologies, often called the medical model, to embrace the full cultural, social and environmental experiences of autism.

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Introduction
Play, although not exclusive to childhood, has an important role in how a child develops – including socialization [24]. For children with autism[1], play often

[1] The term *autism* will be used throughout this paper to denote Autism Spectrum Disorder as well as Asperger's Syndrome as previously defined before the DSM-V changes [1].

does not follow norms and can be challenging [11], particularly with typically developing peers [10]. Technology can help encourage and mediate collaborative play, serving as both a site of intervention and as an intervention itself. In this role, technology can serve many functions including: mediating communication, augmenting the environment (physical or virtual), and structuring a narrative or game.

Background

The importance of play to child development cannot be underestimated. Children learn about the world, test boundaries, and try out new identity roles through play [24]. Additionally, they practice and develop their social skills through social play, testing social rules and trying out social roles [7]. To put it simply, successful play sessions lead to positive child development trajectories and happy, healthy adults [7].

Challenges in the development of social skills and communication can lead to difficulties in social play for children with autism [1,10], leading to further challenges as the children age [10]. In particular, children with autism struggle most often with symbolic (*i.e.,* pretend) play than other children [11]. To be clear, children with autism want and are able to play, but often play differently than other children.

Recognizing these difficulties, work has been conducted in the area of teaching children with autism how to engage in social play. These include peer-play training with models [9], using Integrated Play Groups [26], and adult-child interventions [2]. Strain and Schwartz demonstrate that social play cannot be taught with a discrete skillset because it is a highly contextual experience [21]. This has led to a need to mediate the play experience, rather than teach children how to play. However, some therapies still teach specific social skills (*e.g.,* eye contact, joint attention), which may then be reflected on and practiced during social play [2]. Structured play environments enable therapists to provide directed play, providing cues and positive feedback to children with autism.

These approaches largely rely on a "medical model" of autism in which different play and socialization tends to be seen as deficient play and socialization (*e.g.,* [22,27]) requiring behavior modification or training (*e.g.,* [9,23,27]). Although this approach has led to some substantial advances and can be used successfully in technology design (e.g., [12,25]) (even in our own work, *e.g.,* [20]), it does not tell the whole story.

More recently, there has been an interest in stepping away from the medical model as a lens for studying play in children with autism [13]. Studies have been published exploring play as it is, not as it "ought to be" [5]. Likewise, assistive technology can follow this trend, shifting the focus onto assisting current activities rather than correcting or training for future activities. This technology then goes beyond being "assistive" in its many functions.

There are many options for technology to help mediate and support play in children with autism, and this paper is by no means meant to be comprehensive in its review. In the following sections, however, we describe some technologies that are already being used in collaborative play for children with autism as exemplars of an effort to meet children with autism where they are and understanding their versions of socialization

and of play. Each platform provides different functionality and possibilities for expanding the support of collaborative play. By better understanding and developing technologies in support of autistic play, we may be able to gain the developmental outcomes we want without attempting to fit a child with autism into a typically developing child's mold.

Virtual Worlds

Virtual worlds, such as Second Life [8] or Minecraft [18], can be play-mediators for individuals with autism. For example, each virtual world supports communication directly and often has a surrounding communication ecology to further mediate socialization and play [19]. For example, in Minecraft, users can send text through a chat window or install third party modifications to communicate via voice. The avatars in Minecraft, on the other hand, are far less expressive than those found in other virtual worlds – a user can still express themselves through their actions but cannot emote as in Second Life or World of Warcraft. In having multiple options for communication, users are able to use what is comfortable for them.

Collocated Multiplayer Games

Games that are played cooperatively in-person can also help foster and mediate collaborative play [4,17]. Cooperative games on tablets, given their small form factor welcomes users to share a goal, its rewards, and physical space [4]. These games have the opportunity to be fun while acting as a mediator for individuals who want to play together. This allows for those who are uncomfortable with face-to-face interactions to play together in the same space and to socialize without the burden of typical social norms (*e.g.,* eye contact) [14]. The use of cooperative gestures provides more natural play as the system supports a variety of ways to play, without the presence of adults providing prompts.

Whole-Body Interaction

Whole-body interaction has been explored as a means of self-expression (*e.g.,* [16]) as well as augmenting more traditional therapies (*e.g.,* [20]). As in multiplayer games that use a computer or tablet as a mediator, games that require whole-body interactions allow for a different means of communication among game players. In this, players can use their entire bodies not only to play the game, but also communicate to others their intentions and feelings. During interviews, children who played with the SensoryPaint system expressed the desire to make the system multiplayer in order to play with others [20]. Whole-body platforms also have the advantage of invoking a multisensory experience. SensoryPaint and BendableSound both use a variety of tactile, visual, and auditory stimuli to complete the experience for the players [15,20].

Wearables

Wearables have the potential to offer users exploration of their self and context about the environment, providing independence from medical providers in the monitoring of their own behavior during play. This is only possible through careful consideration of the wearer's desires and preferences in what behavior is tracked. Boyd *et al.* [3] designed a system on Google Glass that provides real time awareness of atypical prosody (*i.e.,* tone of voice) and a few adults with autism indicated they would be interested in alerts about the other people in their environment. By supporting both within persons needs and environment context [6], flexible designs can be developed.

Conclusion

Technology allows us many interaction styles, such as virtual worlds, collocated multiplayer games, whole-body, and even wearable devices. Each of these platforms offers different functionality and varying levels of support for users. Children with autism, who have a whole spectrum of varying, ever-changing needs [1], now have choice when it comes to the technology they use to help them engage with the world. Let this paper serve as a call to researchers and designers to think beyond technology as an assistive technology for children with autism, but rather as technology enabling preferred modes of communication, interaction, and even play with their peers.

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References

1. American Psychiatric Association. 2013. *Diagnostic and Statistical Manual of Mental Disorders*.
2. Michael Arthur, Sandra Bochner, and Nancy Butterfield. 1999. Enhancing Peer Interactions Within the Context of Play. *International Journal of Disability, Development and Education* 46, 3: 367–381. http://doi.org/10.1080/103491299100551
3. LouAnne E. Boyd, Alejandro Rangel, Helen Tomimbang, et al. 2016. SayWAT: Augmenting Face-to-Face Conversations for Adults with Autism. ACM. *Proceedings of ACM CHI Conference on Human Factors in Computing Systems 2016. To Appear.*
4. LouAnne E. Boyd, Kathryn E. Ringland, Oliver L. Haimson, Helen Fernandez, Maria Bistarkey, and Gillian R. Hayes. 2015. Evaluating a Collaborative iPad Game's Impact on Social Relationships for Children with Autism Spectrum Disorder. *ACM Transactions on Accessible Computing* 7, 1: 1–18. http://doi.org/10.1145/2751564
5. Susan Douglas and Lesley Stirling (eds.). 2016. *Children's Play, Pretense, and Story: Studies in Culture, Context, and Autism Spectrum Disorder*. Routledge, New York.
6. Christopher Fraunberger, Judith Good, and Narcís Parés. 2016. Autism and Technology: Beyond Assistance & Intervention.
7. Catherine Garvey. 1990. *Play*. Harvard University Press, Cambridge, MA.

8. Lilly C. Irani, Gillian R. Hayes, and Paul Dourish. 2008. Situated practices of looking: visual practice in an online world. *Proceedings of the 2008 ACM conference on Computer supported cooperative work*, ACM, 187–196. Retrieved January 31, 2014 from http://dl.acm.org/citation.cfm?id=1460592
9. Erik Jahr, Sigmund Eldevik, and Svein Eikeseth. 2000. Teaching children with autism to initiate and sustain cooperative play. *Research in Developmental Disabilities* 21, 2: 151–169.
10. Rita Jordan. 2003. Social Play and Autistic Spectrum Disorders: A Perspective on Theory, Implications and Educational Approaches. *Autism* 7, 4: 347–360. http://doi.org/10.1177/1362361303007004002
11. Sarah Libby, Stuart Powell, David Messer, and Rita Jordan. 1998. Spontaneous play in children with autism: A reappraisal. *Journal of autism and developmental disorders* 28, 6: 487–497.
12. Rebecca MacDonald, Shelly Sacramone, Renee Mansfield, Kristine Wiltz, and William H Ahearn. 2009. Using Video Modeling to Teach Reciprocal Pretend Play to Children with Autism. *Journal of Applied Behavior Analysis* 42, 1: 43–55. http://doi.org/10.1901/jaba.2009.42-43
13. Jennifer Mankoff, Gillian R. Hayes, and Devva Kasnitz. 2010. Disability studies as a source of critical inquiry for the field of assistive technology. *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*, 3–10. Retrieved November 9, 2013 from http://dl.acm.org/citation.cfm?id=1878807
14. Eve Müller, Adriana Schuler, and Gregory B. Yates. 2008. Social challenges and supports from the perspective of individuals with Asperger syndrome and other autism spectrum disabilities. *Autism* 12, 2: 173–190. http://doi.org/10.1177/1362361307086664
15. Deysi Helen Ortega, Franceli Linney Cibrian, and Mónica Tentori. 2015. BendableSound: a Fabric-based Interactive Surface to Promote Free Play in Children with Autism. *Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility*, ACM, 315–316. Retrieved January 11, 2016 from http://dl.acm.org/citation.cfm?id=2811355
16. Narcis Parés, Paul Masri, Gerard van Wolferen, and Chris Creed. 2005. Achieving dialogue with children with severe autism in an adaptive multisensory interaction: The "MEDIATE" Project. *Visualization and Computer Graphics, IEEE Transactions on* 11, 6: 734–743.
17. Anne Marie Piper, Eileen O'Brien, Meredith Ringel Morris, and Terry Winograd. 2006. SIDES: a cooperative tabletop computer game for social skills development. *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*, ACM, 1–10. Retrieved January 23, 2014 from http://dl.acm.org/citation.cfm?id=1180877
18. Kathryn E. Ringland, Christine T. Wolf, Lynn Dombrowski, and Gillian R. Hayes. 2015. Making "Safe": Community-Centered Practices in a Virtual World Dedicated to Children with Autism. *Proceedings of the ACM 2015 Conference on Computer Supported Cooperative Work*, ACM.
19. Kathryn E. Ringland, Christine T. Wolf, Heather Faucett, Lynn Dombrowski, and Gillian R. Hayes. 2016. "Will I always be not social?": Re-Conceptualizing Sociality in the Context of a Minecraft Community for Autism. *Proceedings of*

ACM CHI Conference on Human Factors in Computing Systems 2016. *To Appear.*

20. Kathryn E. Ringland, Rodrigo Zalapa, Megan Neal, Lizbeth Escobedo, Monica Tentori, and Gillian R. Hayes. 2014. SensoryPaint: A Multimodal Sensory Intervention for Children with Neurodevelopmental Disorders. *Proceedings of the 2014 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, ACM, 873–884. http://doi.org/10.1145/2632048.2632065
21. P. S. Strain and I. Schwartz. 2001. ABA and the Development of Meaningful Social Relations for Young Children with Autism. *Focus on Autism and Other Developmental Disabilities* 16, 2: 120–128. http://doi.org/10.1177/108835760101600208
22. Danielle M. Thorp, Aubyn C. Stahmer, and Laura Schreibman. 1995. Effects of sociodramatic play training on children with autism. *Journal of autism and developmental disorders* 25, 3: 265–282.
23. Jeanie Tse, Jack Strulovitch, Vicki Tagalakis, Linyan Meng, and Eric Fombonne. 2007. Social Skills Training for Adolescents with Asperger Syndrome and High-Functioning Autism. *Journal of Autism and Developmental Disorders* 37, 10: 1960–1968. http://doi.org/10.1007/s10803-006-0343-3
24. L.S. Vygotsky. 1978. *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press, Cambridge, MA.
25. Joshua Wainer, Kerstin Dautenhahn, Ben Robins, and Farshid Amirabdollahian. 2010. Collaborating with Kaspar: Using an autonomous humanoid robot to foster cooperative dyadic play among children with autism. *Humanoid Robots (Humanoids), 2010 10th IEEE-RAS International Conference on*, IEEE, 631–638. Retrieved February 20, 2014 from http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5686346
26. Pamela Wolfberg, Kristen Bottema-Beutel, and Mila DeWitt. 2012. Including Children with Autism in Social and Imaginary Play with Typical Peers. *American Journal of Play* 5, 1. Retrieved February 20, 2014
27. Pamela J. Wolfberg and Adriana L. Schuler. 1993. Integrated play groups: A model for promoting the social and cognitive dimensions of play in children with autism. *Journal of Autism and Developmental Disorders* 23, 3: 467–489.