Strength-Based ICT Design Supporting Individuals with Autism

Jessica Navedo
Western Washington University
Bellingham, USA
navedoj@wwu.edu

Amelia Espiritu-Santo
Western Washington University
Bellingham, USA
espiria2@wwu.edu

Shameem Ahmed
Western Washington University
Bellingham, USA
ahmeds@wwu.edu

ABSTRACT
While sociocommunicative behaviors of the autistic population are frequently pathologized, the researchers find evidence supporting strength-based (SB) approaches which utilize the natural talents, strengths, interests and communication styles of individuals with autism, resulting in higher degrees of well-being. Information and Communication Technologies (ICTs) founded in SB approaches are visually designed, simple to use, and are also complex in functionality. Because of the heterogeneity of individuals with autism, personalization and customization are key features for applications to be accessible to a wide variety of user-experiences and needs. By using natural autistic communication-orientation and design preferences, it is possible that learned skills will become more generalizable and that other outcome types will be encouraged. As a key feature of SB approaches, ICT development must incorporate and collaborate with the autistic community these technologies seek to support.

Author Keywords
Autism Spectrum Disorder; Strengths; Talents; Information and Communication Technology; User-centered design

CSS Concepts
• Human-centered computing → Accessibility technologies

INTRODUCTION
We seek to understand how ICTs can be used to support strengths most pronounced in individuals with Autism Spectrum Disorder (ASD) by understanding how behaviors present in specialized ways and the nature of autistic communication-orientation and information processing. While current intervention approaches are founded in applied behavior analysis (ABA), a psychological discipline which promotes behavior modification using conditioning, criticisms of this approach have begun to populate emergent literature as it has served to pathologize natural yet atypical autistic development and information processing [15, 16]. This body of research proposes a technology development strategy which supports individuals with autism through a strengths-based (SB) approach which considers unique personal strengths, deep self-knowledge prompting the ability to inform solutions, the importance of accessibility and relevance in solutions, and individual resiliency while centering the user [9].

ASSETS '19, October 28–30, 2019, Pittsburgh, PA, USA

ACM ISBN 978-1-4503-6676-2/19/10.
https://doi.org/10.1145/3308561.3354641

METHODOLOGY
This preliminary research is exploratory by nature and began with a search for essays discussing SB approaches in autism intervention strategies and technology development on Google Scholar which gleaned 19 potentially relevant essays, of which 9 were selected based on our selection criteria noted below. Because of the emergent nature of SB approaches creating a disparity in language between disciplines and currently developing theories, there were issues in establishing a reliable resource corpus with a single search string. A supplemental keyword-based search was executed in April 2019 through Western Washington University's library database's OneSearch using the following four search strings: (i) Strength-based AND Autism, (ii) Autism AND technology, (iii) Autism AND Thriving, and (iv) Autism AND strength. An additional seven essays were selected from this search. Five more essays were selected from tracing citations throughout these selected papers. 21 essays in total were read for this initial and exploratory research.

Abstracts were read to determine if they met the following selection criteria. There was an emphasis on variety so that aspects regarding generalizable therapeutic approaches which align with SB perspectives and various technology development approaches were represented. Projects which use community-based development models and interdisciplinary approaches were privileged. A majority of research in this area focuses on children, though we found strong implications in the literature indicating benefits and strategies for adults with ASD. Direct study of SB and ICT strategies which support adults with ASD remains an area open for future contribution, which this project does. Articles selected were all published by or after 2008.

A thematic analysis was used to identify dominant themes and recurring codes throughout the literature. Researchers met in person to discuss findings and to coalesce various themes into consistent shared themes. These were tracked, recorded and edited within shared Google Docs. Analogous or repetitive information was succinctly synthesized through this process.

FINDINGS

A thematic literary analysis revealed three themes which highlight SB approaches and inform technology development models and user outcomes.

Theme 1: Persons with autism will always run on autistic neuropathways, regardless of normocentric conditioning [15, 16]. Individuals with autism process information and experience in different ways than typically developed (TD) populations and tend toward enhanced sensory processing and specialized interests [15]. Understanding this encourages developers to design technologies which utilize the natural information and sensory processing inherent in autistic intelligence. Utilizing strategies such as participatory design (PD), Action Research (AR), and Applied AI involve the user-population, incorporating their own intimate knowledge of what works best [18]. The developers of ECHOES (https://bit.ly/2Jr0TQh), a technology-enhanced learning (TEL) environment which teaches social skills, utilized PD approaches to locate features of an interface which worked well with both TD and ASD children. They found visual feedback and the interaction between an annotation tool and participants was important for user learning and engagement [11, 13].

Communication difficulties are a primary issue confronting the autistic population. While autistic communication-orientation can look quite different than TD communication norms, members of the autistic community certainly desire to be heard and understood [21]. Because the autistic population has a natural affinity with technology [10, 18, 19], it is a powerful tool by which communication can be empowered and mediated through scaffolding communication between ASD and TD populations [6, 10], supporting natural autistic communication-orientation [16, 21]. This is an example of utilizing autistic preferences to design accessible and effective technology.

Theme 2: Appropriate measures of ability are necessary for relevant analysis [8, 16]. Typical assessment tools use TD behaviors as a golden standard - a practice increasingly being called into question due to gross underestimation of autistic ability and intelligence [7, 8]. Technologies present an opportunity to engage users with autism while assessing abilities, user preferences, behaviors, and information processing through embedded access to user data and analysis [6, 17]. This may glean insight into how individuals with autism operate naturally, how behaviors and skills may become more generalizable, and make technology design more engaging.

Benton et al. utilized IDEAS (Interface Design Experience for the Autistic Spectrum), a design method implementing PD, to determine which aspects of a game interface were most prominent for the user, drawing focus to the importance of visual aids such as a visual calendar [2]. The ECHOES project, noted above, utilized an annotation tool for users to indicate features they liked or disliked about an interface - which provided unexpected insight into the emotional regulation behaviors of ASD participants [11]. While both of these projects uncovered clues to preferences of users with autism, they both are founded in TD information processing. Using this type of embedded access to assess and chart autistic information processing and responses or behaviors may reveal new ways to design technologies and therapies which cater to a unique and poorly studied autistic way of experiencing and interacting with the world through ICTs and beyond.

Theme 3: Promotion of wellbeing and natural orientation result in the most desirable outcomes [1, 6]. Lanou et al. [14] adapted therapeutic strategies with four autistic children's special interests and abilities to address problematic behavior in a classroom. They found that highly individualized strategies which supported the interests and personalities of the children resulted in incredibly successful outcomes. Supporting the natural strengths, talents, and interests of individuals with autism can often be a doorway to development of communication ability and other skills that are not accessible without a sense of control, well-being, and personal value [7, 15]. In fact, Mottron et al. found implications that personal well-being and satisfaction of idiosyncrasies facilitates access to a vaster array of focus and ability [16]. This implies that technology designed to cater to visual and sensory processing paths and communication-orientation common in the ASD population would be more engaging, promote satisfaction, and make more sense to users thus encouraging generalization of learned skills and a reduction in captive stress-induced behaviors [7, 16]. Nuanced personalization and customization would likely lead to the most profound and successful outcomes [18].

Discussion

Though the autistic population is defined by vast heterogeneity [15, 16], highlighting the necessity of personalization and customization, individuals with autism do tend to possess strengths in visual and sensory processing, logical reasoning, and attention to detail [14]. Technology utilizing visual design which is simple and flexible to use while complex in its functionality caters to these shared strengths [13]. The use of affordances and signifiers by incorporating visual feedback and other sensory-based strategies are key to successful user engagement. Through PD approaches and the application of nuanced user data, the nature of this population may be better understood, letting innate autistic strengths and talents lead toward more supported well-being and promoting generalization in skills and abilities. By privileging natural autistic cognitive and behavioral processes, a special type of human intelligence historically unacknowledged is unlocked. In response to this exploratory research, a more in-depth paper is underway.

REFERENCES

[1] Alexander, H. (2017). Young Author Spotlight. The Family Journal,25(1), 91-98. doi:10.1177/1066480716680186

[2] Benton, L., Ashwin, E., Johnson, H., Grawemeyer, B., & Brosnan, M. (2011). IDEAS: An interface design experience for the autistic spectrum. Conference on Human Factors in Computing Systems - Proceedings, 1759-1764. doi:10.1145/1979742.1979841

[3] Benton, L., Johnson, H., Ashwin, E., Brosnan, M., & Grawemeyer, B. (2012). Developing IDEAS: Supporting children with Autism within a participatory design team. Conference on Human Factors in Computing Systems - Proceedings, 2599-2608. doi:10.1145/2207676.2208650

[4] Benton, L., Vasalou, A., Khaled, R., Johnson, H., & Daniel Gooch, D.. (2014). Diversity for Design: A Framework for Involving Neurodiverse Children in the Technology Design Process. CHI: 3747–3756. doi:10.1145/2556288.2557244

[5] Boyd, B., Towner-Wright, S., Harrop, C., Amsbary, J., & Reichow, B. (2018). That's what I like: The use of circumscribed interests within interventions for individuals with autism spectrum disorder. A systematic review. Research in Autism Spectrum Disorders 57, April 2018: 63–86. doi: 10.1016/j.rasd.2018.09.008

[6] Chandler, D. L. (2016). Opening New Worlds for Those with Autism: Technology Is Creating Great New Possibilities for Those on Every Part of the Spectrum. IEEE Pulse,7(4), 43-46. doi:10.1109/mpul.2016.2563819

[7] Dawson, M., Mottron, L., & Gernsbacher, M. (2008). Learning in Autism. Learning and Memory: A Comprehensive Reference,759-772. doi:10.1016/b978-012370509-9.00152-2

[8] Dawson, M., Soulières, I., Gernsbacher, M. A., & Mottron, L. (2007). The Level and Nature of Autistic Intelligence. Psychological Science,18(8), 657-662. doi:10.1111/j.1467-9280.2007.01954.x

[9] Dunn, W., Koenig, K., Cox, J., Sabata, D., Pope, E., & al. (2013). Harnessing strengths: Daring to celebrate everyone's unique contributions, part 1. Developmental Disabilities Special Interest Section Quarterly, 36(1 (newsletter)), 1-4.

[10] Frauenberger, C. (2015). Rethinking autism and technology. Interactions,22(2), 57-59. doi:10.1145/2728604

[11] Frauenberger, C., Good, J., Alcorn, A., & Pain, H. (2012). Supporting the Design Contributions of Children with Autism Spectrum Conditions. IDC '12 Proceedings of the 11th International Conference on Interaction Design and Children - Proceedings, 134-143. doi:10.1145/2307096.2307112

[12] Grove, R., Hoekstra, R., Wierda, M., & Begeer, S. (2018). Special interests and subjective wellbeing in autistic adults. Autism Research 11, 5: 766–775.

[13] Hayes, G. R., & Karahalios, K. G. (2011). Theme issue on autism and technology. Personal and Ubiquitous Computing,16(2), 115-116. doi:10.1007/s00779-011-0387-z

[14] Lanou, A., Hough, L., & Powell, E. (2011). Case Studies on Using Strengths and Interests to Address the Needs of Students With Autism Spectrum Disorders. Intervention in School and Clinic,47(3), 175-182. doi:10.1177/1053451211423819

[15] Meilleur, A. S., Jelenic, P., & Mottron, L. (2014). Prevalence of Clinically and Empirically Defined Talents and Strengths in Autism. Journal of Autism and Developmental Disorders,45(5), 1354-1367. doi:10.1007/s10803-014-2296-2

[16] Mottron, L. (2017). Should we change targets and methods of early intervention in autism, in favor of a strengths-based education? European Child & Adolescent Psychiatry,26(7), 815-825. doi:10.1007/s00787-017-0955-5

[17] Munson, J., & Pasqual, P. (2012). Using Technology in Autism Research: The Promise and the Perils. Computer,45(6), 89-91. doi:10.1109/mc.2012.220

[18] Porayska-Pomsta, K., Frauenberger, C., Pain, H., Rajendran, G., Smith, T., Menzies, R., . . . Lemon, O. (2011). Developing technology for autism: An interdisciplinary approach. Personal and Ubiquitous Computing,16(2), 117-127. doi:10.1007/s00779-011-0384-2

[19] Putnam, C., & Chong, L. (2008). Software and technologies designed for people with autism. Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility - Assets 08. doi:10.1145/1414471.1414475

[20] Stevenson, J., & Gernsbacher, M. (2013). Abstract Spatial Reasoning as an Autistic Strength. PLoS ONE 8, 3.

[21] Vellonen, V., Kärnä, E., & Virnes, M. (2012). Communication of Children with Autism in a Technology-Enhanced Learning Environment. Procedia - Social and Behavioral Sciences,69, 1208-1217. doi:10.1016/j.sbspro.2012.12.053