Individualised Sensory Technology for Autistic Children

Susana Alarcon-Licona
The University of Sydney
Sydney, NSW, Australia
susana.alarconlicona@sydney.edu.au

Abstract
This submission presents a project which aims on studying the potential of technology in supporting sensory issues in therapy in low and medium-functioning autistic children. The project, firstly, uses ethnographic and other qualitative research methods to understand children's sensory issues, identifying the effect that they have on therapy activities and defining feasible design challenges. This is followed by participatory design with proxies and experts for developing technology for increased understanding and support of sensory issues in autistic children. The resulting findings and applications may contribute significantly to enhance therapy activities. The author suggests that design and implementation of technology in this area requires an individualised approach to be able to meet real needs. Furthermore, that is essential to be rigorous documenting context, participant and technology's characteristics to allow other stakeholders to gain insights from it.

Author Keywords
Interaction design; children; autism; assistive technology; sensory issues.

ACM Classification Keywords
K.4.2 Social Issues: Assistive technologies for persons with disabilities.

Introduction

I have had the fortunate experience of volunteering in schools with autistic children in two different occasions, in two different countries: Mexico and Australia. Regardless of the facilities and the intervention strategies that are followed, sensory issues are one of the most challenging matters affecting the progress of daily activities at school. According to previous studies, sensory issues are present in a large proportion of the population with autism with reports of incidence up to 95% of a sample (Tomchek and Dunn 2007). Common manifestations are hypersensitivity or hyposensitivity to surroundings, unusual interest in aspects of the environment and fixation with sensory feedback (e.g., unresponsiveness to pain, aversion to textures, pressure seeking, repetitive behaviours and visual fascination with lights). These responses are closely related to the ability of adapting to the changing demands of the environment and self-regulating for being able to be calm, alert and engaged in the world when required. Depending on the nature and severity, sensory processing difficulties can affect the ability to learn, interact, play and engage in daily activities.

Sensory issues are studied by education and therapy professionals, but suggested Assistive Technology (AT) for supporting sensory issues is limited to basic off-the-shelf fidget/chewing toys, blankets, brushes, earmuffs or homemade solutions. While there has been an increase in the development of technology for autism support in areas like communication and social interaction; options with the capability to support sensory areas are scarce. Moreover, options are not always suitable to assist specific needs and are rarely used in interventions. An initial literature review showed that some of the successful examples of AT come from the individual needs of one user. Furthermore, experts participating in this study have expressed the need for customised solutions. For me this opens a question in the development and deployment of sensory AT in therapy: Would tailored AT have better chances of making a positive impact in therapy? This project suggests that very own individual manifestations and intervention strategies in autism may be presenting a challenge for the development and use of technologies in this area. Following a similar approach to a standard practice in special education, Individualized Education Plans (IEP), which are customized plans developed by a group of clinicians which address children's unique educational needs, this research is firstly grounded in ethnographic fieldwork and the use of methods such as individual case study and participatory design sessions with proxies and experts. This research involves collaboration with a school for children with autism in Sydney, Australia. Participants of this study include children with autism from 4 to 12 years, and their therapy teams consisting of clinical supervisors, special education teachers and behavioural therapists. Working with a specialized centre opens an opportunity for the correct deployment of the research methods, to empathise with a range of users, collaborate with experts in the field, obtain real data and being able to implement designs in a specific therapy setting.

Besides describing the project, this article reflects on the three questions posed by the workshop, which inherently represent significant challenges in the area: 1) Are we trying to do the right thing? 2) Is it working? 3) Does it matter?

Are we trying to do the right thing? The Potential of Sensory Technology for Understanding and Supporting Sensory Issues

The heterogeneity of the user group, specifically in manifestation of sensory issues posed an initial challenge to decide a research approach. After 8 months of volunteering at the school as therapy assistant and shadow, I realised about the importance of therapy customisation, the extreme behavioural differences in potential participants and decided for an individualised approach. Furthermore, during fieldwork, preliminary insights helped to focus on two questions a) If monitoring during therapy can help in understanding individual characteristics and effects of sensory issues, therefore support therapy customization and b) What kind of technological aids can support therapy by facilitating sensory input/regulation?

Supporting the understanding of individual characteristics and effects of sensory issues in therapy.
Clearly expressed by one of our participants: "Technology can help us to monitor and understand what we can't see". The association between sensory patterns, arousal and self-regulation behaviours has been explored by different authors. In Sensory Integration, Bundy and Lane (2002) point out that children often manifest both behavioural under or over-responsiveness to sensory input and coexistent signs of arousal, and propose the relevance of achieving an optimal level of arousal for ideal sensory processing. While empirical research in such area is scarce, current sensory processing therapies involve strategies aimed to regulate arousal. However, this can be difficult to measure as some low and medium-functioning autistic children do not communicate or present typical responses. Furthermore, studies show that most approaches to assess sensory issues utilise questionnaires or surveys (Woodard et al. 2012, Bundy, Lane, and Murray 2002) which rely on caretakers' self-judgments and only give a general measure at one point in time. In contrast, wearable and mobile environmental and physiological sensors open the door for continuous access to relevant data that can be used by therapy teams and support intervention.

Technological aids to provide the required variety and intensity of sensory input to support therapy.
Technology in this area has effective interaction characteristics for autistic children to use and could help in providing and monitoring required sensory input when needed. As previously mentioned, high-tech AT is not widely available. Low-tech however, is regularly adapted and utilized in intervention. Therapies, involve the use of a variety of sensory accommodations such as deep pressure through weighted vests, mobile-seating options and fidget toys. Therapists manage and adapt these tools in varied activities. Existing technological aids are either adapted from generic tools such as prompting devices providing sensory stimulus in an accessible way (Shabani et al. 2002), or especially made to support conventional therapy techniques for example inflatable vests based on deep pressure (Watkins and Sparling 2014). Similarly, other applications could engage different senses: visual, auditory or tactile-kinaesthetic and be used for increasing attention and awareness on different activities and encouraging expected reactions (Sterian 2015).

Is it working? Planning for Success

From the start, the plan considered to conduct deep study of context and individual cases but also to collaborate with experts in the field of autism intervention to have real understanding, maximise feasibility of the designs and implement them in therapy. Even when we are not in the stage of evaluating success yet, initial findings and designs have elucidated positive attitudes among therapy teams. Besides, this project has proved to be an initiator of reflection among the therapy teams, which constantly think about future possibilities able to support autistic children and their practice. We hope that in a near future, designs can support different sensory profiles, enabling caretakers to use the assets of the technology for supporting sensory behaviours and assisting professionals in optimizing individual intervention plans.

Does it matter? Envisaging Outcomes

As with traditional assistive tools, specific sensory technology would only be suitable for certain users. We hope that we can have an impact in the lives of the children at the participating school and while outcomes may be difficult to measure, I believe that part of the current problem is the lack of available documented technological tools. Although findings cannot be generalised to the autistic population, providing rich documentation and detailed descriptions could maximise applicability to a variety of cases with similar characteristics. Especially when the technology is used to support traditional intervention.

Conclusion

This project aiming on studying the potential of technology in supporting sensory issues in autistic children is based on the individual study of cases and collaboration with experts to maximise feasibility in implementing designs in the field. I suggest that design and implementation of technology in this area requires an individualised approach and collaboration with therapy teams to be able to meet real needs of autistic children with sensory issues. Moreover, that is indispensable to produce thorough documentation of context, participant and technology's characteristics to enable other stakeholders to apply insights from it.

References

1. Anita C Bundy, Shelly J Lane, and Elizabeth A Murray. 2002. *Sensory integration: Theory and practice*: FA Davis.
2. Daniel B. Shabani, Roger C. Katz, David A. Wilder, Kenneth Beauchamp, Crystal R. Taylor, and Kirsten J. Fischer. 2002. "Increasing Social Initiations in Children with Autism: Effects of a Tactile Prompt." *Journal of Applied Behavior Analysis* 35 (1):79-83. doi: 10.1901/jaba.2002.35-79.
3. Mihaela Sterian and Mihaela Mocanu. 2015. "The Role of Assistive Technologies in the Learning Process for People with Sensory Impairments." *Euromentor* 6 (3):70-80.
4. Scott D Tomchek, and Winnie Dunn. 2007. "Sensory processing in children with and without autism: a comparative study using the short sensory profile." *American Journal of occupational therapy* 61 (2):190-200.
5. Nicholas Watkins, and Elizabeth Sparling. 2014. "The Effectiveness of the Snug Vest on Stereotypic Behaviors in Children Diagnosed With an Autism Spectrum Disorder." *Behavior Modification* 38 (3):412-427. doi: 10.1177/0145445514532128.
6. Cooper R. Woodard, Matthew S. Goodwin, Philip R. Zelazo, Daniella Aube, Meghan Scrimgeour, Tyler

Ostholthoff, and Michael Brickley. 2012. "A comparison of autonomic, behavioral, and parent-report measures of sensory sensitivity in young children with autism." *Research in Autism Spectrum Disorders* 6 (3):1234-1246. doi: http://dx.doi.org/10.1016/j.rasd.2012.03.012.