AUTISM AND THEORY OF MIND IN INTERACTIVE SPACES

Scott Brown, School of Media Arts, College of Fine Arts, University of New South Wales
E-mail: scott.brown@unsw.edu.au

Abstract

How is an Interactive Media Arts practice placed to explore what is often considered a scientific field of research? This paper is a discussion on the main areas of study situating an observational PhD study on non-verbal children with autism. The author suggests that in fact an arts practice allows for more sensitive research and allows natural emergence to explore and facilitate the expression of Theory of Mind and physical consciousness.

Keywords: autism, Theory of Mind, interactive arts, agency, language, enacted mind, sensory processing

When an arts practitioner moves across disciplines that are considered scientific in nature, such as empirical human research, the rigor of artistic practice may be questioned. If they are not gathering scientific results, what do they consider their research purpose to be? This strange desire for a structured role or title may actually involve overlooking one of the great strengths of the artist; there is a sensitivity associated with an arts practice that allows the practitioner to be flexible and responsive to participant engagement. This is not necessarily the case with a scientific approach to studying a human population, where the pressure of proving a hypothesis[1] drives the researcher to treat the participant in an objective but disconnected way.

As an early career researcher, currently in the second year of my PhD studies in Interactive Media Arts, I not only attempt to place my work within multiple fields, but continually question my own place and role within the study. I think of this stage of my work as being a conversation, or a short provocation; designed not only to engage with participants during observational studies to be carried out throughout my research, but entailing that I remain open to others who may question my role and direction. This is an openness not afforded within most scientific studies.

Adopting a philosophical perspective, the research presented in this paper aims to look at the potential of physical and interactive media to engage and facilitate agency in non-verbal children with autism. Early decisions around the media I choose to employ for these studies will discuss why the screen - particularly 'smart' touchscreen devices - are not the most appropriate interface for engaging with this population.

I find it useful to question whether screen-based devices are in fact a worthwhile addition to the therapeutic toolkit. It seems we are quick to imagine these devices are capable of being assimilated into a therapeutic environment and do not question whether there is any loss of engagement in the process. Bret Victor is a useful touchstone on this point. Victor is an ex-Apple employee and left the company in spectacular fashion around the same time as the release of the first iPad in 2010 [2]. Victor worked on experimental interfaces for human-computer interaction and has much to say on why the gesture of touch-based screens is not a good interaction metaphor [3]. He makes the important point that the use of a touchscreen does not reflect the way that we interact with our natural world.

Victor's thoughts align well with my own study. I believe that universally, we should be engaging more physically and sensorily with our digital devices. For instance, what does it say about our attitude toward something if we grab it roughly, versus cradling the object gently? Whilst the discussion around interactive media often uses metaphors weighted in the physical, sensory world (dialogue, extension, reflection and so on) this kind of question can't be explored fully through current touchscreen devices.

There are still designers, such as Bill Verplank, for whom physicality is an important interface to interaction, though interestingly, this approach is often referenced as a relic of simplistic technologies of the past [4]. However, this simplicity belies the deep understanding Verplank has for the role of the computer in interactivity. In his Interaction Design Sketchbook, Verplank asks the reader to "consider a deeper understanding of the essence of computers: representation for manipulation" [5].

Much of the work that I am undertaking will look at human senses and how we might represent and engage them more fully in interactive systems. Vision is generally given primacy amongst the senses, which is reflected in the way that we approach interface design and interaction feedback. Auditory, and on occasion haptic feedback are also acknowledged, but often these are an afterthought to the importance placed on vision.

The relevance of sensory engagement to the autistic population is manifold. Being a spectrum disorder, autism presents in numerous ways, but it can be regularly observed that those with autism display either a hyper, or hypo-sensitivity to sensory stimulus [5]; whilst some will seek out certain sensations, others will avoid them as much as possible. This makes them a particularly interesting population to work with for my own study. This is not because I believe that this study will form an intervention or treatment, but because this group have such specific responses to sensation, most of which will remain with them for life.

A diagnosis of autism is generally made early in life [6]. Identified by a therapist, the diagnosis is made based on three main observations: impaired social development; resistance to change and repetitive mannerisms; and impaired language and communication skills [7]. This last point is growing in its significance to my own study. Again, the role of conversation arises, and my work is beginning to take shape around the observation of communication without the use of language.

Acquisition of language is linked to having Theory of Mind (ToM) [8]. Between 25-40% of autistic children have non-functional speech [9], but it is not clear whether the often noted lack of ToM is connected to this figure. Developed during the early years of life, ToM displays an understanding that your personal hopes, beliefs, desires, and so on are different to those of others. Its importance in relation to language is that it leads to the desire to share information. This desire to communicate internal knowledge or desires is an important building block for social engagement and interaction, both of which are important throughout life.

Given that there is such a close relationship between language and ToM, it is strange that many of the tests for ToM rely on some understanding of complex language structures. The False-Belief Test is one of these. A person lacking ToM would not understand that their knowledge differs from that of someone else and therefore cannot understand differing beliefs. This is the crux of the "Sally-Anne" False-Belief Test, carried out by asking the subject where another person believes an object to be, after it has been moved in their

absence. A person lacking ToM would not make the distinction from the knowledge of themselves and the absent other. Even from this simplified explanation, it is easy to see how difficult this could be to explain to someone without complex language skills.

This leads to the question: could there be other ways to observe ToM, perhaps without the use of language altogether? I believe that we approach interacting with technology through too narrow a lens. So too, I think we define communication in a limited and very structured way. Of course, much of this is based upon necessity: to communicate, we need to express ourselves in a way that can be decoded in a reliable and persistent way. However, much of this decoding happens internally; it doesn't encourage external engagement and relies heavily on cultural cues. There is evidence that gestural interaction is a precursor to language acquisition[10] and this is an area that I believe is worth exploring through interactive media.

On this point, I am looking to the work done by scholars who straddle the fields of philosophy and neuroscience, particularly that of Alva Noë and Shaun Gallagher. Embodiment of the mind - both through a consciousness of the body, but also engagement with the external environment - is an area that I believe is rich for discussion on how we might display ToM in physical ways. Are we able to observe the mind through physical, rather than semantic interaction? Noë suggests that the mind, or consciousness, is an emergent property of interacting with the world [11], while Gallagher suggests that this emergence occurs on the level of 'prenoetic', or pre-conscious, phenomenological engagement [11]. Here I also see interesting connections to the fields of Cybernetics and the event-based nature of Interactive Media Arts.

The direction I am taking on the use (or non-use) of language and expression through the physical environment was originally inspired by a well known YouTube video by autistic activist, Amanda Baggs, titled *In My Language* [12]. In this video, Baggs shows us the many and varied ways she sensorily engages with her environment, and in the latter half of the video, she describes this interaction as being in her "native language". Baggs then goes on to state, "Far from being purposeless, the way that I move is an ongoing response to what is around me. Ironically, the way that I move… is described as being 'in a world of my own', whereas if I interact with a much more limited set of responses... people claim that I am opening up to true interaction with the world". This is a wonderful example of the way that the mainstream population has a desire to normalise autistic people; that it is only through behaving in the correct way that you can engage in the conversation.

Pursuing this work requires me to move across several disciplines: design; neuroscience; psychology; and so on. This is not to say that I am an expert in any of these fields; and despite my enrolment in an arts school, nor do I consider myself an artist. I see the processes that I engage in as having much in common with a design approach, and treat my own role as that of a facilitator. Whilst I acknowledge that it is an impossible goal, I aim to remove my own hand from aesthetic choice in the work where possible: there should be an ongoing aesthetic conversation between the system and the participant - they should be considered the artist or author. The iterative design process that emerged from my own Honours work in 2011 established this methodology. Through an observational case study involving a single 2 year old girl with Autism Spectrum Disorder (ASD), I looked to the engagement of the child, the feedback from her mother and Occupational Therapist, as well as some data gathered from the systems created during the study [13]. By not entering into the study with a pre-conceived question or idea of what outcomes I required, it was an unexpected event which shaped the case study and proceeding direction of my work today.

One of the devices created to engage with the child was a series of vibrating 'joysticks'. These were covered in different material and this stage of the process was designed to separate her interest in texture (material) and her interest in haptic feedback (vibration). While using this device, the child looked to her mother and made eye contact - an important indicator of social engagement, particularly for those with autism. The child showed an awareness that her mother and herself were having different experiences and she wanted to express her own excitement to her mother. I believe that the child was displaying an instance of ToM.

As I mentioned above, ToM is loosely defined as the understanding that your own desires, beliefs and intentions are different to those of others. The display of social interaction could be considered a precursor to developing ToM, similarly to the display of Pretend Play. Observable as an external, physical act, Pretend Play leads to use of symbols and ultimately ToM, in that it shows imagination and can reference absent objects or places [14].

There is an underlying suggestion in much of the way that interventions and therapies for autistic children are carried out that a quiet child is a 'good' child. It is in relation to this desire to manage the behaviour of children that I see screen-based interventions getting much traction. It is also my belief that in replacing multi-sensory physical engagement with screen interaction we lose an important ability to explore ideas such as Pretend Play and ToM.

One example of a widely used physical intervention which has recently been emulated on the screen is the Picture Exchange System (PECS) [15]. Visual cues allow a non-verbal child to express their intention or desire through the construction of sentences based on pictorial representations. Although the focus of this intervention is to allow the child to express themselves through images, there is also an important secondary part of the experience: the eye contact between the child and the therapist/teacher/parent, who is leading the intervention. Often, it is important to be led by the gaze of others - once again it shows that we recognise and are open to the thoughts of others, which could be considered to correspond to some level of ToM. Placing this in the world of the screen removes this indirect interaction.

This kind of interpersonal engagement could also be considered a type of Co-operative Interaction and was used in the final design of my Honours work: a haptic change table. Two triggers were placed far enough apart that the child could not engage them both on her own, but required the assistance of her mother to achieve the vibrating response of the device that she desired. This circumstance encouraged her to communicate this desire in some way. Whilst this is a simple cause-and-effect style interaction, the 'sabotage' of the trigger mechanism encourages much

more complex and interpersonal engagement.

The structure of this research is not only *about* systems, but looks at interaction *through* systems. By being open to the knowledge that each participant brings to a study - in this case the child, a teacher, a therapist, a parent, or myself – this process can be compared to the Action Research methodologies established by social psychologist, Kurt Lewin [16]. Acknowledging that the contribution of each person is of value again reinforces the idea that the approach of this study is akin to an open and ongoing conversation. Although some of the methods borrow from scientific practice, it's important to point out that the results of this study cannot be considered scientific in nature.

Also of relevance to this methodology is the Cybernetic approach of Gordon Pask, known for his pioneering Cybernetic machines. Pask's ideas on learning and conversation are particularly interesting, specifically the concept of the 'P-Individual'; an emergent point of agreement between systems, which may build to create a language of their own [17]. However, rather than the system or the child trying to 'learn' from each other, I am looking to observe reproducible events, or points of agreement which show a conversation.

The challenge will be in deciding how these systems will be structured, to keep them as open and aesthetically self-determinable as possible. One of the areas I will first explore is that of natural systems, such as light colour temperatures and the physicality of sound waves. By emulating naturally existing phenomena, I hope to avoid the cultural bias of colour and sound embedded in many children's toys and instead observe their experiential interaction: is the child aware of their control and is the engagement repeatable, suggesting a conscious dialogue with the system?

The observational studies will also begin to establish a language - and hopefully a methodology - of their own. The vocabulary of this language is currently absorbing much performance or theatrical terminology: the event, actors, play, and so on. Like the theatre, the goal in these interactive experiences is to create immersion, so that the prenoetic experience that Gallagher speaks of can be observed and perhaps

explored as a mode of conversation. When we enter the theatre, we are prepared to suspend disbelief. We do not require the sense of realism that 3D cinema may strive toward, but it is instead the connection with a physical presence that focuses our attention and creates a new reality. Similarly to engaging in the dreamlike spaces of Pretend Play, the physical props of theatre suggest enough of a real world experience for our suspension of disbelief and willingness to be immersed in the narrative experience.

Modern theatre often uses multi-sensory, high technology devices to create this immersive experience for the audience. This follows from a rich history of using new technologies to immerse the audience and as Oliver Grau notes, this use of contemporary media can be traced back as far as the travelling panoramas of the nineteenth century, or even the Roman fresco paintings [18]. Where I see current interactive technologies making interesting changes is not only through facilitating the agency of the participant, but also through the handing over of the evolution of a system to that participant, so that they become a vital director of the conversation.

Often I am told that, because I am working with autistic children, I am undertaking important research. However, I think it's vital to continually remind myself that this is always an ongoing conversation with a small population and the people who care for them. I don't yet have results to share and I'm doubtful about there ever being a point where this work will feel finished. In the poignant words of Fluxus academic, Hannah Higgins, "The account that follows, therefore, is not merely subjective but takes its lead from a collective instinct and intuition. Insofar as all intellectual endeavor does precisely that, this particular project is unremarkable"[19]. There is no scientific end-goal in this study, nor do I think there should be; I believe it's important to remain open to the emergent and unexpected nature of interactive technology. Depending on how others view this work, this may be either its greatest strength, or greatest weakness. I hope that through conversation with the participants in the study, they will be the ones to decide which it is.

References and Notes

1. SFARI (2013), <http://sfari.org/news-and-opinion/columnists/jon-brock/2013/connections-registered-reports>, accessed 21 June 2013.

2. Bret Victor (2010), <http://worrydream.com/#!/Departure>, accessed 12 June 2013.

3. Bret Victor (2011), <http://worrydream.com/#!/ABriefRantOnTheFutureOfInteractionDesign>, accessed 17 May 2012.

4. Cycling 74 (2013), <http://cycling74.com/2013/06/20/nime-day-2/>, accessed 25 June 2013.

5. Ashleigh Kendall, "A Teachers Manual for Sensory Processing," University of Sydney (2009).

6. Grace Iarocci and John McDonald. 2005. "Sensory Integration and the Perceptual Experience of Persons with Autism," *Journal of Autism and Developmental Disorders* **36**, (2005) pp. 77–90.

7. Fred R Volkmar and Brian Reichow, "Autism in DSM-5: progress and challenges," *Molecular Autism*, (2013) pp. 1-12.

8. Bertram F. Malle, "The relation between language and theory of mind in development and evolution," in T. Givón & B. F. Malle, eds., *The evolution of language out of pre-language* (Amsterdam: Benjamins, 2002).

9. Amy S Hewitt et. al. "Characteristics of adults with autism spectrum disorder who use adult developmental disability services: Results from 25 US states," *Research in Autism Spectrum Disorders* **6**, No. 2 (2012) pp. 741-751.

10. Rhiannon J Luyster et. al., "Language Assessment and Development in Toddlers with Autism Spectrum Disorders," *Journal of Autism and Developmental Disorders*, No. 38 (2008) pp. 1426-1438.

11. Shaun Gallagher, *How The Body Shapes The Mind* (Oxford, U.K.: Oxford University Press, 2011).

12. YouTube (2007), <https://www.youtube.com/watch?v=JnylM1hI2jc>, accessed 27 June 2013.

13. Scott Brown, "The Aesthetics Of Negotiation: Using interactive technology to facilitate aesthetic choice of children with sensory processing disorders," in Julie Lunn, Stephanie Bizjak and Sue Summers, eds., *Changing Facts, Changing Minds, Changing Worlds* (Bently, WA: Black Swan Press, 2013).

14. Rhiannon J Luyster et. al., "Language Assessment and Development in Toddlers with Autism Spectrum Disorders," Journal of Autism and Developmental Disorders 38, (2008) pp. 1426-1438.

15. Andrew S. Bondy and Lori A. Frost, "The Picture Exchange Communication System," *Focus on Autism and Other Developmental Disabilities* **9**, (1994) pp. 1-19.

16. Clem Adelman, "Kurt Lewin and the Origins of Action Research," *Educational Action Research*, No. 1 (1993) pp. 6-24.

17. Gary Boyd, "Reflections on the conversation theory of Gordon Pask," *Kybernetes* 5, pp. 560-571.

18. Oliver Grau, *Virtual Art: From Illusion to Immersion* (Massachusetts, The MIT Press, 2003).

19. Hannah Higgins, *Fluxus Experience* (London, U.K.: University of California Press, 2002).