Autism and Somantics: Capturing Behaviour in the Wild

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Abstract

This paper looks at the use of a novel software application created with the inclusive participation of the target population, young people with autistic spectrum disorders (ASD). Somantics has been used in a variety of settings, therapeutic and educational, as a method of eliciting non-formal, user-led interaction. This is in contrast with many information technology interventions that target specific behaviours via structured tasks. Moreover, they are often conducted in controlled environments. By investigating behavior 'in the wild' we offer a genuine alternative to traditional paradigms in understanding ASD. This paper highlights the eclectic methodologies (e.g. micro-ethnography, charettes, performance analysis) and tools that we have used to capture ASD behavior. It emphasizes the benefits of adopting a genuine multidisciplinary approach of individuals and processes (e.g. product designers, psychologists, sports scientists, touch therapists) when investigating real-world phenomena.

Keywords. Autism, information technology, mixed methods, ethnography, video observation, performance analysis, charrette.

Introduction

Around 130,000 children in the UK [1] are diagnosed with ASD. Factoring in the considerable impact that this has on families, it is estimated around 2 million people in the UK could be affected directly or indirectly by this condition. Although diagnosis is often difficult, clinicians look for impairments in social interaction and communication, along with problems in emotional regulation. Furthermore, narrow interests and restricted repetitive behaviours are present [2]. ASD is commonly accompanied with anxiety that impacts on communication for approximately 40-45% of young people [3]. The role, nature and treatment of anxiety in ASD has been studied over the last ten years, with some notable clinical [4] and research [5] examples. Children with ASD often find 'comfort' interacting with computers; as this provides them with an outlet for their restrictive behaviours and attention to detail without the need for social interaction in the real-world [6]. There exists a multitude of information technologies for training individuals with ASD in specific skills such as emotion recognition [7] and understanding the mental states of others [8]. Most of these packages encourage active, user-driven, learning and run on any home computer. However, the success of these interventions has been mixed, with some studies reporting that improvements within the computer environment often fail to generalize to real-world environments [9]. Thus, there is a paucity of evidence looking at the effects of technologies that encourage children with autism to engage in creative play through movement and touch [10].

Somantics

The idea was to create a suite of applications for the iPad that use tactile exploration and playfulness to enhance the communicative potential of the most impaired and misunderstood young people on the autism spectrum. Furthermore the potential for gestural communication was boosted by taking the interface beyond the iPad tablet into the environment using the gesture recognition functionality of the *Kinect 3D* camera. Somantics promotes the evolution of gestured-based communication through 3 distinct modes of interaction:

Figure 1. A child interacting with the iPad.

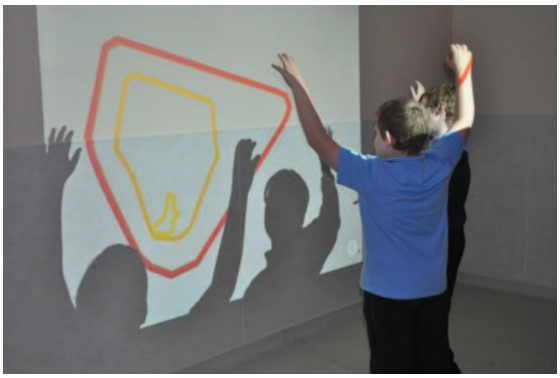

Figure 2. Group interaction using Kinect 3D camera.

Mode (1) *playful interaction*. Research indicates that one of the main barriers to communication for people with ASD is anxiety. We created applications that use repetitious and rhythmic, tactile interaction using the iPad touch sensitive screen, to afford relaxation. People on the spectrum are known to avoid social communication when they are confused by the nuances of face-to-face conversation, when they do not understand the purpose of communication and when sensory information in the environment is overwhelming [11].

Mode (2) *gesture based interaction.* Using the internal two-way iPad camera to capture facial and gestural expressions (see Figure 1.) we produced applications that enable young people to manipulate their captured images in order to create, highly individual 'artworks', effectively augmenting their images with their own graphical gestures. Research shows that people with autism have a poor sense of identity and low self esteem. Our applications will enable young people to explore identity, to determine aspects of self that are meaningful, and to share these with others.

Mode (3) *real-time gestural interaction*. What really makes Somantics novel in terms of gestural communication is the facility project these artworks into the environment, and use the *Kinect 3D* camera (see Figure 2.) to make the projections a multi-touch surface. The high visibility and repetitious mirroring of action into the projected space can reinforce feelings of self-control - an essential pre-requisite for communication. Furthermore, the opportunity to see that control reflected within the environment means that the child's available attention for communication is widened, shaped and shared through interaction with others.

Emergent evaluation methods and tools

The methods continue to emerge and use a mixed methods approach [12] yielding both quantitative and qualitative data. The main evaluation tool is video observation of behaviours. Our studies are thus situated broadly within a visual sensory ethnographical framework [13]. Data generated from more formal discrete planned sessions is assimilated into a more continuous ethnographic narrative, sustained through a combination of field notes, interviews, video and photographs. We have used more formal video analysis software from the psychological and performance analysis worlds, which facilitate systematic quantitative analyses using duration/time and event/activity based coding. They also allow qualitative analysis of video footage by allowing the coding of 'key moments', generating video clips that can be supplanted with textual annotation Indeed, our approach is consistent with our contemporaries in educational settings. For example Snell [14] has highlighted the benefits of combining systematic quantitative analysis with micro-ethnographic analysis of video data.

We thus see these software packages as key evaluation tools and an integral part of the methodological evidence base. Moreover, we envisage their use in both group and case based analyses of Somantics. For example, they can serve as a powerful longitudinal database of a child's behaviour over multiple sessions with Somantics. This archive allows systematic tracking of behaviours, with early sessions serving as quasi-baseline data to see the efficacy of targeted interventions. Quantitative analyses of behaviours have been *triangulated* with input (e.g.

interviews) from key stakeholders such as teachers, carers and parents. Thus we have strove to avoid the reductionism possible, by over-reliance on objective coding and statistical analysis of video data.

Ethnographical Techniques

Our approach to methodology, whilst theoretically informed has also been eclectic and pragmatic. We have borrowed tools and techniques from ethnography, without necessarily conducting a full-blown ethnography. For example, many of us have spent regular (often weekly) one hour sessions in *Special Needs Schools* using Somantics with low functioning autistics (LFA) whom we have become well acquainted with. Of equal importance is the trust we have gained from teachers and supporting carers 'in the field' and how we have integrated them as much as possible in the research process (e.g. interviews, commenting on video footage) to achieve full *triangulation* [15]. In terms of a general ethnographical observation approach we have probably straddled the continuum between *observer-as-participant* and *participant-as-observer* [16]. Thus in some situations members of the team have been known and recognized, but related more to the participants (particularly the LFA children) primarily as a researcher. Whereas in other situations, the researchers have seen themselves more fully integrated with the life of the group and are acknowledged not just as researchers but as 'friends'.

Readers may wonder given the impoverished linguistic skills of many of the autistic children whether ethnographical techniques allow them to have a 'voice' and indeed whether this research format is appropriate. We don't see this as a problem, believing that the nuanced bodily communication facilitated by Somantics serves in part as their voice and it is our challenge to capture and interpret this. Moreover, from its earliest inception in anthropology, ethnography has been concerned with non-literate populations. It also has a large knowledge base that has dealt with gesture and movement, e.g. Kinesics [17].

Charrettes and Performance Analysis

A charrette is a method of structuring thoughts from experts and users following intense periods of working collaboratively, often over multiple sessions [18]. They allow the quick generation of a design solution, but crucially allow the input of all stakeholders to be incorporated. At the invitation from an internationally renowned movement therapy centre, *The Touch Trust*, we trialled Somantics Apps in the context of a range of therapeutic activities. This has offered the chance to assess the feasibility of planned measurement tools and provide rapid feedback for both the design and evaluation processes. We collaborated with experts from sport performance analysis, who have worked with British rugby and netball teams, but have also used their skills in applications such as health and safety. They designed a discrete multi camera set-up, with real-time capture of behaviours using *non-participant observation*. We piloted the use of coding schemes informed by the SCERTS framework [19] and the feasibility of capturing behaviours in both real-time (e.g. discussing main performance patterns; coding specific behaviours using a predesigned template) and post video capture coding. We also experimented with *participant observation* via wireless capture and real-time coding of behaviours using iPads and wearable cameras. We saw genuine benefits of performance analysis expertise complimenting the psychological and design based expertise of the team.

Table 1 shows quantitative data from a charette from one child. They attended two sessions of approximately one hour length. We can quantify the amount of time that can be considered as positive and negative emotional regulation. We can also quantify unwanted behaviours (e.g. touching shirt, violating personal space of others) and we can look at aspects of transactional support through behaviours that require carer intervention. You can see from the below table that there was a reduction in the amount of negative emotional regulation from session 1 to session 2, that unwanted behaviours were also reduced (e.g. invading the personal space of a partner) and this is further corroborated with less need for carer intervention.

Table 1. Behaviours recorded from two charette sessions

	Session 1			Session 2		
	Number	**Time**	**%**	**Number**	**Time**	**%**
Total time		54.27			60.48	
Positive	10	21.45	40	3	48.02	80
Negative	10	32.42	60	3	12.46	20
Touch shirt	10			9		
Personal Space	18			11		
Carer intervention	7			5		

However, it was the qualitative data captured by the use of performance analysis that was arguably of most value, particularly in the early stages of trialling Somantics. For example, emergent behaviours that we hadn't expected to capture and the impact of practitioner reflection and review, were one of the most relevant and empowering factors of the performance analysis system. Indeed the lead author (coming primarily from a quantitative background) quickly realised that the statistics were only meaningful when viewed in the context of parent/practitioner/stakeholder participation. Thus the review process, facilitated by the performance analysis system, provided the most compelling testimonies we needed. Furthermore, it became a shared vocabulary that complimented other data.

Conclusions and further research

We have found the adoption of mixed methodologies 'in the wild' to be challenging in terms of measurement, but it has delivered a richer understanding of behavior. The research team has approached the design and evaluation of Somantics from an interdisciplinary perspective and this ethos has been more formally adopted at our newly created Centre for Applied Research in Arts and Design (CARIAD). In the coming months we will be adding to the functionality of Somantics, by including more sound and music based tools, given their known therapeutic benefits [20]. We will also be extending the research to domains such as stroke rehabilitation and dementia.

Note: in the above research full ethical approval was granted and informed consent was obtained from parents, teachers and carers. All children gave their assent. Permission to use still and moving images has been granted.

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