

# Appropriating commonplace technology for autism support

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## ABSTRACT

This paper describes the use of everyday technologies in the support of people with autism spectrum disorders. The everyday nature of the examples of technology use is discussed in terms of their role in support and the implications for the design of digital assistive technologies for autism spectrum disorders. Some conclusions are drawn but it is intended that the reader will also take their own meaning from the examples.

## General Terms

Design, Human Factors, Theory.

## Keywords

Digital assistive technologies, autism spectrum disorders.

## 1. INTRODUCTION

Autism spectrum disorders (ASDs) impact on cognition, communication, and behaviour. They are diagnosed primarily by observation and the patient is categorised according to psychiatric criteria, typically either DSM IV (Diagnostic and Statistical Manual of Mental Disorders) [1] or ICD-10 (International Classification of Diseases) [4]. Although comprising five disorders, this paper will use the term to mean autism, Aspergers syndrome and pervasive development disorder – not otherwise specified (PDD-NOS).

The incidence of autism has been reported from 4 to 60 in 10000 [3]. A major study conducted by Wing and Gould in the 1970s led to their description of autism as a ‘triad of impairments’ where the impairment to social interaction, social communication and imagination were viewed as each impacting on the others and each being present in an individual to different degree. The traits of autism are represented differently in each individual, varying both in severity and in evidence of the elements of the ‘triad of impairments’ Factors such as personality, education and social environment are highly influential in the behaviours observed (Gould, 1998). This complexity, coupled with the lack of an agreed biological basis, makes treatment particularly difficult. Treatments are likewise varied [2].

Treatment and support for the person with an ASD is multidisciplinary and will often include the use of assistive technologies (any object that is used to support a disability).

Digital assistive technologies (DATs) have the potential to provide support in more unobtrusive or socially acceptable forms. They can overcome some of the shortcomings of existing paper-based supports and enable the provision of supports not previously possible.

The design of DATs poses some complex problems. Participatory design techniques are indicated as desirable, due

to the highly individual needs that characterise ASDs. These same traits, however, make participatory design problematic. More needs to be known about the nature of support if we are to refine approaches to design with this group. The project that this paper draws upon seeks to answer the question: ‘What are the phenomena and relationships within autism and assistive care that are relevant to the design of digital assistive technologies?’

This paper describes one aspect emerging from the interviews, the appropriation of everyday technologies for the support of people with autism spectrum disorders.

## 2. METHOD

Interviews were sought with people who directly supported a person with an autism spectrum disorder. It was considered important to speak to people who had first-hand experience in order to understand support as it actually occurred, rather than as it was expected to occur. A decision was made not to interview any people with an ASD as this would have possibly biased the data to the ‘high end’ of the spectrum.

Thirty-eight interviews were conducted with 40 participants, gathering data on the support of 50 clients. Interviews were from 1 to 1.5 hours duration and were audio recorded. Interviews were conducted from September 2006 to February 2007. Table 1 shows the distribution of interviewees by role and setting. They supported people with ASDs across a wide range of ages, abilities and settings.

**Table 1. Breakdown of interviewees by role and setting.**

Setting	Interviewee role (no. of people discussed)	
<b>Early Intervention</b>	1 Co-ord (1)	1 Occupational therapist (1)
	2 Teachers (2) 3 Aides (4) 6 Parents (6)	
<b>Primary mainstream</b>	2 Aides (2) 1 Parent (1) 1 Grandparent (1) 1 Aide – Community school (1)	
<b>Primary special</b>	4 Teachers (12) 1 Aide (2) 2 Parents (2)	1 IT teacher (0) 1 Sp Therapist (1) 1 Inclusion co-ordinator (0)
	<b>Secondary special</b>	3 Teachers (5) 1 Parent (1)
<b>Adult</b>	3 TAFE staff (3) 1 Community housing officer (1) 1 Day centre co-ord (3) 1 Parents (1)	

The body of each interview consisted of three major parts:

1. Questions about the person being interviewed: their role and relationship to the people they support; their experience of, and formal knowledge, of autism; resources and support available to them.

2. Questions about the people they supported: age, diagnosis, abilities, traits, needs.

3. Questions about the support practices that they employed in the support of that person: the goal of the support, the means employed, where the support came from, any perceived limitations of the support.

### 3. RESULTS

The interviewees describe uses of everyday items, mostly technologies, in ways that either diverge from their intended use or their use is as expected but the role that use plays in their lives is different or amplified. In each case pseudonyms have been used.

#### 3.1 Case 1

Parent of Simon, a 10 year-old boy with Aspergers syndrome. Simon is very sociable with adults, but inappropriate with other children, to the point of distress. He suffers anxiety and becomes very agitated in the presence of babies. Four examples of commonplace technologies are given: a soft toy called 'Puppy', a crying doll called 'Shu Shu', the use of letters and telephones, and a video camera. In the first example, his mother describes her attempts to address his fear of babies.

##### 3.1.1 'Puppy' the proxy and 'ShuShu'

*Anyway to cut a long story short, recently I decided that we had to approach it through the stuffed animals, so he was particularly upset about something, about some incident involving young babies or children, and so I picked up Puppy, the stuffed toy, and said, "Puppy, I just don't know what to do, because Simon is so worried about this, and I don't know why he is so worried." and he was immediately engaged. And he said, "Yes, Puppy,..." and he took over. And he said, "Puppy, mummy's friend is coming to visit, and she has a new baby. Now Puppy, I don't want you to worry,..." so that whole stuff, it all came out. It was really interesting. It was like I had to take focus off him, and act it out with the toy, and then he took over.*

*So the next day, I sat with him and I put the [crying] doll on, and he went like this [The interviewee was using a hands over the ears gesture here], and I said, "Now, you know it is ShuShu, and she is going to stop this in a minute." And he said, "I want you to turn it off." And I said, "Okay, I will." And I turned it off. And I said, "But you did really well, and that is what we will do with Puppy." So then, he came and had control the doll, with Puppy, and I said, "Let's show Puppy how to do this." So he went through the whole acting scenario, and the next day he came in and showed it himself.*

*...confrontation is just overwhelming, whereas if you go at a roundabout it, you tend to get a lot more from him.*

'ShuShu' was intended to help to desensitise Simon to the crying of babies. The use of the 'Puppy' enabled Simon's mother to shift the discussion of the problem to a third person, Simon was able to pick this up and work in the same way, apparently less confronted by the discussion.

The parent had mentioned earlier that Simon's interactions with other children was poor, with Simon preferring the

company of adults. This example led to me asking if his relationships with other children would benefit from some kind of mediation, such as email.

##### 3.1.2 Letter and telephone

*Interviewer: So when it comes to relating to other kids, if it was somehow mediated, say through email, or some kind of technology, whether the distance may be effective?*

*Very effective. I know it is, because, if his cousin from Sydney writes to him, he will write back. For instance, Joanne, she is a gorgeous kid, that he goes to school with, she is just the loveliest girl, and Simon says he is going to marry her when he grows up, very caring for Simon. She wrote a letter to Simon in the holidays, it just turned up in the letterbox. So I said to Simon. "Why don't you write back to her?", and that was okay, let's do it. So yes, it is very effective. He is also very good on the phone, his speaking over the phone has improved out of sight. For instance, his major fear of babies, his Achilles heel. My husband's sister has a new baby, now he can't visit the baby, he couldn't go to the christening, we didn't force it, it was too much. But he will speak to my sister-in-law over the phone, and ask all about her, how is she going, what is she doing now, really nice things. And he loves her photos. So is not that he is not interested, he can't handle the confrontation with the baby, but it doesn't mean that he is not interested. So, certainly, when it is written, or over the phone, he has the control. I think that is the important thing. He can choose whether he puts that phone down on not.*

Simon's parent sensed that the telephone afforded him control over the interaction. The letter and the telephone may both provide some distance. They may also be less distracting, with Simon not needing to look at the other person's facial expressions.

Simon's parent then described his reluctance to go to birthday parties, and that the use of a video camera smoothed the way.

##### 3.1.3 Video camera

*...Simon used to get invited to a lot of birthday parties, and it used to be so difficult, because he didn't want to go. But we thought, we had to get him there, do the right thing, get used to it and all the rest of it. So we used to go through all this to palaver to get him there, and in the end, we said, "All you have to do, is take the present in, be polite and leave. We don't expect you to do anything more than that." And then we took a video camera and said, "We will video you doing it." Well, then he could do it, because he had the motivation, and he would be going there with the present, and he would say, "Are you videoing me mum?"*

Simon is an avid user of video and digital cameras, using them to tell stories and record holidays. The video camera came up again as an alternative to a simple interview for a school project.

*At school, years back, they had an assignment. The kids had to talk to their grandparents and write what they did, but Simon did his on video. His grandparents came up, and he interviewed them, he had a sheet of the questions, and he did a great job! The school was very happy with that. So it was a way of getting him to use his interest, I suppose, in a really productive way. He got good marks at school. He has used video an awful lot, making up stories, Luna Park, for instance, he sets the camera, and he takes the toys to Luna Park on the*

*ghost train... so re-enacting a lot of scenarios, in his own life. Favourite things, I guess.*

The video camera was used at the party as a form of motivation, and possibly as an intermediary, along with a script, in his interviewing of his grandparents. I got the impression that being able to record things provides him with control, some structure and an ability to review.

## 3.2 Case 2

I interviewed two disability support officers and a psychologist at a TAFE (vocationally-oriented tertiary institution). The interviewees described the support of three students, each with Aspergers syndrome.

Here, the psychologist related his use of two common communication tools of young adults, SMS and MSN.

### 3.2.1 SMS

*He is intensely introverted, so he finds it really hard to make eye contact. And he does not have much awareness of social cues and skills. He does not offer lot of himself in conversation, so you say, "What's going on?", "Not much", "What have you been doing?", "Nothing". He doesn't say a lot, but I found it useful... we are doing a few things with him... I was using his mobile phone, first of all to get him to put reminders on there, and we set up an SMS system this year as well, so that I could send him an SMS to remind him about making eye contact with two people today, or something like that. And that has improved. When he comes to see us, he is more aware of making himself do it.*

The SMS enabled the psychologist to provide prompting over distance. The need for prompting by a support person is a limit on a person with an ASD's independence, not to mention the disabling impression that it causes. The receipt of an SMS, on the other hand, is socially invisible.

The psychologist also related his use of MSN with this student.

### 3.2.2 MSN

*We also have online counselling here, we have done that in a way that is in encrypted form, but because he is already a keen user of MSN, I am just using that, not for counselling, but just to engage him, just like meeting him in the corridor, "Hi, how are you going?". We have conversations about anything.*

*Interviewer: So, maintaining a relationship.*

*But also, because it is difficult getting stuff out of them when he is in the room, but he relates fairly well on MSN.*

*Interviewer: So he is more comfortable, in fact through that medium.*

*In some ways I think he is, yes. He does a lot of it with his friends, he was already doing a lot of it, so I thought that I would join in.*

The use of MSN may be providing a safe social distance, which could facilitate the development of a relationship over time. Other interviewees had stressed the importance of a relationship in supporting people with an ASD.

## 3.3 Case 3

The interviewee was an aide for a 15 year old boy with high functioning autism. He has very good reading, speech and exceptional maths. His social skills are poor and he suffers from anxiety and fear of failure.

### 3.3.1 Grey lead pencil

*We also do it in grey lead, so if he makes a mistake, we can easily rub it out... He just says that he finds it difficult to work in class, because he feels like is going to fail, but if he is playing his Game Boy, it has a reset button. So he feels that he has not failed anyway.*

*Interviewer: So the grey lead is a kind of reset button?*

*Yes, definitely.*

The grey lead 'reset button' is interesting as it is a non-technological metaphor for a technology. This is the reversal of a common process of transferring a non-technological concept onto a technology, such as the 'Trash' icon on most desktops. The aide in this case is leveraging a concept that the person is comfortable with; the reset button on his Gameboy.

## 3.4 Case 4

The interviewee was a teacher at a special school, engaged in provision of iPods. The school received funding to buy some iPods for assessing their usefulness.

### 3.4.1 Video iPod

*...the main drive, as it developed in 2006, was social scripts, behaviour modelling in the form of videos, and the PCS, picture communication symbols from Mayer Johnson. Also photographs of the students themselves engaged in certain activities. Now, we would love to go further with the photographs and have sequencing of photographs so that it demonstrated... students love to look at the little screen. I am starting to call it "bright screen learning", because I think it is tapping into our love for looking at television sets, it is a very human thing. and autistic students love looking at it too, iPod screens, computer monitors. But if you are looking at yourself on the screen...*

*Interviewer: It is engaging.*

*... it is really engaging. Because "there is me", and better still, "there is me sitting down at the table, not punching anybody. Mind you, sitting down with my hands on my knees like this. Now look! I am picking up the pen and I am writing. I love it, I am going to watch that again." Showing alternative behaviours. But it's not just about showing behaviours. I can see a future for them, particularly the iPod, for when you catch the bus. You can compare the picture of the bus with the one that is coming, "it is a number 53. That's right... what is it again? I can look back and check that it is number 53... what is again? I can look at the picture again." And as the bus is coming towards me, I can look at the iPod screen, see the 53, look back at the bus... it is a match. The next step could be: how much money do I need? The iPod could show the correct money, it could also show alternative ways to make the correct money. What if the bus doesn't come? The iPod can show alternatives. Maybe I can catch a taxi. So, that is the case for a higher functioning person with autism, who [when encountering a change of routine] might then have to go home and start off their day all over again. In extreme cases: "I have to go back and have a shower now, and have another breakfast... because the day is not right."*

The school has identified iPods as potentially good platforms for a range of DATs, such as the social skills training described above. They are seen to be engaging and motivating.

### 3.5 Case 5

The interviewee was the parent of a 16 year old boy with moderate-severe autism, intellectual disability, language disorder, auditory processing problems and extreme anxiety. Addressing the build up of anxiety was seen as critical.

#### 3.5.1 DJ mixer and drum kit

*He has a DJ mixer. So, with his CDs he can adjust the music, and the tempos, that sort of thing. He has a drum kit. And that is a really sensory type activity, that he really enjoys, he is quite rhythmic.*

*Interviewer: and do you think that you have had benefits from that?*

*Absolutely. Just as a timeout for him.*

*Interviewer: So it helps with anxiety?*

*Absolutely. He can take himself away from whatever it is that is bothering him, and just lose himself in the rhythm.*

This is more than recreation – it is therapy for a highly anxious person. The benefit may lie in control, repeatability and predictability.

His parent also made some observations on his motivation to use technology.

#### 3.5.2 Technologies in general

*I think with technology everything is predictable. He knows that most of the time, if he does something. It will happen. I think for him, [digital assistive technology] is something that would be really useful. And also because his interactions with people, he finds so very difficult.*

Predictability and mediation of interaction appear to be important factors.

Although at the time of interview, he was not using email regularly, his parent had formed the impression that he wanted to communicate and that email may be one medium that would not trigger his anxiety.

#### 3.5.3 Email

*And I don't know whether it is me interpreting it, but there are times when I feel that he really wants to tell me something. You get these little signs, and you think, he would really like to be out in his world, but he wants to be able to do it in a way that he can back off when he needs to, and it is not that physical interaction... I remember the first time that he sent an e-mail from school, and when we got home, I sat down and we opened it, you could see that he was impressed, "Oh, I wrote that!"*

His use of webcam may be a form of debriefing. It does not appear to be fulfilling its common communication role.

#### 3.5.4 Webcam

*...that is another thing with him, he uses the webcam. But he doesn't use it to communicate with anyone else, he uses it to watch himself on the webcam, and talking to himself. He really enjoys that. And he will sit there and have these long winded... and it's all jargon, and things like that. He just loves it. His latest thing, it is into YouTube. He is going through, looking in everyone else's... I hope that they are all appropriate.*

Care must be taken when proposing the role that technologies play when the person themselves is unable to tell us. It is apparent, however, that they can offer qualities that are not found in other interactions.

This boy is highly visual. His ability to process and respond to verbal communication is poor. At times of stress, it

reduces to nil. His parents carry notepaper to communicate at these times.

#### 3.5.5 Incidental notes

*Interviewer: So, now everything is text?*

*Yes. And we can write it, incidentally like, we have notepaper. On the go sort of thing. So we don't need to use the visual photos. But it is still visual. And often what we find, and the difficulty we are having with his placement, is that we are trying to say, "He is not going to understand that unless you write it down. Because the he then it is concrete, and it is real.". When you have written down, that is the way it is. When you speak to him, he doesn't understand, he doesn't pick it up.*

...

*At the moment that is all we have, to write it down, because we can't talk to him when he is like that, he is not going to hear. And it doesn't always work, it depends on how far along the anxiety scale he is. But, it is just a piece of paper...*

*Interviewer: so you tend to carry a piece of paper and pen with you?*

*Yes. Everywhere.*

...

*Interviewer: so the ones that you do on-the-fly, the short explanations...*

*Just read it, then he turfs it...*

*Interviewer: So you give it to him, and he does what he likes with it*

*Yes. When we first started off using them, we used to encourage him to pop it in his pocket. Or I would have in my bag or something, and we could refer to it. But he has matured, he has got to a stage now, or we have come to an agreement I suppose. Between us. That if it is written, then that is okay, I am happy with that and he is happy with that. It is like confirmation for him.*

Something as basic as pen and paper are indispensable tools.

### 3.6 Case 6

The interviewee was the parent of a 6½ year old boy with Aspergers syndrome. He has an excellent vocabulary, described by his parent as gifted, but he is weak on interpreting slang. He has problems with anxiety, social skills and is prone to aggressive behaviour.

#### 3.6.1 DVD

*... and I feel that computer games have helped him a lot with his being able to socialise with other kids. He started Auskick last winter. In the Auskick kit, and they gave him a DVD of how to kick the ball... well, instantly he could do a drop punt, and he would say to me "You hold it like this mum.", you have to do it properly. And he is brilliant at it.*

*Interviewer: So, do you think that he got more from the DVD than if somebody actually stood with him and showed him how to do it?*

*Absolutely. Because he could replay it, he could pause it, and see how they were actually holding the ball, ... so, I think it was absolutely pivotal, with his success in that group environment. And he has just really excelled at football. And he really enjoys it. Because he knows all the rules. And he can tell the other kids, "No, that is a push in the back, you can't do that.", and the other kids are really tolerant, and they accept him. They accept him to be the umpire, as well as a player.*

*He has just started baseball. But the baseball kit, has the drink bottle, the bag, the shirt, the hat,... no DVD. And now he doesn't want to go. He wants to quit baseball. And he is not socialising very well with the other kids while he is there. He is getting up to mischief. Because, he doesn't know the rules. I said to him, "We need to get you a computer game so that you know what to do once you have hit that ball, you know how to hit it properly...", because, if he gets confused, he gets destructive, and starts throwing bats... but if he just knew the rules, could visually see it on a 3-D pitch, that is what he needs.*

*Interviewer: So he can somehow learn it and rehearse it in his head?*

*Yes, and then tell all the other kids how to do it. He wants to be confident.*

The boy in this case did not want to attempt something new unless he knew that he could master it. The DVD allows rehearsal, it is repeatable and pausable.

### 3.7 Case 7

The interviewee was a specialist teacher at a special school. She saw application for minimalist technologies, citing the benefits of something as simple as bubble wrap.

#### 3.7.1 Bubble wrap

*...even a device that provides sensory input to the child to reduce their anxiety.. If they are still in a together enough state to do so. We quite often send kids out with a piece of bubble wrap. It is just something that they keep in your pocket, it is inconspicuous, and if they feel the need they can put their hand in their pocket and pop a couple of bubbles.*

Anxiety can be exhibited in many ways. Self-stimulation can take many forms that are socially problematic. Bubble wrap may be seen as an odd thing to do in public, but this everyday material is relatively benign.

### 3.8 Case 8

The interviewee was the relative of a 13 year old boy with Aspergers syndrome. He was described as gifted and eloquent, however, at times of stress was rendered non-verbal, leading in one instance to his assaulting a teacher.

#### 3.8.1 MP3 player

*For de-stressing we have bought him an iPod. He finds it very useful, on the way home from school when he's really stressed he can play his own kind of music. He likes classical music and that German rock band what's the name. . . it's really hard stuff, very heavy head-banging stuff. So it's quite an extreme the two musics. But he plays his own music according to his need. In shopping malls, he despises shopping malls, especially when it's busy. It becomes quite an issue... She would make him push the trolley, just to keep his mind focussed on something, give him a task to do. And that would work for a while but then he would become impatient, people would get in his way. So now the iPod, he concentrates on the music and keeps out all the other noises. For school, of course, iPods are not allowed in school, he has prayer beads, which he carries in his pocket.*

The MP3 player is playing an important role in reducing anxiety and minimising the impact of the shopping centre environment. Its use by a teenager would not raise an eyebrow.

## 4. DISCUSSION

People with ASD often have a great affinity for technology. It is hardly surprising therefore that I would find interviewees recounting stories of high technology use. Many of the people discussed in the interviews had computers and computer games

high in their list of pastimes. These examples are interesting because the technology is being employed specifically to support the ASD, and they were mostly appropriated by people who work at the 'coalface'; parents, teachers and aides.

There were fewer examples given by interviewees of purpose-built assistive technologies in use. When they were discussed, problems with availability was mentioned as a barrier to greater use. Cost was also mentioned as a problematic (Lightwriter, a text-to-speech keyboard, costs over \$7000). Interviewees also referred to usability problems, such as complexity of interface or difficulties in non-structured situations (such as purchasing a ticket while boarding a bus).

One interviewee, who assisted families and mainstream schools in integration of children with ASDs, commented that many teaching staff failed to grasp the conceptual design of some assistive technologies provided. Such shortcomings resulted in ineffective use, or abandonment of, important tools for integration and support.

### 4.1 Qualities of the technologies

For the people who selected these support examples the technologies are familiar and known quantities.

Many of the technologies, such as DVD, video, iPod, email and SMS allow the content to be processed without the distractions of 'live' interaction. They also possess qualities such as being less controlled by others, persistent, predictable, repeatable, pausable.

One of the principal limitations of support for autism is that, due to the role that people play in support provision, independent living is problematic. The SMS permitted the person remote access to support.

'Puppy', the letter and telephone, MSN and email offer a mediation of interaction that takes pressure of the person with an ASD. Dealing with an inanimate object can minimise distractions (such as the other person's face) that may force the person with the ASD to use precious cognitive resources interpreting. As mentioned by the interviewee in Case 1, these technologies provide control, and the ability to end the interaction at will. The result of these qualities is, somewhat counterintuitively, that richer social interaction may be possible when it is mediated by technology.

Motivation is critical in ASD support. People with an ASD may not respond to social expectations or the possibility of consequences. Motivation of an autistic person is 'all carrot and no stick'. Motivation is also not always easy to identify. For Simon, in Case 1, being videoed did the trick in overcoming his discomfort at attending birthday parties. The iPod is likely to be a more universal motivator, but also apparently highly effective.

Anxiety was a frequent trait mentioned by most interviewees. This leads to many supports that are designed to either avoid the elevation of stress levels, or to help to bring them down from an elevated state. The grey lead pencil is a novel example of the former, and one that interestingly was inspired by the student's wish that life was more like a Gameboy where he could push the reset button when he had made a mistake. His aide then helped him to conceptualise the lead pencil as playing the same role for his schoolwork. The use of the DJ mixer and the drum kit by the boy in Case 5 is a good example of entertainment objects being used therapeutically. The boy in question suffered crippling anxiety that reduced his ability to communicate even with his parents.

It is often necessary to make content specific to the person with the ASD as many lack the ability to generalise. Technologies such as video, video iPod and webcam allow us to put the person themselves in the story.

Commonplace technologies are less disabling than the purpose-built. One interviewee suggested that MP3 players could be a socially invisible platform for the ASD student to review his lessons, "No one would know what they were listening to."

## 4.2 Learning from the everyday nature of mundane technologies

The use of 'found' technologies by people with autism and those who support them can be instructive for the prospective designer. There are lessons in their success for the design of new assistive technologies.

### 4.2.1 Contribution of the support person

The first lesson is to appreciate the abilities of the support network. If people who support a person with autism can select and apply commonplace technologies so skilfully, then what would prevent them from playing a greater role in the selection and design of digital assistive technologies? If there is a barrier, it would not appear to be a technology one. There is little difference in the examples in this paper between the use of digital and non-digital objects. The use of mobile phones and the internet appears little different to the bubble-wrap and the pen and paper. Is the problem one of ready access? Do they need time to acquire mastery of the technology in question?

### 4.2.2 Repositioning the designer

There are benefits for designers in enlarging the role of the support person in design. In doing so we may allow for better management of the complexity inherent in working with people with ASDs. One approach is to become agnostic, try to minimise our impact on the setting and allow the prevailing relationships (social order and ethics) to function. This may not be the cop-out that it first appears, relationships are complex and the care settings are managing complex and uncertain issues as well as they can. If we introduce a new technology, or propose a new use of an existing technology, then we must make a choice whether we take on the full responsibility for the changes that will flow from it, or we take pains to make as little impact ourselves and allow the user and their support people to select and progress at their own pace. This approach may be harder to sell, in terms of immediate, measurable results, but may prove to be a more naturalistic approach. The results may be more persistent and the negative impacts more easily foreseen by support people and managed by them.

### 4.2.3 Foreseeing and managing effects

One of the problems encountered in the complex world of ASD support is being able to anticipate the impact of a new support. While this is never easy, by employing technologies that are familiar to the person with the ASD, the support people and others some adverse effects may be avoided.

### 4.2.4 Familiarity with mundane technologies – a mixed blessing

One of the benefits mentioned earlier is that mundane technologies are socially neutral, or even 'cool'. One possible disadvantage of familiarity is that those using the technology need to see its new purpose in order to effectively support it.

One of the applications for the iPod that the interviewee in Case 4 described was the mapping of an existing use of PCS symbols on to the iPod. So that is a "model" of how they can be used. Another "model" that could be applied is that of the computer. Presume that you have desktop computers that you run software for the children currently, for literacy, social skills development, and the like. So, the idea of taking "computing type" uses over to the iPod is another way of conceptualising its use. Another area for the iPod can be for as-yet unsupported needs. So, if we were to categorise the iPod, you could do it by the way in which it is being used. For example, putting PCS symbols onto it makes it an electronic PCS display; by putting social stories on it makes it an electronic social story reader; by putting the snippets of animation for social modelling onto it, it is moving closer to a mobile computer application. So, one way to look at it is to simply define it by its hardware; it is an iPod, but another way of looking at it is to define it by the applications that are found for it, or are possible for it. In Case 4 the staff involved in its introduction saw the iPod as an exciting platform for many supports, however, the early evidence from the classrooms was that teachers saw it as an iPod, with which they were familiar as consumers. Their use of it as a highly motivating reward for their students can be understood in that light. When appropriating familiar technologies for use as assistive technologies, it may be necessary to re-conceptualise them to ensure that they are understood and used as they are intended. This can be contrasted with the observation of another interviewee who noted that many staff in mainstream schools had poor understanding of the assistive technologies that were provided and therefore either underutilised them or inappropriately.

## 5. CONCLUSION

This paper has described some uses to which everyday technologies have been used in support for people with autism spectrum disorders. Some of their qualities are:

- They are available and accessible.
- More likely to be socially neutral, even sometimes 'cool'. Their support function may be invisible to peers and others.
- Most do not have the high impact on their daily lives that a dedicated, novel technology may have.
- They are uncomplicated. They do only a limited number of things. They are not attempts to provide complete care.

These examples also provide insights for technology designers:

- The users and their support people selected the technology and chose the use. This is not always the case in autism support.
- They are more accessible to support people. In terms of already being in the environment.
- In terms of being known quantities, their properties are well understood.
- Get the support person's hands on it.
- Be conceptually obvious, no black boxes.

Designing DATs for and with people with ASDs is seen as problematic. It is clear that members of the support network possess the knowledge of the individual and of the disorder but any role for them beyond passive informants has yet to be studied. The demonstrated ease displayed and apparent success of these examples suggest that the technology aspect per se is not a barrier to their assuming a greater role in the design of digital assistive technologies.

## 5.1 Future work

The selection and application of these technologies (appropriation) by support people indicates that they possess skills in technology that they are less able to exercise in deliberate design or dedicated assistive technology projects. Such projects would likely put them in a position of weakness, disempowered by a lack of familiarity and ownership. The next phase of the research on which this paper is based will explore the skills possessed by the support person that are relevant to the design of digital assistive technologies. It can be seen from the examples of technology application in this paper that the task in developing new methodologies that permit greater participation by this group will lie in the identification and minimising of barriers to participation inherent in the methodologies themselves, rather than in the fact of technology use per se.

## 6. ACKNOWLEDGMENTS

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