



**Virtual platforms and technology in the use of serious
games for people on the Autistic Spectrum**

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I. Introduction

iSpectrum aims to improve the work-based social interaction skills of people with autism, Asperger syndrome and other related special needs through a virtual work environment serious game to increase their chances of gaining employment.

iSpectrum is funded through the Leonardo programme and is part of the Leonardo Transfer of Innovation stream (TOI), which supports the development of skills and training. Leonardo is part of the European Commission's Lifelong Learning Programme.

The aim of TOI is to improve the quality and attractiveness of the European Vocational Education and Training (VET) system, adapt and transfer best practice and innovation in VET to new contexts, produce tangible products and integrate results into training systems/practices at geographical, sector and organisational level.

This report will examine Autism and employment, the use of games and virtual environments in education and training, look at proposals for the iSpectrum project, including its release platform and aspects of the in-game environment, and make recommendations for the final version.

II. Autism and employment

In the UK today, there are 332,600 people of working age with diagnosed Autism spectrum disorders (ASD); as few as 6% of them are in full-time employment. Across Europe, there is a similar situation: in Bulgaria there are at least 15,035 people with ASD, 116,114 in Italy and 164,849 in Germany. Throughout the European Union, the unemployment rate among people with ASD is believed to be over 90%: well over half a million people in these three countries alone are not only missing out on employment, but missing out the independence and self-esteem benefits which come with employment.

Under current arrangements ASD sufferers do not contribute to the economy as much as their potential would suggest; their ability to be involved in satisfying and beneficial employment is held back by their lack of educational progress, and the potential for their personal life improvement is hindered by the lack of employment and learning opportunities.¹

These grim figures do not do justice to the potential of people with ASD to undertake many vocational options. In *The Undiscovered Workforce*, available from the National Autistic Society careers service, Prospects, the following suitable employment types are listed:

- Tasks where attention to detail and accuracy is required
e.g. research work, data input or word processing
- Tasks involving numbers, statistics and facts
e.g. finance or accounting
- Tasks where there is a clear procedure to follow
e.g. dealing with incoming and outgoing post, archiving, library work or filing
- Highly structured tasks with a right and a wrong way of doing something
e.g. IT support, computer programming or systems testing.²

The document does caution against generalisation. As one online commentator observes, "It's true that there are a lot of capable autistic people in IT, and that many have an aptitude for working with computers. However, no form of autism guarantees computer skills."³ Although the popular stereotype exists of the 'autistic computer geek', people with ASD are as individual and distinct as those without and, conversely, outdoor occupations are often very suitable.

ASD and outdoor work case study – volunteering with the RSPB

David Crew (38) suffers from both epilepsy and Asperger syndrome. He began volunteering at the RSPB following a difficult period of unemployment and bouts of depression. "I like outdoor work but had spent several months in my house not really mixing with other people."

David has been volunteering at RSPB Rye Meads nature reserve for over three years, and does a range of physically demanding tasks. He credits this with building up his strength as well as his mind, saying he has never felt this fit. "I can also feel myself getting fitter and stronger and this all adds to my confidence," he says.

"Volunteering at the RSPB has completely changed my outlook and given me a new focus, making me feeling better both mentally and physically."

<http://www.rspb.org.uk/volunteering/about.aspx>

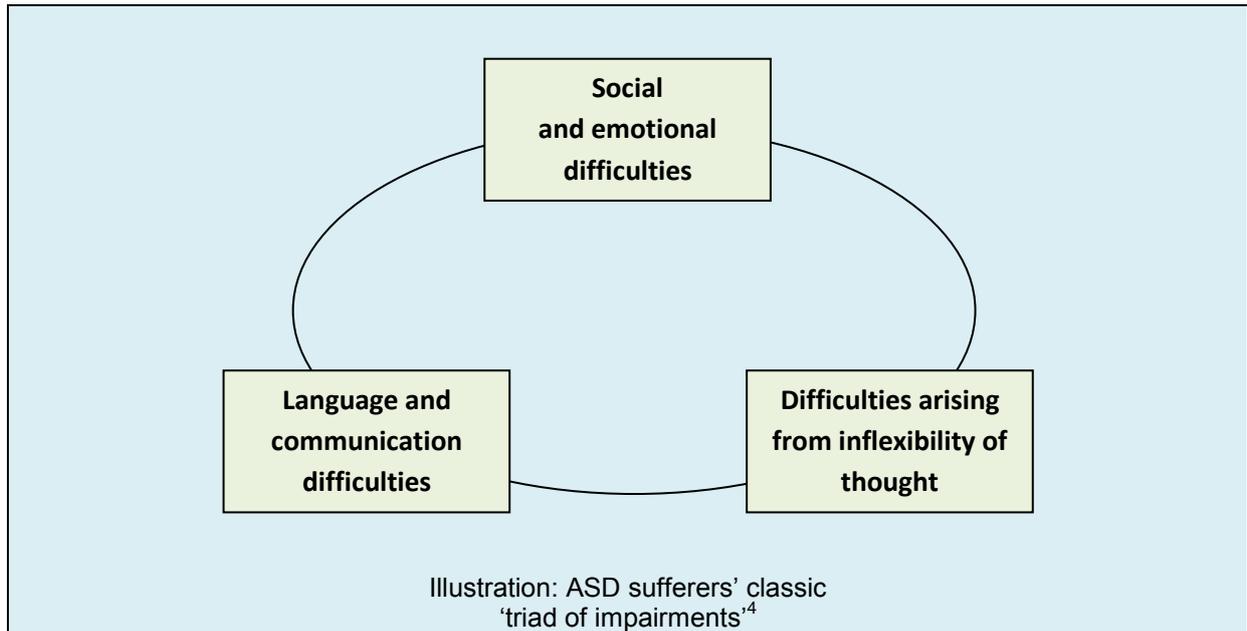
The popular consensus seems to be that the problem is not so much a limited ability to do jobs as limited opportunities to find the most appropriate jobs. People with ASD often struggle with social interactions which can be problematic in the work environment, but also presents obstacles to a

¹ <http://www.bera.ac.uk/blog/2011/02/15/autism-in-education-learning-employment-conference-2011/>

² The undiscovered workforce: looking for staff <http://www.autism.org.uk/~media/NAS/Documents/About-autism/Autism-library/Magazines-articles-and-reports/Reports/Our-reports/The%20undiscovered%20workforce%20-%20looking%20for%20staff.ashx>

³ <http://www.elmindreda.org/reflections/doesnotmean.html>

successful interview where the emphasis is on making a positive impression in a face-to-face encounter.



When researching the number of people across Europe recorded as on the Autism spectrum, the conclusion is that the barriers to gaining employment are high. While there are interventions in some European states to assist with interview techniques (although this is not the case in Bulgaria) there is no general or easy way to prepare people with ASD for job interview situations: gaining 'interview experience' and the experience of going to job interviews and repeatedly being refused employment seems prohibitively demoralising.

Simulating interviews through role play is also problematic as difficulty with imaginative activities is a classic facet of Autism. In traditional interview role play being asked to imagine that a familiar room is an unfamiliar office and an established acquaintance is a stranger being met for the first time can cause confusion.

The advantage of making the simulation in a virtual environment is that it will be different to, for example, the tutor or support worker's office. However, the consensus from VETPROs⁵ and people with ASD is that simulations can be helpful if it is clearly explained that the simulation is only an example of what can be expected and the actual office or work place that they will go to will differ in some aspects.

⁴ It should be noted that individuals with Asperger syndrome also have difficulties with gross and fine motor skills and organisation, as well as fears and phobias which can have a profound effect on their daily life
<http://www.autism.org.uk/working-with/education/educational-professionals-in-schools/breaking-down-barriers-to-learning/asperger-syndrome-the-triad-of-impairments.aspx>

⁵ Glossary of terms - Leonardo
<http://www.leonardo.org.uk/page.asp?section=00010001002300110009§ionTitle=Glossary+of+Terms>

III. Games and education and training

Gaming and education case study: Channel 4 Education

The development of the worldwide web revolutionised C4 Education's approach to delivering content. Whereas before content was delivered via TV slots (ironically, at times when the target audience was either in bed or at school), web content is accessible at any time and offers greater interactivity and engagement.

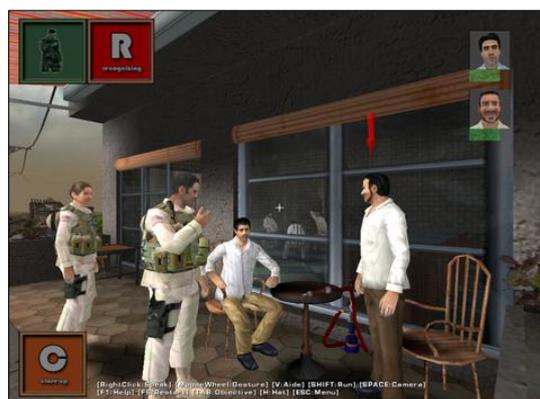
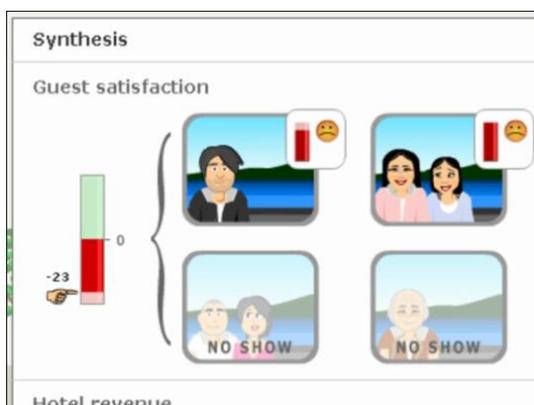
Channel 4 Education commands a respectable budget and contracts games from independent developers, addressing issues such as citizenship, civil liberties and sexual health. Their work has been recognised by the British Interactive Media Association and their current rollout of games includes some projects for dedicated gaming platforms.

A backhanded compliment to the success of Channel 4 Education's material was the pirating of some of its game content. Interestingly, they were not unduly upset by this, as it meant their content reaching a wider target audience, although they conceded it did affect the completeness of data gathered via their official website.

<http://www.agent4change.net/resources/online-services/636-sex-pirates-and-bloody-foreigners-channel-4-onlin-e.html>

Games provide a safe place to practice, where learners know they will not be penalized or stigmatized for their mistakes. There is also a low physical risk to the learner, and of course there is no risk to patients or others. Playing games can be a safe place to try different approaches, to experiment, and most importantly to make mistakes and to fail.⁶

Anxiety about mistakes and their potential consequences is very demoralising for people starting jobs, which is why a simulation or a serious game can prove a very effective tool in readying people for the workplace. These platforms provide trainees and learners with a 'sandbox', a space where they can develop and rehearse the skills needed without the fear of serious mishap. The classic example is that of aviation simulators being used to train pilots, but there are examples of the principle being applied in a variety of other situations.



The two serious games shown here are *Rooms Management*⁷ (left), an environment for trainee hotel staff and *Tactical Language Training*⁸ (TLT), a language training tool for teaching Arabic dialects to American military personnel. Both provide feedback on the users' performance and likely outcomes: in the left-hand image, guests are represented as being dissatisfied by a 'sad' face. In the TLT screenshot, there is a 'trust meter' in the top-right corner to show locals' responses to the servicemen. In a dynamic real-world environment, the hotel might lose business and the servicemen could be putting themselves in a dangerous situation. Likewise, an inexperienced employee with Autism could easily run into difficulty in the workplace which might be avoided with a little 'hands-on' practice.

⁶ Serious Games: Why use games for training? <http://thedesignspace.net/MT2archives/000632.html>

⁷ <http://www.betterhoteltraining.com/HT/login.aspx>

⁸ http://www.isi.edu/isd/carte/proj_tactlang/

IV. Games and virtual environments and Autism

Connections between ASD and gaming are well documented. In 2008, Dr John Charlton of Boston University announced research at the British Psychological Society's annual conference in Dublin suggesting that gaming addicts were exhibiting similar behavioural traits to people with Asperger syndrome⁹.

- Flat, or blank expression much of the time
- Being "in their own world" / Preoccupied with their own agenda
- Single-mindedness
- Limited interests / Intense focus on one or two subjects
- Lack of interest in other people

In essence, Dr Charlton simply observed that gaming addicts and people with Asperger syndrome exhibit similar traits, whilst having two entirely unrelated conditions. That some people with ASD enjoy playing computer games is an advantage but there has to be some element of the game that encourages the player to take breaks and to discourage obsessive game playing.

ASD and computer games case study – PEPS-C

Scientists at Queen Margaret University College, Edinburgh, developed a computer aid to help autistic children overcome communication problems. The game-style test aimed to highlight comprehension problems for autistic children. The test, known as PEPS-C, resembles a computer game with 12 sub-tests. It was trialled on 30 children with Autism. Children heard a phrase and touched the picture on the screen which they believed matched it.

QMUC researcher Joanne McCann said: "The phrase 'chocolate biscuits and jam' can be said in a way which suggests three items, 'chocolate, biscuits and jam', or in a way which suggests just two items, 'chocolate biscuits and jam'.

"Children with Autism can find it difficult to pick up whether a person is happy or sad from the tone of their voice. In the affect test, they hear the computerised voice say a type of food in a tone suggesting the person either likes or dislikes it, and they have to point to a happy or unhappy face on the screen."

Robert McKay of the National Autistic Society Scotland said: "It is interesting that the test is computerised as we know from experience that children with Autism can perform better using computer-based learning aids."

<http://edinburghnews.scotsman.com/scitech/Game-makes-autism-studies-childs.2462572.jp>

It is worth noting Mr McKay's statement: *We know from experience that children with Autism can perform better using computer-based learning aids.* There is a great deal of precedent for the use of serious games with Autism, albeit mostly with younger children. One of the most popular applications for serious games / virtual environments with Autism is the use of games to develop facial recognition.

Difficulty identifying someone's face and divining their mood or intentions from facial cues are characteristic problems of people with ASD. One example of a game environment used to counter this is *Let's Face IT! (LFI!)* a project by Dr James Tanaka of the University of Victoria, Canada.

*The program is a series of games that involve distinguishing faces from other everyday objects, attaching labels to facial expressions and interpreting the meaning of facial cues in a social context.*¹⁰

⁹ Distinguishing addiction and high engagement in the context of online game playing

http://api.ning.com/files/VB7iLrlel209u-wYc7c*XJ7CUwe9mp2bbvwQzi17AEB9aNQ1Tsc6Bwg9qsvx*GJ45NkqDP1kg8JtCYCOeTh1OkubAWNj4u5j/CharltonDanforth>AddictionEngagementPaper.pdf

¹⁰ <http://communications.uvic.ca/edge/tanaka.html>

Children in the face training group improved their analytic face recognition (looking at individual features such as the mouth) and holistic recognition (looking at the face as a whole).

Another system went further, allowing users to influence the on-screen expression through their own actions. Researchers in California used a tactile robot (named 'Pluff') covered in fur as an input device, with a corresponding avatar on screen:

*[Participants] continued to touch and hug the controller throughout the session in order to maintain his elevated mood. If Pluff was ignored or jostled too hard, his mood declined and the children quickly tended to him to elevate his mood.*¹¹



Image: the 'Pluff' controller

Although the tactile controller sounds much like a 'cyber pet', the aim of the project was to develop the participants' social skills, including turn-taking and joint attention, which the accompanying study describes as 'core deficits' of the Autism spectrum.

ASD in virtual environments case study: Brigadoon – a haven in Second Life

Second Life is a hugely popular online virtual world. Second Life users (residents) are represented in the online world by avatars and can interact with one another and explore the virtual environment.

Within Second Life, John Lester, a former IT director at Massachusetts General hospital's neurology department, created an island called Brigadoon as a location for people with ASD to meet, interact and socialise.

Unencumbered by the real-world consequences of unsuccessful social interactions, users are able to 'come out of their shells' and express themselves more freely in the virtual environment.

"People dealing with Asperger's or Autism sometimes have real difficulty in social situations, and are often filled with great creative ideas," said Lester. "Brigadoon gives them a place to socialise and to build and create their own world."

<http://www.guardian.co.uk/society/2006/mar/08/guardiansocietysupplement1>

¹¹ SMART-Games: A Video Game Intervention for Children with Autism Spectrum Disorders, Gotsis, Hughes, Piggot & Stone http://delivery.acm.org/10.1145/1820000/1810569/p194-gotsis.pdf?ip=193.61.104.66&CFID=28477444&CFTOKEN=56273855&_acm_=1307965997_d14afc83d577101eb65f7f77cc82a66d

Virtual environments and Autism

People with ASD often struggle with imaginative activities. They take a very literal view of the world. Training through role play (asking someone to 'imagine' they are at an interview) may fall foul of this. A virtual world environment gives a clear visual representation of what is happening.

One of the most influential works on using virtual environments with ASD is *Virtual reality for the treatment of Autism* by Dorothy Strickland.

Autism and attention disorders involve abnormal stimulus response to the external world. Virtual reality offers the potential to regulate an artificial computer environment to better match the expectations and needs of individuals with these problems.

Strickland identified the following aspects of virtual environments which made them suitable for application with people with ASD:

- Virtual environments can be adapted
- Small changes between scenarios can improve generalization
- Mistakes in a virtual world are of less consequence
- A virtual world stresses visual and auditory stimuli rather than touch
- Interactions are simpler than in life

A cautionary note is that, while the virtual environment should provide a 'sandbox' for individuals to practise work-based social interaction without fear of catastrophe, for the purposes of generalisation and individuals to extrapolate the lessons of the serious game to the wider world, it does not make sense to wrap users in too much cotton wool – the aim of the iSpectrum project is to provide a gateway rather than a sanctuary.

V. The iSpectrum platform

Accessibility

In order that iSpectrum be available to the widest possible user base, it follows that the game should be accessible:

- a. At the very least, on the most widely available platform
- b. If possible, in a format allowing it to be accessed via various different platforms

In terms of platform availability, the standout option is the ubiquitous PC, which can be found in most households. Also worthy of consideration are the current generation of dedicated gaming platforms (PS3, Xbox 360, Wii).

Against the gaming systems, there is the immediate issue of cost. Even if iSpectrum were distributed to the platforms in an electronic format (e.g. via Xbox live) rather than as a 'hard copy' (disc), the manufacturers charge a licensing fee for software releases to their systems. Furthermore, as the platforms use proprietary formats, a game produced for one system cannot be played on another. In essence, to release to two systems, two games would have to be made.

The PC, likewise, is not without compatibility issues. While the overwhelming majority of PCs use Windows, Apple's Mac OSX has a significant market share and open source OS (i.e. various distributions of Linux) are growing in popularity. While applications for each operating system cannot be used on another without some form of emulation, all are united by the worldwide web. It makes sense that a game designed to be accessed through a web browser will be available to users regardless of operating system.

Another happy outcome of releasing iSpectrum via the web is that it becomes, in theory, available to users on contemporary gaming platforms: all three are – or can be – loaded with Flash-enabled browsers, creating the possibility of users accessing iSpectrum through a dedicated gaming platform. As a note of caution, a cursory visit to online forums suggests that games console web browsers are not as reliable as standard PC browsers. However, if the opportunity exists for the game to reach a wider audience, it should definitely be explored.

Browsers and platforms

The most popular browsers, therefore the ones most users would access iSpectrum through, are:

Microsoft Internet Explorer – all machines loaded with Windows
Mozilla Firefox – cross-platform, available for Windows, Mac and Linux
Google Chrome – cross-platform, available for Windows, Mac and Linux
Apple Safari – available primarily for Mac, but also Windows

More specialised browsers should not be overlooked: if iSpectrum works on these browsers, it expands the scope of the game beyond PCs and onto dedicated gaming platforms.

Opera – available cross-platform for PCs, also the basis of the Nintendo Wii browser
MCE – browser for Microsoft Xbox 360
PS3 browser

Getting iSpectrum onto games consoles should not simply be regarded as a 'novel extra' – these systems are increasingly viewed as a valuable tool for working with Autism. The best example is the Wii and its movement-based control system. Many parents have commented that the Wii has been invaluable in getting their children to exercise and this has particularly been the case with children with ASD who previously lacked motivation.

With the other major console players also providing movement-based control (Xbox Kinect, Playstation Move) and the buzz about using games consoles with SEN growing, the potential of dedicated games systems will hopefully continue to gain recognition.

To apply this to the iSpectrum project, while using movement-based input doesn't seem feasible or even well suited to the game's concept and goals. During the project lifetime the budget would not allow development of the game for these platforms. However this could be part of the sustainability plan or an aim to explore options for another project using such technology. It would be beneficial to develop the game for the Wii, a system liked and trusted by youngsters with ASD, their parents and professionals. It would also give iSpectrum more of a chance of luring in 'hardcore' gamers.

File size is also an accessibility issue: the larger the file, the greater the data transfer time. C4 Education commented that one major part of their online content development process is reducing applications to the minimum possible size. Waiting for bulky files to load is a slow, frustrating chore and could become a deterrent to players. Where it is possible to reduce data transfer time without compromising quality, this should be done to promote engagement.

Input / control methods

In terms of how the virtual environment should be experienced, previous research on the subject would seem to suggest that accessing the virtual environment via a standard computer desktop is preferable to a more 'immersive' solution, such as a virtual reality headset.

In *Virtual Reality for the Treatment of Autism*, Dorothy Strickland noted that "Many children with Autism, including the ones chosen for this study, object to hats or helmets being placed on their heads."

The VR helmet used in the experiment weighed over three and a half kilograms. Kerr¹² commented on Strickland's experiment: "Overall the helmets were not popular at all. Desktop environments would solve this problem and can still give a feeling of subjective immersion, especially for visual search tasks."

Kerr also observes that a desktop environment solution is more widely accessible in terms of cost.

Special Educational Needs and dedicated games platforms case study – the Nintendo Wii

The Wii was released at a time when Nintendo appeared to be losing out in the dedicated gaming platform market to Sony and Microsoft. Thanks to its novel movement-based control systems, the machine proved a big hit with gamers and, with titles like *Wii Sport* and *Wii Fit*, the Wii gave the lie to the age-old wisdom that video games make people unhealthy – a major coup for Nintendo was gaining the NHS Change4Life endorsement. News stories circulated about the Wii being used for PE lessons in schools in order to engage students with poor self-image.

In November 2009 *Special Children Magazine* published an article on the use of the Wii at Dorin Park, a specialist SEN school in Merseyside. As well as countering physical and motor skill problems, the school's teachers stated that playing Wii sports had a very beneficial effect for children's self-esteem and social skills. The children loved playing computer games **and** playing sports, doing what average youngsters their age were doing. Furthermore, the presence on the screen of the Wii Me (an avatar representation of the player) facilitated children's turn-taking and sharing skills. Even when players weren't participating, their avatars remained on screen in the background, cheering and clapping, prompting their real-life counterparts to do the same.

¹²Developing Scaffolded Virtual Learning Environments for People with Autism, Steven John Kerr
<http://etheses.nottingham.ac.uk/1559/1/KERR-PHD-THESIS00091179.pdf>

VI. The serious game environment

An online survey was conducted with mock-up images of the in-game environment for the proposed game in the iSpectrum project. Respondents were invited to rate aspects of the prototype game environment on a numeric scale and also to supply their own comments.

The survey will be the subject of a comprehensive report from the Innovation in Learning Institute at the University Erlangen-Nürnberg. It was conducted in German, Italian, Bulgarian and English, respondents included people with and without ASD including professionals who work in the field of Autism; the comments and feedback below, from the English language version of the survey were echoed by several respondents.

The interview / job centre



Illustration from the 'job centre' section of the survey

Respondents were generally quite dubious about the job centre employee, citing his serious demeanour and lack of eye contact.

Change the interviewer face to show a more welcoming stance. He looks scary to me and I'm not autistic!

The interviewer looks stern and is not looking at the interviewee.¹³

Many were also critical of the 'IT' job option picture (left side of wall), stating that it needed a more clearly visible IT context rather than a potentially misleading picture of a typical meeting. Some commented that users would be daunted by the prospect of too much 'face-to-face' interaction in the job setting and would therefore be more likely to select the less gregarious 'outdoor' option.

The third picture, on the right-hand wall, was criticised as a distraction and the possibility that users would interpret it as a third job offer and try to select it.

Many respondents queried the system of rewarding users with coins for opting to attend an interview. The general feeling was that this was unrealistic and potentially an issue as it might be interpreted literally by users who would subsequently expect to be paid for attending a 'real life' interview:

I don't understand why you earn coins for attending an interview? I would prefer to see a reward related to experience or confidence. I think there is a danger that this is feeling a bit patronising.

¹³ Sample responses from the online survey

At this early stage, the idea of introducing coins is misleading. It could potentially lead to big assumptions/misinterpretation that the user is paid every day for turning up for work.¹⁴

The 'all-white' environment

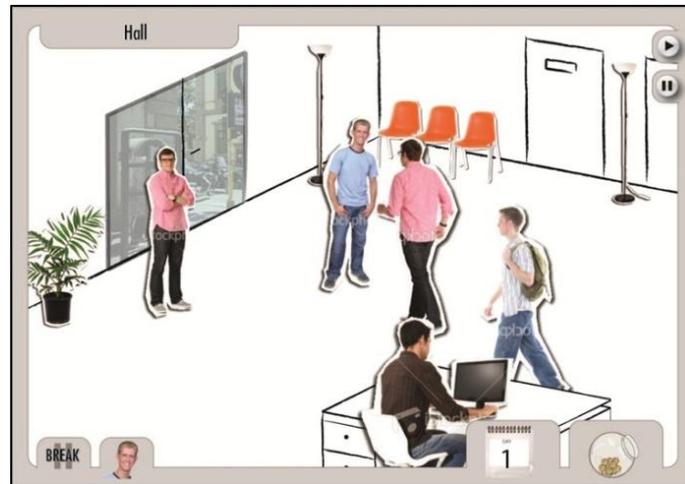


Illustration a mock-up of the office environment from the survey

Many respondents criticised on the 'whiteness' of the game, albeit on two levels: one was the 'clinical' atmosphere of the office.

I think the wall should be beige or some other colour so the desk and people stick out more

I think the environment should look more realistic - I have never seen an advisors office look so clear, clean and uncluttered or light and white.¹⁵

The other was the question of ethnicity as all of the characters included in the mock-up were white. Respondents commented that this was problematic because it gave a misleading expectation of a workplace environment but also because it meant that users with different ethnic backgrounds wouldn't be able to choose somebody that looked like them.

Gender and racial mix, people generally like to select people that look like them. This could cause some frustrations for some users

I think one of the characters skin tone should reflect mixed race, lest the scene be deemed a "whites only" arena.¹⁶

Respondents also commented on a lack of gender diversity in the game, although one such comment did concede that ASD is primarily a male condition.

¹⁴ Sample responses from the online survey

¹⁵ Ibid.

¹⁶ Ibid.

The 'recreational' video game:

The prototype game included a short game within it to provide light relief and fun during planned "breaks". The image below shows a break time choice: the player can opt for a cup of coffee or play the 'game within the game'. Here, however, is a problem: are players likely to fixate on the short videogame and lose interest in the wider virtual environment?

A person with Autism, once logged on to a video game may well lose all sense of time and not be able to return to work.¹⁷



In current educational game development, the learning content and the gaming content are too often separated. If gameplay is presented as a carrot-on-a-stick or a reward for succeeding at the learning content, not only is immersion broken, but the learning content appears to players as an impediment to gameplay, not as engaging in and of itself.¹⁸

A fair number of respondents expressed surprise that an arcade machine was included at all, describing this as unrealistic. Some alternatives proposed were a handheld video game or playing basic games on a desktop computer (e.g. solitaire).

There was a mixed response as to what the nature of the game should be: whether it should be work-related to help the users' focus on activities or whether it should be a purely recreational game provided as a break from work.

Autism associated difficulties

Another possible issue for the virtual environment is text and whether/how to use audio or screen readers: people with Autism often have related issues such as dyslexia, which would make text-heavy elements of the game difficult. If audio accompaniment is possible, that would be a definite plus. However, this may swell the file size of the game and hence reduce engagement (see above).

Alternatively, Flash games can use screen readers. Unfortunately, not all screen readers work the same way so while the game may be functional with some, this may not be the case with others. Therefore, if a screen reader option is required, we need to play test the game with screen readers and find one that works, ideally covering as many platforms as possible.

¹⁷ Ibid.

¹⁸ Not-So-Serious Games: Digital Education through Entertainment Game Design, Monica Evans <http://www.inter-disciplinary.net/wp-content/uploads/2011/04/vq2ever13103111.pdf>

Generalisation and goals

One recurring theme when trawling through the wealth of online content about Autism education strategies is that of *generalisation*: the learner struggles to apply the skills/lessons learnt in a controlled environment to the wider world.

On a similar note, care should be taken that the game is geared towards its final objective: getting people in employment – not simply be a game for its own sake. While it is necessary for it to be attractive as a gaming experience and to incorporate some elements of challenge and reward in order to engage users: the objective is that the game should be a pathway to the ‘real world’ rather than a refuge from it.

Despite their growing sophistication and an increased acceptance by educators, there is still a considerable stigma attached to educational games. For players, educational games are often assumed to be boring, clunky, and ‘no fun’; for many educators, these same games are still mistrusted on educational grounds, as the actual teaching process is often hidden in the underlying game system.¹⁹

Realism

Although one of the keys of the project is to provide users with a more controlled, predictable version of a working environment, care should be taken that the environment is not too predictable, otherwise users may start taking shortcuts, especially when repeating tasks.

This outcome was observed when testing a virtual environment for people with ASD at Nottingham University. The aim of the virtual environment was to confront users with potentially awkward social situations they might encounter in real life. In this case, the user was looking for an empty seat in a virtual café:

Repeated behaviours were displayed such as approaching the tables in the same order, knowing exactly where the empty table was and selecting the same questions. In the hard level, many users did not even bother to look around the room to find an empty table as they had remembered from the previous week that there wasn’t one on this level.²⁰

Obviously, such rigidity does not translate well to a real-world environment, so the virtual environment needs to encourage more flexibility. While the overall virtual environment structure should remain constant, small differences should be introduced, such as varying the location of some items, to prevent users from just ‘drifting’ through a task in the fashion described above.

Another realism issue is that the virtual environment should not promote unrealistic expectations of the workplace. In other words, the virtual workplace should not be more ‘Autism friendly’ than would be the case in real life.²¹ The stated aim of iSpectrum is to increase users’ chances of employment. While, ideally, users will have the chance to find employment at some future date in a well designed ‘Autism friendly’ workplace, the reality is that this is far from guaranteed and the serious game should be designed with the aim in mind of preparing users for the challenges of the workplace and equipping them with skills and strategies to overcome them.

¹⁹ Evans

²⁰ Kerr

²¹ iSpectrum: Advisory Group Meeting in Erlangen, Germany, 19th April 2011

VII. Conclusions and recommendations

Good gameplay does not come from the game graphics, but from the continual decision making and action that engages the learner and keeps him or her motivated to continue... An important aspect of game design is ensuring that users experience a proper level of challenge.²²

From the sobering statistics at the outset of this report, it is clear that there is much room for improvement in getting people with ASD into paid employment internationally. While there are initiatives in place and often a genuine desire to work and earn on the part of individuals, there are numerous barriers to their gaining work.

This is in part, no doubt, due to the inevitable but regrettable stigma surrounding Autism spectrum conditions, but there is also the matter of overcoming social awkwardness and interviewing successfully, followed by a transition to the workplace where further social interaction must necessarily follow. The iSpectrum project could prove an invaluable tool in enabling people with ASD to gain employment and, with it, greater independence and self-esteem.

In light of the material covered in this report, the following points are recommended for the iSpectrum project:

1. The game should be compatible with non-specialised, widely available equipment and, if possible, across a range of platforms. The very least is that the game should be ready to play on a 'garden variety' PC. A web-based game is the best option for portability and accessibility.
2. The game should be tested across a range of browsers on different operating systems and platforms, including current generation games consoles.
3. The game should include a mix of character types of different gender and ethnicity. This should not only include the 'backing cast', but also giving the user to select their own avatar to match their own gender / ethnicity as closely as possible.
4. While routine is essential (not just to people with ASD, but to any normal workplace) provision be made to prevent users from 'autopiloting' through parts of the game which involve repeated activities. Subtle changes to location of items, etc, might help prevent complacency.
5. As users are likely to interpret things very literally, care needs to be taken about every aspect of the game that might be liable to misinterpretation. Examples of this include the pictures that are used to convey job options (i.e. The overly sociable IT picture) and the issue of payment for attending an interview which may give the player unrealistic expectations.
6. The game should include audio or any other non-ambiguous cues in order that users with dyslexia or any other Autism-related difficulty should be able to use it with ease. This may include task instructions and feedback.
7. Consideration should be given to whether the break time video game option is a realistic addition. If not, perhaps an activity on the in-game desktop computer might be a sensible replacement.
8. Users may need help in supervising their game time. While the game should be engaging, there needs to be a check on 'too much' or obsessive game playing.
9. Not least, the iSpectrum serious game be recognisably a game, complete with all that entails: challenge, frustration, reward and fulfilment.

²² Serious Games for Language Learning: How Much Game, How Much AI? W. Lewis Johnson, Hannes Vilhjalmsson, & Stacy Marsella
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