



**Doctorate in Educational Psychology (DEdPsy)**

**2015**

**A Video-based Virtual Environment for Teaching Social Skills  
to Adolescents with Autism: In Search of Generalisation**

**Owen Rhys Barry**

## Declaration

This work has not been submitted in substance for any other degree or award at this or any other university or place of learning, nor is being submitted concurrently in candidature for any degree or other award.

Signed ..... (candidate) Date ..... **15/10/15**

### Statement 1

This thesis is being submitted in partial fulfilment of the requirements for the degree of DEdPsy.

Signed ..... (candidate) Date ..... **15/10/15**

### Statement 2

This thesis is the result of my own independent work/investigation, except where otherwise stated. Other sources are acknowledged by explicit references. The views expressed are my own.

Signed ..... (candidate) Date ..... **15/10/15**

### Statement 3

I hereby give consent for my thesis, if accepted, to be available online in the University's Open Access repository and for inter-library loan, and for the title and summary to be made available to outside organisations.

Signed ..... (candidate) Date ..... **15/10/15**

### Statement 4: Previously Approved Bar on Access

I hereby give consent for my thesis, if accepted, to be available online in the University's Open Access repository and for inter-library loans after expiry of a bar on access previously approved by the Academic Standards & Quality Committee.

Signed ..... (candidate) Date ..... **15/10/15**

## **Abstract**

A novel video-based virtual environment was employed to facilitate social skills training with a group of 18 adolescents with autism. Verbal, non-verbal and paralinguistic skills were taught in the simulated social scenario of ordering at a café counter. Skill generalisation was promoted through explicit cognitive, affective, behavioural and environmental teaching strategies. A waitlist control design was employed. Data were gathered through structured observations in a natural café setting and through questionnaire measures to parents and teachers, pre- and post-intervention. The results revealed that the intervention group's observed social skills improved significantly, in comparison to the control group's. All participants' observed social skills in the target scenario had improved following exposure to the intervention and these effects were maintained one month after the intervention ceased. This research provides support for the further study of VEs for teaching SST to children and adolescents with autism. The implications for the teaching strategies employed to promote generalisation in SST programmes are discussed and future directions are proposed.

## Acknowledgements

There are several people that I need to thank as this research relied on the generosity, help, and voluntary time of my friends, family, and colleagues.

Firstly, I would like to thank the pupils involved in the project. Their energy and enthusiasm for the intervention was fantastic. I also need to express my gratitude to all the staff at the Centre for their organisation and co-operation during some challenging café trips.

I first discussed my research idea with Dr Simon Griffey, and anyone who knew Simon would not be surprised to hear that he met my extravagant research idea with the highest amount of encouragement and support. His positivity has buoyed me throughout this research and inspired me throughout my training. I feel very grateful to have worked with him.

I would like to acknowledge Dr Lorraine Silver's infallible help and guidance whilst I was developing my research methodology. I also owe thanks to Dale Bartle for his invaluable supervision and his constructive feedback, particularly regarding my draft submission.

I'd also like to express my gratitude to Nigel Newbutt and Sarah Parsons for their time and enthusiasm in discussing their own use of virtual environments with children and young people with Autism. The knowledge and experience that they shared with me directed my thinking during the initial stages of this research.

I am now forever in the debt of Becky and Joe Williams for loaning me a 'small' camera to film the café interactions. I am also indebted to Luke and Becky Rees for allowing me to film in their beautiful café in the Mumbles, Swansea.

I'd like to thank Paul Strickland from Xenodu for supplying the software for this project. Paul's advice was invaluable whilst filming and with the technical arrangements of the intervention.

I'd like to thank Laurie Hunt, who has helped me in a colossal number of ways throughout this research, despite having her own challenging work to complete.

Finally, but not least, I'd like to thank my parents and my brother. They have had an enormous influence on my professional and personal life, and their love, support and encouragement have motivated me beyond explanation.

## Summary

This document is separated into three parts. Part A provides a detailed literature review that examines the current understanding of Autism Spectrum Conditions (ASC). Attention is drawn to the social difficulties that this population shares and how these might impact upon general life outcomes. It considers the psychological theories that aim to explain the population's difficulties in generalising knowledge and skills to novel settings. The body of research on the approach of social skills training (SST) for developing the social and communication difficulties of those with ASC is then discussed, followed by a critique of these approaches. Virtual environments are then introduced and their potential usefulness in social skills training is argued. Current exploratory research in the area of virtual environments and SST is briefly critiqued and subsequent research questions are proposed.

Part B is an account of the empirical study, which aimed to evaluate the outcomes of a video virtual environment for teaching social skills to 18 adolescents with ASC. The approach to creating a virtual environment was novel and the unique materials and arrangement were described in detail. Specific teaching strategies to promote generalization were included in the design. Participants were observed pre- and post-intervention in a targeted social scenario. Pre- and post-test questionnaires were administered with parents and teachers. The results are discussed and implications for future practice are provided.

Part C is split into two sections. The first provides a critical commentary on the process of the generation and implementation of the empirical study and how this impacted upon the conclusions and the subsequent contribution to knowledge. A detailed overview of the implications for Educational Psychologist's (EP) practice is provided. The second section is a critical review of the research practitioner, where the researcher's personal development in the area of research is discussed, ethical issues are considered, and the researcher's impact on the research process is described.

## Contents

Declaration.....	i
Abstract.....	ii
Acknowledgements.....	iii
Summary.....	iv
Contents.....	v
List of Tables.....	x
List of Figures.....	x
List of Appendices.....	x
List of Abbreviations.....	xi
<b>PART A – LITERATURE REVIEW.....</b>	<b>1</b>
1. Introduction.....	2
1.1 Structure of the Literature Review.....	2
1.2 Search Terms and Sources.....	3
2. Autism Spectrum Conditions.....	4
2.1 Terminology.....	4
2.2 Definition and Diagnosis.....	4
2.3 Autism Spectrum Conditions and Social Functioning.....	5
2.4 Prevalence and Life Outcomes.....	6
2.5 Psychological Theories of Autism.....	8
2.5.1 <i>Executive Dysfunction</i> .....	8
2.5.2 <i>Weak Central Coherence Theory</i> .....	9
2.5.3 <i>Theory of Mind</i> .....	10
2.5.4 <i>The Empathizing-Systemizing Theory</i> .....	11
3. Social Skills Training Programmes for Children and Adolescents with Autism.....	13
3.1 An Overview of Social Skills Training Programmes.....	13
3.2 Defining Social Skills.....	14
3.3 Social Skills Training Methodologies and Goals.....	16

3.4 The Impact of Social Skills Training.....	17
3.5 Critique of the Research Outcomes.....	18
3.6 Generalisation Strategies in Social Skills Training.....	20
4. Defining and Promoting the Generalisation of Skills.....	22
4.1 Defining Generalisation in Intervention and Training Settings.....	22
4.2 Behaviourist Factors.....	24
4.3 Cognitive Factors.....	24
4.4 Affective and Attributional Style Factors.....	25
4.5 The Impact of the Learning Environment.....	27
4.6 Relevance of Generalisation Determinants to Social Skills Training.....	28
5. Virtual Environments and Social Skills Training.....	29
5.1 Defining Virtual Environments.....	29
5.2 The Affordances and Benefits of Using Virtual Environments for Social Skills Training.....	30
5.3 The Use and Understanding of Virtual Environments.....	31
5.4 Impact of Virtual Environments for Social Skills Training.....	32
5.5 Critique of the Research Outcomes.....	35
5.5.1 <i>Methodological Limitations</i> .....	35
5.5.2 <i>Further Limitations</i> .....	36
5.6 Future Directions for Virtual Environments.....	37
6. The Current Study.....	39
6.1 Overview.....	39
6.2 Research Aims.....	39
6.3 Research Questions.....	39
7. References.....	41
<b>PART B – THE EMPIRICAL STUDY.....</b>	<b>53</b>
1. Abstract.....	54
2. Introduction.....	55
2.1 Social Skills Training.....	56
2.2 Behaviour Generalisation Strategies.....	57

2.3 Cognitive Generalisation Strategies.....	58
2.4 Affective and Attributional Style Generalisation Strategies.....	58
2.5 The Teaching Environment and Generalisation.....	59
2.6 Virtual Environments for Social Skills Training.....	59
2.7 The Current Study.....	62
3. Methodology.....	63
3.1 Research Paradigm.....	63
3.2 Participants.....	63
3.3 Inclusion Criteria.....	64
3.4 Materials.....	64
3.4.1 <i>Technology and Video-based Environments</i> .....	64
3.5 Procedure.....	66
3.5.1 <i>Training Content and Teaching Approach</i> .....	66
3.5.2 <i>Natural Observation Procedure</i> .....	67
3.6 Pre- and Post-Measures.....	67
3.6.1 <i>Structured Observation</i> .....	67
3.6.2 <i>Social Skills Rating System</i> .....	68
3.7 Design.....	68
3.8 Ethical Issues.....	69
3.9 Statistical Analyses.....	70
4. Results.....	71
4.1 Inter-rater Agreement (IRA).....	71
4.2 Social Skills Observation Results.....	71
4.3 Social Skills Rating System Results.....	74
4.3.1 <i>SSRS Teacher Version</i> .....	74
4.3.2 <i>SSRS Parent Version</i> .....	75
5. Discussion.....	76
5.1 Overview.....	76
5.2 Research Question 1.....	76
5.3 Research Question 2.....	76
5.4 Research Question 3.....	76



5.5 Limitations.....	78
5.6 Future Directions.....	79
5.6.1 <i>Increasing Number of Learning Contexts</i> .....	79
5.6.2 <i>Evidence of Effective Teaching Approaches</i> .....	79
5.6.3 <i>Representativeness of the Virtual Environment</i> .....	80
6. Relevance to the Practice of the Educational Psychologist.....	81
7. Conclusions.....	82
8. References.....	83
<b>PART C – THE CRITICAL REVIEW.....</b>	<b>91</b>
1. Introduction.....	92
2. Part A: Contribution to Knowledge.....	93
2.1 Research Positioning.....	93
2.2 The Research Idea: A Personal Perspective.....	94
2.3 Arriving at Virtual Environments.....	95
2.4 Design and Data Collection.....	96
2.4.1 <i>Structured Observation</i> .....	97
2.4.2 <i>Questionnaires</i> .....	98
2.5 Contribution to Knowledge.....	99
2.5.1 <i>Research Question 1</i> .....	99
2.5.2 <i>Research Question 2</i> .....	100
2.5.3 <i>Research Question 3</i> .....	101
2.5.4 <i>Engagement with the Virtual Environment</i> .....	101
2.6 Relevance to the Educational Psychologist Practice: Part 1.....	102
3. Part B: Critical Account of the Research Practitioner.....	104
3.1 Introduction.....	104
3.2 Research Idea Development and Communication.....	104
3.3 Interventions Materials and Content.....	105
3.4 The Organisation of Large Scale Research.....	106
3.5 Statistical Analysis and the Method.....	106

3.6 Relevance to the Educational Psychologist’s Practice: Part 2.....	107
3.7 Ethical Considerations.....	108
3.7.1 <i>Participant Autonomy</i> .....	108
3.7.2 <i>Informed Consent</i> .....	109
3.7.3 <i>Facilitator Competence</i> .....	110
3.7.4 <i>Participant Harm</i> .....	110
3.8 How the Findings will Impact upon my Practice.....	111
4. References.....	113
Appendices.....	117

## List of Tables

<b>Table</b>	<b>Title</b>	<b>Page</b>
1	Features of ASC according to DSM-V Criteria	5
2	The Instructional Hierarchy	23
3	Participant Characteristics	63
4	Items in Social Skill Observation Measure	68
5	Overview of Ethical Issues and Researcher Actions	69
6	Means and Standard Deviations of Social Skills Observation scores at Time 1, Time 2 and Time 3	71
7	Means and Standard Deviations of SSRS scores at Time 1 and Time 2 (Pre and Post Intervention)	74

## List of Figures

<b>Figure</b>	<b>Title</b>	<b>Page</b>
1	Examples of the Determinants of Social Responding	15
2	A Virtual Reality Environment	29
3	A Video-based Virtual Environment	38
4	Video-based Virtual Environment Arrangement	64
5	Participant's View of the Video Virtual Environment	65
6	An Example Teaching Strategy Flow Chart for Eye Contact in the VVE	66
7	A Line Graph Showing the Mean Differences in Social Skills Observation for Group A and B at Times 1, 2 and 3	72
8	A Line Graph Showing the Mean Differences in SSRS Teacher Scores for Group A and B, Pre- and Post-intervention.	74
9	A Line Graph Showing the Mean Differences in SSRS Parent Scores for Group A and B, Pre- and Post-intervention.	75

## List of Appendices

<b>Appendix</b>	<b>Title</b>	<b>Page</b>
A	Social Skills Observation Inventory	117
B	Social Skills Rating Scale (Parent Version)	118
C	Social Skills rating Scale (Teacher Version)	119
D	Parent Information Leaflet (Sides 1 and 2)	120
E	Consent Form for Parents	122
F	Verbal Script to Gain Consent from Participants	123
G	Verbal Script for Pupil Debrief	124
H	Gatekeeper Letter	125
I	Example Actor Scripts	126
J	Teacher Consent Form	127

## **List of Abbreviations**

ASC	Autism Spectrum Conditions
DSM-V	Diagnostic and Statistical Manual of Mental Disorders: 5 <sup>th</sup> Edition
EP	Educational psychologist
HFA	High-functioning Autism
ICD-10	International Statistical Classification of Diseases and Related Health Problems: 10 <sup>th</sup> Edition
SST	Social Skills Training
VE	Virtual Environment
VR	Virtual Reality
VVE	Video-based Virtual Environment



**A Video-based Virtual Environment for Teaching Social Skills  
to Adolescents with Autism: In Search of Generalisation**

**Part A: Major Research Literature Review**

## **1. Introduction**

Leo Kanner is widely considered to be one of the first researchers to document Autism as a unique condition, describing not only the rigid and repetitive behaviours of a cluster of his patients, but also describing their “autistic aloneness” (Kanner, 1943, pg. 242). Kanner was alluding to what he described as the individual’s inability to relate to others in a significant way. Research into the validity, neurobiological and psychological models of Autism has significantly advanced since this paper (Lai, Lombardo & Baron-Cohen, 2014), yet difficulty in communicating with others remains an enduring major feature of Autism (Baron-Cohen, 2010; Travis & Sigman, 1998).

As both health and educational professionals have been aware of these social difficulties for a significant amount of time, there have been numerous attempts at teaching the skills needed to function in the social world to those with Autism (Barry et al., 2003). One of the common approaches to teaching social skills is through the use of Social Skills Training (SST) programmes (Bellini, Peters, Benner & Hopf, 2007). Many evaluations of SST programmes have reported small successful outcomes for improved social functioning (Cappadocia & Weiss, 2011). However, many have failed to find that the skills taught generalise beyond the teaching setting to real life contexts (Rao, Bediel & Murray, 2008).

### **1.1 Structure of the Literature Review**

This review will begin by considering the clinical definition of Autism and the prevalence and impact on the life outcomes of those with the condition. This review will proceed to provide an overview of some of the prominent psychological theories of Autism and how these theories might relate to an individual’s ability to generalise newly learnt skills or knowledge.

This review will define and describe social skills training (SST) programmes that have been used with children and young people with Autism. This review will

include a detailed critique of the evidence base for SST and highlight teaching strategies that have been used to promote the generalisation of learning in SST programmes. This review will then consider factors that promote generalisation from a range of training environments.

The central focus of this review will be an exploration of the literature relating to a novel approach to SST through the use of Virtual Environments (VE) (Parsons & Mitchell, 2002). This review will evaluate the impact of using a VE for SST, and will evaluate whether the affordances of the technology used could increase the generalisation of skills to naturally occurring contexts. Finally, further research and research questions are proposed.

## **1.2 Search Terms and Sources**

The chosen search terms were ‘Autism Spectrum Disorders,’ ‘Autism Spectrum Conditions,’ ‘Autism,’ ‘Virtual Environments,’ ‘Virtual Learning Environments,’ ‘Virtual Reality,’ ‘Social Skills,’ ‘Social Competence,’ ‘Social Skills Training,’ ‘Social Communication Training,’ ‘Generalisation,’ and ‘Transference.’ The search terms were entered into the PsychINFO 1806-2012 electronic database, the Web of Science electronic database and the ASSIA (Applied Social Science and Index Abstracts) electronic database. These searches occurred in January 2014 and once again in December 2014. Due to the size of the literature base, not all literature was included and literature was selected based on its relevance to this research. This review also drew information from various published books on Autism and two published social skills programmes.

## **2. Autism Spectrum Conditions**

### **2.1 Terminology**

Throughout this literature review and subsequent research, the term Autism Spectrum Condition (ASC) will be used in place of Autism Spectrum Disorder. As highlighted by Baron-Cohen et al. (2009), the term ‘disorder’ highlights and privileges the potential areas of weaknesses posed by the condition. It may be that the term disorder has significant stigma within the population with Autism as it diminishes the potential for the promotion and identification of strengths that those with the condition may possess (Baron-Cohen et al., 2009).

### **2.2 Definition and Diagnosis**

At present, ASCs are identified by two broad diagnostic categories (American Psychiatric Association, 2014). Lai et al. (2013) highlight that the first is described as “restricted and repetitive patterns of thoughts and behaviour” (pg. 896) and the second is described as “difficulties in social communication and interaction” (pg. 896). These categories are often referred to as the ‘Dyad of Impairments’ (Mandy, Charman & Skuse, 2012). According to the World Health Organisation (WHO, 2013), Autism Spectrum Conditions are classified as neurodevelopmental disorders, which result in the impairment or delay in functions that are largely related to the central nervous system. Neurodevelopmental disorders occur in early infancy and are often present throughout life (WHO, 2013).

The current diagnostic process involves measuring an individual’s social and cognitive skills in their own natural environment (Frederickson & Cline, 2009). The standardised measurements employed are underpinned by a substantial research base and validated diagnostic criteria (Carrington et al., 2014). The two most commonly cited sets of diagnostic criteria for Autism are those set by the WHO in the International Classification of Diseases, 10<sup>th</sup> Edition (WHO, 1992),



and the American Psychiatric Association’s (APA’s) Diagnostic and Statistical Manual, 5<sup>th</sup> Edition (DSM-V, 2014).

Table 1 *Features of ASC according to DSM-V Criteria (APA, 2014).*

<b>Core Features</b>	<b>Sub Features</b>
<p>Deficits in social communication.</p> <p>Deficits in social interactions in multiple contexts.</p>	<p>Deficits in social-emotional reciprocity.</p> <p>Deficits in non-verbal communicative behaviours used for social interaction.</p> <p>Deficits in developing, maintaining and understanding relationships.</p>
<p>Restricted and repetitive patterns of behaviour, interests or activities.</p>	<p>Stereotyped, repetitive motor movements, use of objects or speech.</p> <p>Insistence on sameness, inflexible adherence to routines, or ritualised patterns of non-verbal or verbal behaviour.</p> <p>Highly restricted, fixated interests that are abnormal in intensity and in focus.</p> <p>Hyper-reactivity or hypo-reactivity to sensory input.</p>

(Adapted from Lai, Lombardo & Baron-Cohen, 2013)

Table 1 provides a detailed overview of the sub-features of the dyad of impairments that are required to meet the criteria for a diagnosis of ASC based on the DSM-V. These diagnostic characteristics have been reliably observed to occur across different countries, languages and cultures (Haq & Le Couteur, 2004); and via different assessment and diagnostic screening tools (Fombonne, 2009).

### **2.3 Autism Spectrum Conditions and Social Functioning**

Those with ASC struggle to interpret and use non-verbal communication such as eye-contact, tone of voice, posture, and facial expression as well as other context-based cues that are crucial for reciprocal communication (Koning & Magil-Evans, 2003). The presence of Autism often leads to general difficulties in verbal conversation skills (Bauminger-Zviely, Eden, Zancanaro, Weiss & Gal, 2013) and

can include difficulties in initiating conversation, asking appropriate questions, commenting on the activity of others, responding when spoken to and attention skills (Chung et al., 2007). Those with ASC can often shift between topics at random intervals, rather than follow a conversational topic (Travis & Sigman, 1998). Also, when conversation is initiated, it can often be regarding a topic that is of fixed interest to the individual with ASC (Bellini et al., 2007). An aspect of communication that may also be linked to the cognitive component of the condition is that those with ASC often engage using egocentric speech and often shift the conversation to a topic of personal interest (Laugeson, Frankel, Gantman, Dillon & Mogil, 2012).

Social difficulties in ASCs do not always arise from a lack of interest in social communication (White, Keoing & Scahill, 2007). However, due to a lack of skills, those with ASC may present as being uninterested in such activity (Cotugno, 2009). Children and adolescents with ASC struggle to form effective friendships (Bauminger, Shulman & Agam, 2003) and report fewer feelings of companionship, security and support from close peers, along with higher levels of loneliness than their peers (Bauminger & Kasari, 2000). One major impact of the inability to form strong relationships with others is a subsequent lack of experience and engagement in the home, school, and the community (Barry et al., 2003).

The WHO (2013) highlights that the most effective approaches for meeting the social communication needs of those with an ASC are direct psycho-educational, developmental and behavioural interventions. In the absence of these interventions, evidence suggests that difficulties with engaging in social experiences could increase with age (Howlin, Mawhood, & Rutter, 2000).

## **2.4 Prevalence and Life Outcomes**

The prevalence of Autism has been increasing over the past 20 years (Tsai, 2014). It is thought that this has been caused by a number of factors, including an

improvement in the effectiveness of the diagnostic tools, an increase in the awareness of the condition and an increase in the sensitivity of the diagnostic procedures following updates to the diagnostic criteria (Haq & Le Couteur, 2004). In a study of the United Kingdom (UK) school population, Baron-Cohen et al. (2009) estimate that the prevalence in the UK population is around 157 in 10,000 children, or 1.57 in 100. On a worldwide level, the current estimates for prevalence rates for ASCs vary widely between 2.1 to 240 per 10,000 people, but have a median of 69.5 per 10,000 people (Tsai, 2014).

Outcomes for those with an ASC vary considerably based on the severity of their condition, as well as their cognitive ability, language ability and the presence of co-morbid factors such as Attention Deficit Hyperactivity Disorder or Epilepsy (Howlin, Goode, Hutton & Rutter, 2004). Studies in relation to general outcomes are difficult to compare due to the differential measures of a 'good' or a 'poor' life outcome. In a large scale review, Levy and Perry (2011) conclude that outcomes are based on a complex relationship between symptom severity, cognitive and language outcomes, social outcomes, education and training, living situation and social integration. Levy and Perry (2011) suggest that general life outcomes for those with ASCs are generally better for those who receive good quality support and interventions that assist the development of language, communication and self-help skills. These outcomes included independent living and being in a meaningful relationship, as well as academic and employment prospects. It should be noted that this review included various populations and samples from various cultures, several levels of socio-economic status, and numerous levels of ASC severity, including various profiles of language skills and cognitive abilities. Thus, the generalisation of these findings to a general population should be undertaken with care (Levy & Perry, 2011).

## 2.5 Psychological Theories of Autism

A significant issue that those with ASC experience is difficulty in applying and generalising information or skills to novel contexts (Baron-Cohen, 2008; Happe & Frith, 2006). It is clear that this may significantly impact upon the type of teaching that those with ASC require in order to develop and implement skills successfully, whether they are social, academic or practical in nature. The remainder of this chapter provides a summary of the relevant theories of Autism and an overview of how the condition might impact upon skill learning. The dominant psychological theories and research evidence for Autism have emerged from cognitive and behavioural perspectives (Rajendran & Mitchell, 2007).

### *2.5.1 Executive Dysfunction.*

Executive functions are typically described as psychological processes that are used in planning, impulse control, flexibility of thought, working memory and task shifting (Ozonoff & Jensen, 1999). Executive functions require the individual to disengage from a task in order to guide responses and plan further actions (Hill, Bethoz & Frith, 2004). There is debate in the literature over the definition of executive functions, but they are thought to be involved in planning ahead, self-reflection and forming a representation of abstract concepts in the mind (Liss et al., 2001).

It has been suggested that executive dysfunction is a primary causal factor of ASC and that the subsequent deficits significantly relate to repetitive and restricted behaviours, as well as the reported difficulties in emotional regulation and the deficits in theory of mind (Ozonoff, Pennington & Rodgers, 1991). Following significant empirical attention to this theory, it is now considered that impairments in executive function do have an impact on the development and functioning of an individual with Autism, but executive functioning may not be the primary cause of such difficulties (Pellicano, 2012).

There is empirical evidence to suggest that those with Autism have particular difficulties in planning ahead and in flexibility of thought (Ozonoff & Jensen, 1999). Flexibility of thought is particularly relevant to the generalisation of skills taught as it requires the individual to shift or transfer rules and relevant information between different situations based on the context (Geurts, Corbett & Solomon, 2009). Arguably, an individual who has difficulties with flexibility of thought may struggle to identify the relevant social responses that can be applied in varying social contexts.

### *2.5.2 Weak Central Coherence Theory.*

A prominent cognitive theory of autism is the Weak Central Coherence (WCC) theory, which was proposed by Frith (2003) in the book 'Autism: Explaining the Enigma.' Frith draws attention to how the majority of children focus upon the general meaning or global idea of a concept and often filter out or fail to remember the surface and specific detail of a concept. In comparison, children with an ASC focus upon specific details of objects, phenomena or information and tend to miss the general meaning or 'gist' of a situation. Frith (2003) highlights that, despite the weakness of the central coherence system, the patterns of thought related to WCC can lead to strengths in areas such as rote memory and problem solving that involves segmenting global information.

Since the conception of the WCC theory, subsequent research has shifted focus towards identifying a processing bias towards local information, rather than a processing deficit of global wholes (Happé & Frith, 2006). Brown & Bebko (2012) argue that the mechanisms that underpin the WCC theory are over-selectivity and poor categorisation. The authors suggest that the observed difficulties in generalisation are compounded by a tendency to over-discriminate between different stimuli, which in turn leads to a poor level of information categorisation. Information categorisation refers to the ability to see where units or entities fit

together or share features (Klinger & Dawson, 2001). If the ability to create a mental representation of how concepts can share features is lacking, it will significantly impact upon the individual's ability to apply a piece information across a number contexts (Brown & Bebko, 2012). For example, an individual may know a train's features in great detail, including its wheels, brakes and carriage. However, the individual may not understand that a horse can pull a carriage, a chair can have wheels or a bicycle has brakes, as these features occur in different contexts.

In order to promote the generalisation of skills, practitioners will need to create change in the learning environment in gradual stages in order for the individual to make links between the use of the skills and the potential contexts for skill use (Ranjendran & Mitchell, 2007). Furthermore, the links between categories, or the link between how the local information (a social skill) can be related to differing global categories (a social environment) will need to be made explicit to the individual, as this has shown to reduce the processing bias effects (Plaisted, Swettenham & Rees, 1999; Happe & Frith 2006).

### *2.5.3 Theory of Mind.*

One of the most well known psychological models used to explain the social difficulties for those with ASC is Theory of Mind (ToM). ToM is the ability to represent the mental state of others in an abstract form. ToM involves understanding what others may feel, think or believe, in order to predict their future behaviour (Baron-Cohen, 2008). This ability would be crucial for social interaction, as it would be required to understand the speaker's intended meaning, actions and feelings (Frith, Happe & Siddons, 1994).

In a focal psychological study, Baron-Cohen et al. (1985) found that children with ASC performed less well on laboratory studies designed to test ToM in comparison to those with Downs Syndrome and their typically functioning peers. They

discovered that, regardless of IQ, individuals with ASC did not differentiate between their own mental state and the external target's mental state. This finding has been replicated with different tests under various experimental conditions (Baron-Cohen et al., 1994).

To date, many of the studies used a pass or fail approach to ToM testing, and on some occasions, those with ASC passed the tests (Baron-Cohen et al., 1985). There has been evidence to suggest that as the participant's language and social skills ability increased, the likelihood of an individual passing a ToM test increased (Frith et al., 1994). It could be that for those with ASC, ToM may be fluid and could increase over time (Baron-Cohen, 1989). This suggests that there may be factors that could increase ToM ability through environmental influences such as teaching programmes.

#### *2.5.4 The Empathizing-Systemizing Theory.*

More recently, Baron-Cohen (2002) provided a different perspective on the effects of the WCC, over-selectivity and ToM via the Empathizer-Systemizer theory (ES). In ES theory those with ASC are described as Systemizers, and this can be described as the tendency for the individual to seek to understand a system in great detail (Baron-Cohen, 2009). A system is defined by a set of rules, values and laws and, when these are understood, it can lead to successful predictions of how it might behave (Baron-Cohen, 2008). An effective Systemizer focuses upon the details of a system and will start to analyse a system at its most specific point. This is often seen as a deficit in previous theory and research (Baron-Cohen, 2002).

In contrast, the ES theory proposes that those with ASC are less skilled Empathizers. Empathizers are described as having the ability to have an appropriate reaction to the emotions of others, which Baron-Cohen (2009) describes as affective empathy. It also encompasses cognitive empathy, which is comparable to

ToM as it is based on understanding the mental states of others in order to predict behaviour.

This is important to the current research as it suggests that educational programmes should consider how the systemizing aspects of ASC impact upon learning styles and psycho-educational programmes should plan to take advantage of these strengths (Baron-Cohen, 2010). This could be achieved by systemizing aspects of learning through teaching approaches such as rule-based instruction and rote recall. Although this would be useful for basic skills where systems are easily predictable, it may be difficult to systemize SST learning goals in higher-level social interactions, which are not predictable in nature.

Finally, Frith (2003) suggests that systemizing may reflect the Autistic brain's preference to analyse the physical, concrete aspects of the world, rather than the psychological aspects. This could support the proposition that an empirical experience of a naturally occurring system may be more effective at promoting the generalisation of social skills, as the individual could test the rules of the social situation in a natural setting.



### **3. Social Skills Training Programmes for Children and Adolescents with Autism**

#### **3.1 An Overview of Social Skills Training Programmes**

Social skills training (SST) programmes are one of the most common approaches for developing the social communication skills of those with ASC (Bellini et al., 2007). SST programmes are designed to provide learning experiences to teach children and adolescents the necessary skills to interact successfully with their social environment (Rao, et al., 2008). SST programmes typically attempt to isolate individual skills (such as maintaining eye contact or asking appropriate questions) from complex interactions and teach them in small achievable steps, based on the individual's level of development (Cappadocia & Weiss, 2011). Social skills may then be practised in increasingly complex and realistic interactions (Flynn & Healy, 2012).

SST programmes have been conducted in school-based settings, but have also been conducted within clinical and outpatient settings (Barry et al., 2003). Frequently, these settings would not resemble the context in which the skills would be performed outside of the learning environment. SST programmes are often delivered within groups, which are believed to maximise the exposure to social learning opportunities (Cotugno, 2009; Spence, 2003). However, certain teaching approaches have required individual or pairs-based teaching environments due to the types of teaching approaches or the intervention materials required (Bellini et al., 2007).

Thus far, the length and intensity of SST programmes have varied greatly and can often range from a few weeks to a year in length (Cappadocia & Weiss, 2011; Rao, et al., 2008). Gresham, Sugai and Horner (2001) suggest that short-term interventions will not be intense enough to improve social skills to such an extent that they are maintained and generalised, and to allow for the effective evaluation of psychoeducational outcomes.

### **3.2 Defining Social Skills**

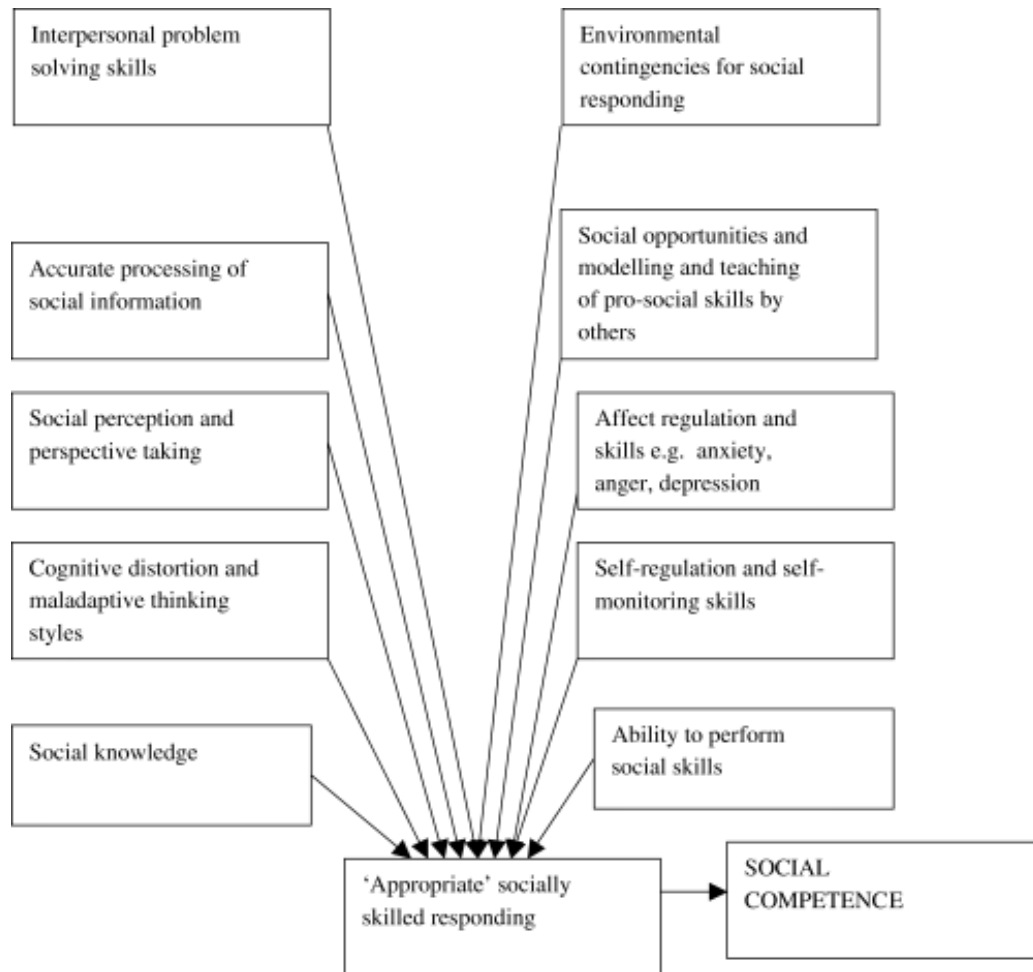
In order to define social skills, Gresham et al. (2001) make an important contrast between social skills and what the authors describe as social competence:

In sum, social skills are behaviours that must be taught, learned and performed whereas social competence represents judgements or evaluations of these behaviours within and across situations. (Gresham et al., 2001, pg. 333)

In the above definition, social skills are functional behaviours that can be taught. The performance of an individual's social skills includes their own ability to understand when to apply social skills in differing contexts. As social interactions are at the very least dyadic in nature, the authors describe social competence as the subsequent judgements made by others in the interaction. These are judgements made regarding the appropriateness of social responses in a given context.

Spence (2003) expands upon this distinction in a model outlined in Figure 1. This model provides a non-exhaustive overview of the factors that can influence social competence judgements. The author highlights how a number of cognitive, emotional and environmental determinants impact upon the level of social skills and responses.

The term SST has often been used as an umbrella term for programmes which aim to teach a number of the factors highlighted in Spence's model of social competence (Spence, 2003). At present, there is little evidence to suggest which factors of social competence are the most effective to include, and therefore most programmes target an array of factors in an attempt to ensure programme effectiveness (White et al., 2007).



*Figure 1.* Examples of the Determinants of Social Responding (Adapted from Spence, 2003).

Kelly (2011) describes the development of social skills as a hierarchical process, where the individual must first develop emotional and social self-awareness before being able to judge whether to use certain skills in a given environment. Kelly (2011) outlines that, following a ‘self-awareness’ stage, the individual can progress to practise skills relating to non-verbal, paralinguistic and verbal behaviours. Spence (2003) outlines that in much of the empirical evidence there is an agreement that specific functional social skills can be separated into non-verbal (such as posture and eye contact) and verbal skills (such as starting a conversation and asking questions). Disagreements in the literature occur when the skills targeted become idiosyncratic, or often occur in complex interactions (Rao et al., 2008).

### **3.3 Social Skills Training Methodologies and Goals**

As SST programmes are interested in developing the social behaviour of individuals with ASC, it seems logical that the early programmes were reliant on direct instruction and behaviourist techniques (Gresham et al., 2001). Matson, Matson and Rivet (2007) highlight how effective programmes have strong behaviourist elements, such as modelling, reinforcement and behaviour shaping strategies. However, SST has evolved to include cognitive elements designed to develop the individual's ability to perform more complex social problem solving and to understand cause and effect relationships in order to apply social behaviours in differing contexts (Solomon, Goodlin-Jones & Anders, 2004). Arguably, these interventions are the most common in school-based settings and are known as Traditional SST (Cappadocia & Weiss, 2011).

More recently, SST for children and young people with ASC has attempted to apply strategies from other evidence-based interventions, such as strategies from cognitive-behaviour therapy interventions (Lopata, Thomeer, Volker & Nida, 2006), peer and adult mediation programmes (Banda, Hart & Liu-Gitz, 2010), script fading procedures (Wichnick, Vener, Pyrtek & Poulson, 2010), video modelling (Delano, 2007), and virtual environments (Baker, Parks-Savage & Rehfuss, 2009). Many studies incorporate hybrids of these strategies, such as the inclusion of cognitive-behaviour therapy techniques, peer-mediation tasks and parent-mediation tasks in one intervention (Bauminger-Zviely, Eden, Zancanaro, Weiss & Gal, 2013).

Although less related to teaching specific skills, a number of SST interventions have attempted to address other aspects of social competence that are specifically relevant to those with ASC (Cotugno, 2009). For example, there have been SST programmes designed to improve theory of mind (Ozonoff & Miller, 1995), emotional literacy (Solomon et al., 2004) and socio-cognitive skills (Bauminger-Zviely et al., 2013), in an attempt to improve social functioning indirectly.

There has been scarce research exploring how effective each individual teaching technique may be for use in SST (McMahon, Lerner & Britton, 2013). As the field of research of SST has grown, it has been apparent that each programme has included a combination of teaching techniques, based on the programme's aims and the needs of the participant (Bellini et al., 2007).

### **3.4 The Impact of Social Skills Training**

A number of literature reviews and meta-analyses have been conducted in order to assess the impact of SST on social competence for those with an ASC (Gresham et al., 2001). For example, Bellini et al. (2007) carried out a meta-analysis of 55 school-based SST interventions. It was found that the interventions had a low impact upon the skill acquisition, maintenance and generalisation of social skills. A key finding was that intervention effects were not influenced by the type of teaching strategies employed (for example, direct skills teaching or play based teaching). It was concluded that for the maximum benefit of SST a high number of intervention sessions should be used and that the interventions should occur in the participants' natural setting. It was also noted that interventions that were 'tailored' to the individual's strengths and weaknesses were most effective.

In a meta-analysis of 36 SST studies, Wang and Spillane (2009) concluded that impact results varied considerably with the type of intervention used. They found that video-modelling could be considered an effective technique and found large effect sizes for cognitive-behavioural training. It is important to note that these designs included teaching strategies that overlapped with traditional SST training, such as direct instruction and behaviour modelling. This issue has also been identified in a review by Cappadocia and Weiss (2011), which compared traditional SST methods with SST programmes using cognitive behaviour approaches and parent mediated components. All three approaches led to reports of positive outcomes, based on a review of 10 different studies. However, the teaching strategies often overlapped and it proved difficult to evaluate whether one approach is more effective than another. This was due to all programmes including teaching

strategies such as role-play and modelling, or common learning objectives.

Individual studies designed to evaluate the impact of SST programmes often incorporate a common research methodology (Wang & Spillane, 2009; White et al., 2007). An example of a common research methodology for exploring the effectiveness of a novel SST programme can be found in a study by DeRosier, Swick, Davis, McMillen and Matthews (2010), who measured the effectiveness of the Social Skills Group Intervention for High Functioning Autism (SSG). The sample included 55 children, aged between 8 and 12 years old, with an ASC. The teaching methods employed were direct instruction, role-play and modelling. A random control group was used to compare the SSG with another social skills programme that was not designed for adolescents with ASC. A number of parent questionnaires and child self-report methods were administered, pre- and post-intervention. Following the intervention, the results showed that the intervention group's social skills and reported self efficacy improved significantly in comparison to the control group's. The use of a randomised control trial was important as it provided a control for extraneous variables such as natural maturity of social skills, as well as ruling out the impact of other incidental social skill promotion that the child may receive in special educational settings. However, one drawback of this research was that the measures used to test for the generalisation of skills into a real world context were based on parental self-report methods. The parents may have been primed pre-intervention for what skills they would need to be aware of practising before a post-measure was taken.

### **3.5 Critique of the Research Outcomes**

Perhaps the most salient criticism of the evidence for SST is that, despite the reported positive effects of SST, it is often found that there is little evidence to support the generalisation of skills to real life contexts (Barry et al., 2003). One contributing reason is that many of research studies on SST have not included a measure of skill generalisation (Reichow & Volkmar, 2010). To highlight this, in Bellini et al.'s (2007) meta-analysis, only 15 of the 55 studies included a measure

of skill generalisation. Similarly, Wang and Spillane (2009) reported that only 9 of 36 studies reviewed had included a measure of skill generalisation.

Another significant methodological issue is that many of the studies have not considered the impact of natural social skill maturation over time or have failed to include a randomised control group design to control for such a confounding variable (White et al., 2007). This is an issue, as the level of participant ability may impact on the type of teaching and measurement methodologies that need to be employed.

Further to this is the issue of zero baseline effects (Wang & Spillane, 2009). This occurs when participants performance scores begin at zero and pre-existing individual differences are ignored. Zero baseline scores result in a process where even small improvements in the social skills measured could result in large effect sizes and over-inflated conclusions regarding the impact of the intervention. Wang and Spillane (2009) found that 7 of the 36 SST evaluations reviewed included observation measures that were not sensitive enough to highlight the social skills that the participants may have already possessed and often reported a pre-intervention zero baseline score.

As discussed, social skills are multidimensional and therefore reductionist methods of measuring social skill ability should be avoided (McMahon et al., 2013). However, the number of different measurements that have been employed to evaluate progress have reduced the ability for effective comparisons to be made between different interventions (Flynn & Healy, 2012). Furthermore, many of the measures have not been tested for reliability or validity prior to use (McMahon, et al., 2013). Therefore, it may not always be clear what is truly being measured.

Finally, Reichow and Volkmar (2010) highlight that many studies had no, or poor, measures of intervention fidelity, as well as poor descriptions of the intervention procedure. Accurate descriptions of intervention procedures and a measure of integrity ensure that study outcomes are related to the consistent and reliable

application of the independent variable (Neely, Davis & Rispoli, 2015). Programme fidelity is often reduced in naturalistic settings (Reichow & Volkmar, 2010), and it may be that future SST evaluations should include both an accurate procedure description, as well as a detailed intervention manual, to emulate fidelity effectively.

### **3.6 Generalisation Strategies in Social Skills Training**

In order to promote generalisation, interventions and evaluations must actively include elements that both teach and measure the generalisation of skills (Radley et al., (2014). Previous studies that have only included a measure of skill generalisation have often reported low impact outcomes (Bellini et al., 2007; Rao, et al., 2008).

However, studies that have incorporated teaching strategies for generalisation have reported more positive outcomes for both the generalisation and the maintenance of skills. For example, Radley et al. (2014) sought to evaluate specific generalisation strategies in the Superheroes Social Skills Programme (Jenson et al., 2011), which incorporates approaches based on the strategies described by Stokes and Osnes (1989). The key approaches in the programme were to include peers in the intervention to reinforce behaviour naturally, to provide a number of naturally occurring response exemplars in the same social situation through video modelling and to encourage individuals to self-monitor their skills outside of the teaching environment. The final approach would be achieved through verbal prompts provided by adults in the environment. The authors found that skills taught using these approaches successfully transferred to novel contexts.

Teaching SST in natural settings was also discussed by Bellini et al. (2007), where it was concluded that when SST interventions took place in a naturalistic setting, there was a greater likelihood of the maintenance and generalisation of skills in real-life contexts. As previously mentioned, both school- and clinical-based interventions will only be able to reproduce the physical and psychological fidelity of a social situation to a certain level of representation (Barry et al., 2003). Perhaps



future research should aim to maximise the teaching within naturally occurring environments and create practical opportunities to try to create an experience with a high level of psychological fidelity.

## 4. Defining and Promoting the Generalisation of Skills

### 4.1 Defining Generalisation in Intervention and Training Settings

A therapeutic behavioral change, to be effective, often (not always) must occur over time, persons and settings, and the effects of the change should spread to a variety of related behaviors. (Stokes & Baer, 1977, pg. 350).

Generalisation refers to the independent performance of skills, actions, learning or behaviours by the learner outside of the teaching context, following learning experiences (Brown & Bebko 2012; Rao, et al., 2008). The main aim of social skills programmes is for the skills taught within the learning environment to generalise to other settings in order for the individual to achieve their own social goals successfully. Arguably, generalisation is the goal of any educational programme of this kind (Ennis-Cole, 2015).

A framework that has been frequently used to describe when generalisation may occur in the process of learning is the Instructional Hierarchy (IH, Table 2). This hierarchy was originally designed by Haring and Eaton (1978) in an out of print book called '*The fourth R: Research in the Classroom.*' It was designed to act as a framework to evaluate a number of academic and classroom based interventions. As Ardoin and Daly (2007) highlight, the IH has continued to be used in the instruction and evaluation of a number of behaviour and academic skills to date. The IH suggests that skill development and the assimilation of learning is a linear process (Skinner & Daly, 2012) and, if one stage is not completed, the learner may show performance errors in future stages (Daly, Lentz & Boyer, 1996).

The IH may be a useful framework for the current research as it provides a hierarchy in which to measure the developmental stage of a skill over time, and provides a measurable point in the learning process to promote the generalisation of

skills (Ardoin & Daly, 2007). For example, according to the IH, it could be that promoting skill generalisation when a skill has not been learnt to fluency or maintenance could impact negatively upon long-term performance levels and increase the chance of errors in subsequent environments (Martens & Witt, 2004).

Table 2 *The Instructional Hierarchy*

<b>Stage of Skill Development</b>	<b>Performance Measure</b>	<b>Teaching Strategy</b>
<i>Acquisition</i>	Number or percent correct and errors	Modeling, prompting, and error correction
<i>Fluency</i>	Rate proficiency	Practise and reinforcement
<i>Maintenance</i>	Rate in the absence of practice/on longer tasks	Practise beyond an accuracy criterion (overlearning)
<i>Generalisation</i>	Rate in new situations	Practise with diverse materials, persons, or settings
<i>Adaptation</i>	Rate of emergent skills	Practise to retention and endurance standards

(Adapted from Martens & Witt, 2004)

However, based on the literature of Autism and the potential for over-selectivity (Brown & Bebko, 2012), it could be that overtraining individuals to respond to stimuli with accuracy and fluency may lead to automatic responses in a given context (Skinner & Daly, 2010). This could reduce the likelihood of the skill generalising to other appropriate stimuli. It may be that SST programmes should focus on strategies that can lead to skill generalisation, whilst the maintenance of a skill should be promoted with due caution.

In an influential paper on generalisation within behaviourist teaching approaches, Stokes and Baer (1977) argue that it is often assumed that when an individual has acquired a skill to fluency in the learning environment, generalisation will occur

naturally. This is possibly due to the linear nature of the IH. Contrary to this belief, despite theory suggesting that generalisation is more probable following fluency, this is not a consistent finding (Ardoin & Daly, 2007). Skinner and Daly (2010) state that teaching programmes should include elements and ‘tactics’ that train the individual to generalise skills as part of the teaching, rather than something that is promoted following skill acquisition.

#### **4.2 Behaviourist Factors**

In interventions that involve behaviour change, the teaching methods often include strategies that have emerged from behaviourist approaches (Matson et al., 2007). Although not originally related to SST, Stokes and Osnes (1989) built upon the work of Stoke and Baer’s (1977) original 9 categories, thought to promote the generalisation of behaviour, by grouping common methods into three generalisation-promoting categories. These were: (a) exploiting natural contingencies; (b) training diversely; and (c) incorporating functional mediators. Exploiting natural contingencies relates to a time during training when behaviours are trialled and maintained in natural contexts, following the removal of the facilitator and training. Training diversely is described as the use of numerous examples of behaviours or it can be achieved by varying the context and the concurrent stimuli as much as possible, to train for a variety of potential contexts. Finally, the incorporation of functional mediators relates to including stimuli that prompt the subsequent performance and self-monitoring of the performance of the acquired learning.

#### **4.3 Cognitive Factors**

For a pure behaviourist approach to be effective at promoting generalisation, the individual would require a consistent set of stimuli to respond to (Cornish & Ross, 2004). As fluid learning situations (such as social interactions) become more inconsistent as they become more complex (Frederickson & Cline, 2009), it may be

that a pure behaviourist approach would not be able to teach responses for every potential outcome of a social interaction. This could also reduce the likelihood of skill generalisation. Stokes and Baer (1977) recognise this in their original description of ‘training diversely,’ and suggest that some skills would need to be ‘trained loosely’ to account for this problem.

Encouraging the learner to become active in choosing and understanding their own responses in a social situation will be important for tackling the diverse social world (Gresham et al., 2001). For learners to generalise these skills to new situations they will need problem solving skills, to be aware within situations, to understand the relevant social factors of the situation and make a best judgement accordingly, and will need to evaluate the reactions and responses of the social environment (Spence, Donovan & Brechman-Toussaint, 1994). Therefore, SST programmes will need to develop the learner’s ability to identify problems, generate goals, develop alternative solutions and to predict the likelihood of changes in a given context (Cornish & Ross, 2004).

#### **4.4 Affective and Attributional Style Factors**

A widely overlooked variable in the research of SST is the affective and attributional style factors that can impact upon the quality of skill generalisation. Many empirical studies of skills training often assume that the individual will be motivated to learn and will fully engage with the intervention (Yamhill & McLean, 2001). This is not always the case and intrinsic motivation has been found to be a key determinant of the engagement and treatment outcomes of psychosocial interventions (Medalia & Spaerstein, 2011). Medalia and Spaerstein (2011) emphasise that effective strategies to raise intrinsic motivation to learn could include matching the programme tasks to the individual’s ability, by personalising tasks, by linking tasks to target contexts and by giving the participant control over the learning process. These strategies could be implemented in a SST programmes

by allowing the learner to choose a social skill to study, to choose the context in which to learn a skill or to learn at a pace that is comfortable to the individual.

An attributional style factor that may impact upon training and generalisation is locus of control. Locus of control can be described as a person's perceived sense of control over a situation (Rotter, 1975), and this can be internal (where their own actions control the situation) or external (where outside forces control the situation). For example, in a study of typically functioning adults, a pre-training intervention was administered in order to raise the participant's internal locus of control prior to a negotiation training programme. The participant's motivation to learn subsequently increased, which in turn was a significant mediator of the participant's ability to generalise skills to novel settings (Weissbein, Huang, Ford & Schmidt, 2010). The researchers concluded that these internal factors are malleable and can be promoted to improve the effectiveness of training.

Another factor that could link to generalisation is the participant's perceived usefulness of the learning content (Bhatti, Ali, Isa & Battour, 2014; Yamnill & McLean, 2001). If the learning represents goals or skills that the learner feels could be used in a real life situation, then the likelihood of generalisation may be higher. In relation to SST, it may be that the learning environment would have to include a social situation meaningful to the learner. For example, this could be an experience such as ordering at a restaurant, or a situation the individual may find difficult such as asking to join in a game on the playground. This is particularly relevant to those with an ASC as, although they may learn to interact positively with others in SST, they may not recognise why this is important, due to poor empathizing skills (Baron-Cohen, 2002), and may not be motivated to do so in a naturally occurring situation.

Finally, Bhatti et al. (2014) discuss the impact of a learner's performance self-efficacy. Even when the facilitator has judged that the individual has acquired a skill, the individual's self-belief in his or her own ability to use the skill in a real

life setting may impact upon generalisation. This is particularly relevant to SST, where the individual may become anxious in new situations and may not use social skills due to fear, or anxiety related to making mistakes. In future, it may be useful if SST programmes include measures of the participant's self-efficacy during training to assess the individual's confidence levels of applying a newly acquired skill to a novel context.

#### **4.5 The Impact of the Learning Environment**

There has been a considerable amount of interest in the potential approaches to promote the generalisation of skills in the fields of Occupational Psychology and Applied Clinical Psychology. Research in these areas has focused on how training programmes can create the most effective training environments in order to promote the generalisation of taught skills to various workforces and work environments in non-ASC populations (Kozlowski & DeShon, 2004).

Theoretically, it is likely that skills that are taught within the context in which they need to be performed are more likely to be reproduced in that context. Laker (1990) describes this as the transfer distance principle, where the closer that the learning context is to the target situation in terms of similarity and representation, the more likely that the learning may be transferred in to a similar context. As this distance increases, the learning context becomes less representative of the target context. Subsequently, the learning stimulus may then need to become less specific and the skills taught will need to resemble general rules or skills for the learner to be able to apply in different contexts (Goldstein, 1986).

The idea of transfer distance is useful, but to reduce the distance between the learning environment and the target environment virtually, then the specific factors relating to the 'distance' will need to be better understood. One way to define the distance could be using a theory developed by Baldwin and Ford (1988), who emphasise that there is a distinction between the physical and psychological

dimensions of a training situation. The authors argue that, if the training situation is able to replicate psychological processes such as psychological cues, psychological determinants, and the subsequent affective responses for the individual in the training environment, then the actual physical context may not be required. They describe these two phenomena as the psychological fidelity and the physical fidelity of a learning situation, and reason that both dimensions should be considered during the formulation of any skills training.

#### **4.6 Relevance of Generalisation Determinants to Social Skills Training**

In relation to SST, the target context is likely to be the target social interaction or skill occurring within a natural setting. It may be viable for school-based interventions to replicate contexts that occur in school settings. However, it may prove difficult recreating environments that are representative of those outside of the school context through modelling, imaginary environments and role-play alone. Based on the transfer distance theory, it may be that these teaching methods alone may not be enough to produce the psychological fidelity needed for the successful transfer of learning.

This chapter has provided a broad and non-exhaustive overview of the factors that may be involved in the generalisation of learning within a wide range of learning environments. Based on the literature, it would be valid to state that the process of generalisation is multifaceted and context dependent. As those with ASC struggle to generalise information following learning, the approaches aimed at improving generalisation should be given considerable prominence in SST for this group. It is clear that to apply all of the above strategies in every aspect of a SST programme may not be feasible as all strategies may not be useful or appropriate for every social context or every individual learning goal. Consequently, the facilitator should consider which strategy might be most effective at helping the individual develop the desired behaviour (Brown & Odom, 1994; Spence, 2003) and ensure the approaches that are implemented are made explicit when reporting empirical findings.



## 5. Virtual Environments and Social Skills Training

### 5.1 Defining Virtual Environments

Virtual reality (VR) consists of a computer generated three-dimensional reality that a user can access via a screen or through more immersive technologies, such as headsets and motion sensors (Lorenzo, Pomares & Lledo, 2013).



*Figure 2. A Virtual Reality Environment*

One approach to incorporating VR is through the use of virtual environments (VEs). A VE can be described as a computer generated, interactive representation of an environment that strives to simulate real life scenarios in real time (Parsons, Mitchell and Leonard, 2005; Mitchell, Parsons & Leonard, 2007). Within a VE, the user is able to navigate the environment through an avatar and may be able to interact with a number of objects and characters within the environment (see Figure 2).

## **5.2 The Affordances and Benefits of Using Virtual Environments for Social Skills Training**

There are many a priori arguments as to why using VEs may be effective teaching platforms for SST (Herrera et al., 2008). Arguably, the most important benefit of a VE is that it creates a naturalistic environment for the training of a range of social interactions (Ke & Im, 2013). Based on the earlier sections of this review, the incorporation of naturalistic training environments that reduce the transfer distance between the training environment and the target environment could increase the potential for generalisation (Baldwin & Ford, 1988; Laker, 1990). VEs can simulate a natural environment to a certain degree of representation (Parsons & Mitchell, 2002) without the individual having to travel to the real environment. Arguably, this has practical benefits for both school and clinical applications.

VEs simulate social scenarios where the environment reacts to the user's social responses (Lorenzo et al., 2013). This allows for the opportunity of learning new ways of responding in social situations, as simulations can be repeated and the environment will react accordingly to change (Strickland, Marcus, Mesibov & Hogan, 1996). This satisfies a further recommendation for the generalisation of skills by using multiple trainers and naturally occurring reinforcers and outcomes to promote the transfer of social problem solving.

Additionally, these environments create role-play situations in a learning environment within which the user feels safe to practice (Parsons & Mitchell, 2002). They allow for social mistakes to be made without the subsequent real life social consequences, such as embarrassment, or the potential negative reactions of others. This is an important factor as those with ASCs typically find new, or novel, social situations distressing and confusing (DeRosier et al., 2010). The use of a VE can reduce the number of threatening social factors to the individual as many of these factors can be manipulated by the facilitator (Parsons, 2005).

The VE could create advantages for teaching social skills through the ability to reduce the number of interoperable social conventions in a given situation (Lorenzo et al., 2013). The facilitator may then be able to focus training on particular aspects of that situation, without the distraction of an abundance of interacting social factors. However, reducing the number of social elements in the situation could reduce the representation of the simulation. Debatably, this could reduce the likelihood of generalisation to real life, when the removed social conventions are present within a real life scenario. However, the facilitator's control over the difficulty level of the social interaction in the VE can ensure that learning can occur at the learner's level (Parsons, Mitchell & Leonard, 2004). It could allow for the participant to take control of the learning process through the choice of difficulty settings of an interaction, and participants can be encouraged to choose their own learning goals and targets (Irish, 2013; Parsons & Mitchell, 2002). They may also gain self-awareness of situations in which they feel comfortable (Lorenzo et al., 2013).

Finally, VEs could facilitate the possible simulation of mental events that could help participants to develop flexible thinking in both understanding their own mental states, and the mental states of other people (Parsons, Leonard & Mitchell, 2006). Reviewing, discussing and clarifying the verbal and non-verbal reactions of others, based on the interactions experienced in a VE, may help develop theory of mind (Parsons & Cobb, 2011).

### **5.3 The Use and Understanding of Virtual Environments**

If those with an ASC process social situations differently, then it may be useful to consider that this population could have a different understanding of a VE and may have different approaches to interacting with such technologies. In order for SST with a VE to be successful, individuals with ASC would have to understand that these environments are designed to represent real life interactions (Parsons et al., 2005), and be able interact with them as they were real life situations (Hopkins et

al., 2011). Participants would have to be able to apply the same rules in the VEs as if they were in a real life interaction, rather than interact with them as a game where boundaries can be explored.

In an early study using VEs delivered through a head-mounted display, Strickland et al. (1996) found that attention and eye contact towards a target stimulus were sustained appropriately by those with ASC when interacting with a VE, in comparison to a control group. Parsons et al. (2004) found that those with an ASC were able to understand that the VE was a representation of real life. They found that the participant's personal space awareness was poor in the VE, but were unable to provide evidence for whether this was a difficulty for the participants in real life, or whether the participants could understand the relevance of real life social conventions in the VE.

In a follow up study, Parsons et al. (2005) aimed to measure not only the functional use of the VE by an ASC population, but also the understanding of social conventions involved in the VE-based scenarios. The focus VE scenario was entering a café, ordering food at the counter and finding a seat in the VE. They used a comparison group of pupils matched for IQ from both mainstream and specialist schools. It was concluded that the ASC group interacted with the VE in similar ways to the control group and mirrored the social impairments that may be observed in real life interactions.

#### **5.4 Impact of Virtual Environments for Social Skills Training**

Currently, there is little research focusing upon the efficacy of the use of technologies for SST, particularly the evidence of its use in schools (Reed, Hyman & Hirst, 2011). There has also been little empirical evidence to support using VEs in SST training (Irish, 2013), and it is often evaluated en masse in relation to other technological approaches (Grynszpan, Weissm Oerez-Diaz & Eynat, 2014). Many of the studies that have been conducted often stated that the interventions were 'preliminary' or 'exploratory' (Kandalajt, Didehbani, Krawczyk, Allen &

Chapman, 2013), and may not currently meet criteria for evidence-based practice (Irish, 2013).

The teaching methods employed within the VEs are generally instructional in nature (Parsons & Cobb, 2011); often rely on the repetition of social skills (Lorenzo et al., 2013); and seem to include post evaluation and reflection on performance within the VE interactions (Irish, 2013). Overall, there has been less focus on how skills are taught with the VE thus far and the approaches used have been heterogeneous in nature (Grynszpan et al., 2014).

In an early review article, Irish (2013) reviewed twelve studies that used either a VE or single user VE (SVE) in order to teach social communication skills. Irish concluded that such studies were exploratory and all reported tentative positive impacts of VEs through various questionnaire and observation based measures. The author also highlighted that most studies emphasised the potential benefits of the approaches and that further research would require more rigorous research methodologies.

In a VE designed to improve social judgements regarding where to sit in a busy café, Mitchell et al. (2007) found that participants generalised learning from a VE intervention to a novel café environment. They also found that the skill learning also transferred to making decisions regarding where to sit in a bus scenario. Participants used a keyboard and mouse to navigate basic VEs. Based on participants' judgements, text messages would pop up on screen to provide instruction and to act as teaching agents based on whether their responses were socially appropriate. However, this study was only a measure of generalisation within the VE, and no measure of real life functioning was gathered.

Other empirical evidence for SST using VEs has led to reported improvements in executive functioning and general social competencies of those with Asperger Syndrome (Lorenzo, et al., 2013); improvements in facial recognition and facial gaze in adolescents with ASC (Bekele et al., 2014); improvements in pretend play in young children with ASC (Herrera, et al., 2008); and improvements in an array

of conversation skills for young adults with High-functioning Autism (HFA) (Ke & Im, 2013).

Stichter, Laffey, Galyen and Herzog (2013) evaluated iSocial, a VE programme that incorporated several evidenced-based practices that included cognitive-behaviour therapy, applied behavior analysis and direct instruction. In this study, the VE was not designed to replicate real life but acted as a joint game for individuals to work on together as part of a greater programme to improve social engagement. The authors reported a small positive impact on positive social behaviors, but did not find improvements in parent and teacher reports of emotional recognition and social problem solving. One potential confounding variable was that the practice of skills occurred in an unrealistic and unrepresentative VE context. This could have increased the transfer distance between the VE and real life scenarios.

A study was conducted by Kandalaft et al., (2013) with eight young adults diagnosed with HFA. Ten sessions were facilitated through an online VR software program accessed via a desktop computer, controlled by using a mouse, keyboard and a microphone. Using an avatar of the participant, the participant and the facilitator practised a number of social scenarios in the VE, such as attending a party. During these scenarios, the coach would make notes on interaction performance relating to target social skills goals and reviewed the participant's responses during a joint dialogue with the participant. Following the intervention, pre- and post-test measures revealed an increase in performance in measures of theory of mind, emotional recognition and conversational skills. Furthermore, the participants generalized these skills to novel settings. The authors concluded that VE programmes that include a number of contexts, scenarios and social goals, could be used to develop overall social functioning, or to develop more specific skills in a particular context.

## 5.5 Critique of the Research Outcomes

### *5.5.1 Methodological Limitations.*

The emerging research studies aimed at evaluating the use of VEs in social skills training mirror a number of the methodological limitations found in the evidence for SST evaluations. For example, a major limitation is the use of small sample sizes (Mitchell et al., 2007; Parsons, 2005; Parsons, et al., 2004). Sample sizes have ranged from single case studies to 10 participants (Irish, 2013; Kandalaf et al., 2013). This could be a reflection of the difficulty that researchers face in obtaining samples from the ASC population and also of the resource demands and practical difficulties posed by the duration and intensity of training. Small sample sizes will impact upon the power and the effect size found following statistical analysis (Marszalek, Barber & Kohlhart, 2011). The majority of the published studies found during this literature search for VE SST have not reported either the level of power or effect size. Considering the small size of the samples, it may be questionable to generalize these studies' findings to the whole population (Asendorpf et al., 2013).

There has often been a lack of random control group design studies, or adequate control group designs (Grynszpan et al., 2014). Therefore, the possibility for confounding variables increases, such as the natural maturity of social skills over time. Furthermore, providing any SST programme could produce an effect regardless of the tools and teaching methods used.

Similar to the evidence base for traditional SST programmes, Grynszpan et al. (2014) emphasize that as the teaching approaches and teaching intensity differ between studies, it is difficult to suggest that the VE was the mediator of any positive outcomes. It is also clear that the teaching methods incorporated with the technology are as important as the technologies themselves (Kerr, Neale & Cobb, 2002). Therefore, VEs should be considered as tools that provide affordances and assistive qualities for teaching, rather than an independent teaching tool (Dunleavy,

Dede & Mitchell, 2009). To use a VE in isolation could lead to poor participant choices and ineffective use of a VE by the participant.

Despite the potential benefits that VEs provide for the potential generalisation of skills taught, there has yet to be a study that includes an adequate measure of skill generalisation and maintenance in real life contexts (Irish, 2013). Generalisation may need to be measured in a less broad manner than previous SST studies, and measured within a real life target scenario. Based on what is understood about ASCs, it may be unrealistic to predict that skills will generalise beyond a target interaction, and that measuring the generalisation to a novel real life situation itself would be a more useful measure. For example, if the target social situation is paying for goods at a supermarket, social skills measures should be sought in this real life context, rather than determining if skills improve in a school-based interaction. Perhaps there should be a distinction made between the maintenance of a learnt social skill in a learning setting, and the maintenance of the generalisation of a skill. Arguably, a measure of the generalisation of a skill over time may be a more useful measure of social skill learning, since the purpose of SST is for the skills to be generalised to novel social settings in order to improve the individual's ability to interact with the world (Ennis-Cole, 2015).

#### *5.5.2 Further Limitations.*

The level at which VEs represent real life is often referred to as representation. Representation is a key issue in the field of SST and, in past research, the quality of the graphics of VR environments has been basic, and often represents what would be expected of a computer game, rather than real life (Irish, 2013). In a qualitative study of two VE users with ASC by Parsons et al. (2006), the virtual characters were described as being unrealistic and lacking personality. The assumption is that the more realistic the environment is in representing real life, the greater the chance of generalisation (Parsons & Cobb, 2011). Therefore, from a purely graphical perspective, future environments will need to be better at representing a real life environment and real people.



Current VEs for teaching social skills are highly structured and may not represent the fluid and unpredictable behaviour of real life social interactions (Bauminger-Zviely et al., 2013). In previous studies, participants have suggested that the scenarios were heavily rule-based and that the characters in the environment were too predictable (Andersson, Josefsson & Pareto, 2006). If VEs do not represent the relevant social elements of real life situations then they may not create an effective environment for the generalisation of social skills (Parsons et al., 2005). It may be that avatars in the VE will need to be controlled by other humans in order for the responses to be more realistic and natural in their presentation.

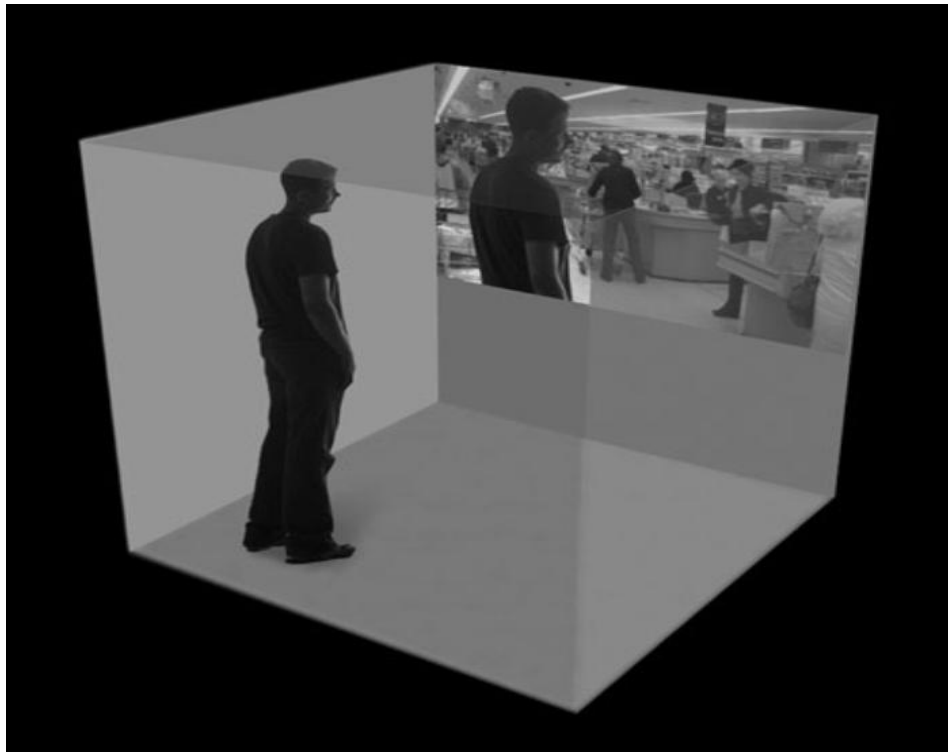
Finally, there are concerns that the use of VEs and computer-based interventions may encourage social isolation and less willingness to interact with the real world (Cromby, Standen & Brown, 1996; Latash, 1998). There has yet to be empirical evidence to suggest that participants demonstrate a significant increase in the use of computer methods of communication following training with a VE (Irish, 2013). However, there has been no measure of this concern in any evaluation studies to date. This may highlight the importance of ensuring that the VEs will be used as training tools to promote skill use in real life, rather than promote the use of VEs as a substitution for communication (Parsons & Mitchell, 2002).

## **5.6 Future Directions for Virtual Environments**

One future direction for VEs could be through the incorporation of collaborative VEs. This is where a VE for SST is accessed by multiple users at once, regardless of their locality (Lorenzo et al., 2013). In this instance, the facilitator would also not be physically present, but can still guide participants through SST using the VE. These interactions can then become more realistic as real life participants will be in control of the avatars in the environment (Parsons et al., 2006).

Lastly, as technology improves it will be imperative that VEs become more representative of real life. These advancements have already begun to emerge in other fields. For example, Gega, White, Clarke, Turner and Fowler (2013)

employed an approach that improved the representativeness of VEs through the use of a video-based virtual environment (VVE). Through the use of a motion depth camera, an avatar of the participant is layered over a live video layer in order to simulate a social interaction from a third-person perspective (see Figure 3). The facilitator would control the responses of the video avatar.



*Figure 3. A Video-based Virtual Environment (Adapted from Gega et al., 2013)*

The authors used this method with a sample of adults who were diagnosed with social phobia and simulated a number of lifeskill-based social experiences. In conjunction with a CBT approach, they found that participants' confidence in engaging with real life scenarios increased following the use of the VVE. Arguably, using a VVE moves beyond traditional video modelling as the individual is able to interact with the environment. As real people are on screen, the VVE simulates a highly representational environment in which to practise social skills.

## **6. The Current Study**

### **6.1 Overview**

This review has examined the various factors that may influence the generalisation of skills for those with an ASC and has made subsequent suggestions of what could be considered for future teaching in SST programmes and the subsequent evaluation of VE-based interventions. The research presented has highlighted a number of ways that the current approaches to SST for children and adolescents with ASCs have successfully promoted the generalisation of skills. Importantly, it has highlighted the potential of using VEs for SST, in particular the ability to create a contextualised and naturalistic learning environment. Finally, the review has highlighted appropriate recommendations for future research.

### **6.2 Research Aims**

The purpose of this study is to explore whether a VVE could be used for SST for adolescents with ASC, with a specific focus on whether the skills taught would be generalised to a real life social interaction. It will include SST teaching methods, as described in this review, that can be used to promote generalisation. This research aims to provide a pre- and post-test, control trial methodology (as suggested by Grynszpan et al., 2014), with specific measures of skill generalisation and generalisation maintenance over time.

### **6.3 Research Questions**

In order to assess the effectiveness of a VVE SST intervention for adolescents with ASC, the present research will be driven by the following research questions: -

1. When simulating a target social interaction within a video virtual environment social skills training intervention, do the skills taught generalise to the naturally occurring target interaction?

2. If skills do generalise to the naturally occurring interaction, is this effect maintained over time?
3. When simulating a target social interaction within a video virtual environment social skills training intervention, do the skills taught lead to a reported improvement in overall social functioning?

## 7. References

- American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Andersson, U., Josefsson, P., & Pareto, L. (2006). Challenges in designing virtual environments training social skills for children with autism. In *Proceedings of the 6<sup>th</sup> International Conference on Disability, Virtual Reality, & Associated Technologies*, (pp.35-43), Esbjerg, Denmark: Academic Press.
- Ardoin, S. P., & Daly, E. J., III. (2007). Introduction to the special series: Close encounters of the instructional kind—how the instructional hierarchy is shaping instructional research 30 years later. *Journal of Behavioural Education, 16*, 1–6.
- Asendorpf, J. B., Conner, M., De Fruyt, F., De Houwer, J., Denissen, J. J. A., Fiedler, K., Fiedler, S., Funder, D. C., Kliegl, R., Nosek, B. A., Perugini, M., Roberts, B. W., Schmitt, M., van Aken, M. A. G., Weber, H., & Wicherts, J. M. (2013). Recommendations for increasing replicability in psychology. *European Journal of Personality, 27*(2), 108–119.
- Baker, J., Parks-Savage, A., & Rehfuss, M. (2009). Teaching social skills in a virtual environment: An exploratory study. *Journal of Specialist in Group Work, 34*(3), 209-226.
- Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology, 41*, 63-105.
- Banda, D. R., Hart, S. L., & Liu-Gitz, L. (2010). Impact of training peers and children with autism on social skills during center time activities in inclusive classrooms. *Journal of Research in Autism Spectrum Disorders, 4*, 619–625.
- Baron-Cohen, S. (2010). Empathizing, systemizing, and the extreme male brain theory of autism. *Progress in Brain Research, 186*, 167-175.
- Baron-Cohen, S. (2009). Autism: The empathizing-systemizing (E-S) theory. *Annals of the New York Academy of Sciences, 1156*, 68-80.

- Baron-Cohen, S. (2008) *Autism and Asperger Syndrome*. Oxford: Oxford University Press.
- Baron-Cohen, S. (2002). The extreme male brain theory of autism. *Trends in Cognitive Science*, 6, 248–254.
- Baron-Cohen, S. (1989). The autistic child's theory of mind: a case of specific developmental delay. *Journal of Child Psychology and Psychiatry*, 30, 285-298.
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a “theory of mind?” *Cognition*, 21, 37–46.
- Baron-Cohen, S., Ring, H., Moriarty, J., Schmitz, B., Costa, D., & Ell, P. (1994). Recognition of mental state terms. Clinical findings in children with autism and a functional neuroimaging study of normal adults. *British Journal of Psychiatry*, 165(5), 640-649.
- Baron-Cohen, S., Scott, F. J., Allison, C., Williams, J., Bolton, P., Matthews, F. E., & Brayne, C. (2009). Prevalence of autism spectrum conditions: UK school-based population study. *British Journal of Psychiatry*, 194, 500-509.
- Barry, T. D., Klinger, L. G., Lee, J. M., Palardy, N., Gilmore, T., & Bodin, S. D. (2003). Examining the effectiveness of an outpatient clinic-based social skills group for high-functioning children with autism. *Journal of Autism and Developmental Disorders*, 33(6), 685–701.
- Bauminger-Zviely, N., Eden, S., Zancanaro, M., Weiss, P. L., & Gal, E. (2013). Increasing social engagement in children with high-functioning autism spectrum disorder using collaborative technologies in the school environment. *Autism*, 17, 317-339.
- Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development*, 71(2), 447-456.
- Bauminger, N., Shulman, C., & Agam, G. (2003). Peer interaction and loneliness in high functioning children with autism. *Journal of Autism and Developmental Disorders*, 33, 489–507.

- Bekele, E., Crittendon, J., Zheng, Z., Swanson, A., Weitlauf, A., Warren, Z., & Sarkar, N. (2014). Assessing the utility of a virtual environment for enhancing facial affect recognition in adolescents with autism. *Journal of Autism and Developmental Disorders, 44*, 1641-1659.
- Bellini, S., Peters, J. K., Benner, L., & Hopf, A. (2007). A meta-analysis of school-based social skills interventions for children with autism spectrum disorders. *Remedial and Special Education, 28*(3), 153–162.
- Bhatti, M., Ali, S., Isa, M., & Battour, M. M. (2014). Training transfer and transfer motivation: The influence of individual, environmental, situations training design, and affective reaction factors. *Performance Improvement Quarterly, 27*(1), 51-82.
- Brown, S. M., & Bebko, J. M. (2012). Generalization, overselectivity, and discrimination in autism phenotype: A review. *Research in Autism Spectrum Disorders, 6*(2), 733-740.
- Brown, W. H., & Odom, S. L. (1994). Strategies and tactics for promoting generalization and maintenance of young children’s social behaviour. *Research in Developmental Disabilities, 15*(2), 99-118.
- Cappadocia, M. C., & Weiss, J. A. (2010). Review of social skills training groups for youth with Asperger Syndrome and High Functioning Autism. *Research in Autism Spectrum Disorders, 5*(1), 70–78.
- Carrington, S., Leekham, S., Kent, R., Maljaars, J., Gould, J., Wing, L., Le Couter, A., Berckelaer-Onnes, I. V., & Noens, I. (2014). Signposting for diagnosis of autism spectrum disorder using diagnostic interview for social communication disorders (DISCO). *Research in Autism Spectrum Disorders, 9*, 45-52.
- Chung, K. M., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tasse, M. J. (2007). Peer-mediated social skills training program for young children with high- functioning autism. *Research in Developmental Disabilities, 28*, 423–443.
- Cornish, U., & Ross, F. (2004). *Social skills training for adolescents with general moderate learning difficulties*. London: Jessica Kingsley Publishers.

- Cotugno, A. (2009). Social competence and social skills training and intervention for children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*, 1268–1277.
- Cromby, J., Standen, P. J., & Brown, D. J. (1996). The potentials of virtual environments in the education and training of people with learning disabilities, *Journal of Intellectual Disability Research*, *40*(6), 489-501.
- Daly, E. J. III, Lentz, F. E., & Boyer, J. (1996). The instructional hierarchy: A conceptual model for understanding the effect components of reading interventions. *School Psychology Quarterly*, *11*, 369-386.
- DeRosier, M. E., Swick, D. C., Davis, N. O., McMillen, J. S., & Matthews, R. (2010). The efficacy of a social skills group intervention for improving social behaviors in children with high functioning autism spectrum disorders. *Journal of Autism and Developmental Disorder*, *43*(8), 1402–1403.
- Delano, M. E. (2007). Video modeling intervention for individuals with autism. *Remedial and Special Educational*, *28*, 33-42.
- Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, *18*(1), 7-22.
- Ennis-Cole, D. L. (2015). *Technology for learners with autism spectrum disorders*. Switzerland: Springer International Publishing.
- Flynn, L., & Healy, O. (2012). A review of treatments for deficits social skills and self-help skills in autism spectrum disorder. *Research in Autism Spectrum Disorders*, *6*(1), 434-441.
- Frederickson, N., & Cline, T. (2009). *Special educational needs, inclusion and diversity: A textbook*. Buckingham: Open University Press.
- Frith, U. (2003). *Autism: Explaining the enigma* (2<sup>nd</sup> Ed). Oxford: Blackwell.
- Frith, U., Happe, F., & Siddons, F. (1994). Autism and theory of mind in everyday life. *Cognition*, *50*, 115-132.



- Fombonne, E. (2009). Epidemiology of pervasive developmental disorders. *Pediatric Research, 65*, 591-598.
- Gega, L., White, R., Clarke, T., Turner, R., & Fowler, D. (2013). Virtual environments using video capture for social phobia with psychosis. *Cyberpsychology, Behaviour, and Social Networking, 16*(6), 473-479.
- Geurts, H. M., Corbett, B., & Soloman, M. (2009). The paradox of cognitive flexibility in autism. *Trends in Cognitive Science, 13*(2), 74-82.
- Goldstein, I. L. (1986). *Training in organizations: Needs assessment, development and evaluation*. Pacific Grove, CA: Brooks Cole.
- Gresham, F. M., Sugai, G., & Horner R. H. (2001). Interpreting outcomes of social skills training for students with high-incidence disabilities. *Exceptional Children, 67*(3), 331-344.
- Grynszpan, O., Weiss, P. L., Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: A meta-analysis. *Autism, 18*(4), 346-361.
- Haq, I., & Le Couteur, A. (2004). Autism spectrum disorder. *Medicine, 32*(8), 61-63.
- Haring, N. G., & Eaton, M. D. (1978). Systematic procedures: An instructional hierarchy. In N. G. Haring, T. C. Lovitt, M. D. Eaton, & C. L. Hansen (eds.), *The fourth R: Research in the classroom*. Columbus, Ohio: Charles E. Merrill Publishing Company.
- Happé, F., & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorder. *Journal of Autism and Developmental Disorders, 36*(1), 5-25.
- Herrera, G., Alcantud, F., Jordan, R., Blanquer, A., Labajo, G., & De Pablo, C. (2008). Development of symbolic play through the use of virtual reality tools in children with autistic spectrum disorders: Two case studies. *Autism: The International Journal of Research and Practice, 12*(2), 143-157.
- Hill, E., Bethoz, S., & Frith, U. (2004). Brief report: Cognitive processing of own emotions in individuals with autistic spectrum disorder and in their relatives. *Journal of Autism and Developmental Disorders, 34*(2), 229-235.

- Hopkins, I. M., Gower, M. W., Perez, T. A., Smith, D. S., Amthor, F. R., Wimsatt, F. C., & Biasini, F. J. (2011). Avatar assistant: Improving social skills in students with an ASD through a computer-based intervention. *Journal of Autism and Developmental Disorders, 41*(11), 1543-1555.
- Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 45*, 212–229.
- Howlin, P., Mawhood, L.M., & Rutter, M. (2000). Autism and developmental receptive language disorder: A follow-up comparison in early adult life: II. Social, behavioural and psychiatric outcomes. *Journal of Child Psychology and Psychiatry, 41*, 561–578.
- Irish, J. E. N. (2013). Can I sit here? A review of the literature supporting the use of single-user virtual environments to help adolescents with autism learn appropriate social communication skills. *Computers in Human Behaviour, 29*(5), A17-A24.
- Jenson, W., Bowen, J., Clark, E., Block, H., Gabrielsen, T., Hood, J., Radley, K., & Springer, B. (2011). *Superheroes social skills*. Eugene, OR: Pacific Northwest.
- Kandalaf, M., Didehbani, N., Krawczyk, D., Allen, T., & Chapman, S. (2013). Virtual reality social cognition training for young adults with high functioning autism. *Journal of Autism and Developmental Disorders, 42*, 1544–1555.
- Kanner, L. (1943). Autistic disturbance of affective contact. *Nervous Child, 2*, 217–250.
- Ke, F., & Im, T. (2013). Virtual-reality-based social interaction training for children with high-functioning autism. *The Journal of Educational Research, 106*(6), 441-461.
- Kelly, A. (2011). *Talkabout for children: Developing self-awareness and self-esteem*. Milton Keynes: Speechmark.
- Kerr, S. J., Neale, H. R., & Cobb, S. V. G. (2002). Virtual environments for social skills training: The importance of scaffolding in practice. *Asssets, 104-110*.

- Klinger, L.G., & Dawson, G. (2001). Prototype formation in autism. *Development and Psychopathology, 13*, 111–124.
- Koning, C., & Magil-Evans, J. (2003). Social and language skills in adolescent boys with Asperger Syndrome. *Autism, 5*(1), 23-36.
- Kozlowski, S. W. J., & DeShon, R. P. (2004). A psychological fidelity approach to simulation-based training: Theory, research, and principles. In E. Salas, L. R. Elliott, S. G. Schflett, & M. D. Covert (Eds.), *Scaled Worlds: Development, validation, and applications* (pp. 75-99). Burlington, VT: Ashgate Publishing.
- Lai, M. C., Lombardo, M. V., & Baron-Cohen, S. (2013). Autism. *Lancet, 383*, 896-910.
- Laker, D. R. (1990). Dual dimensionality of training transfer. *Human Resource Development Quarterly, 1*, 209–235.
- Latash, M. L. (1998). Virtual reality: A fascinating tool for motor rehabilitation (to be used with caution). *Disability and Rehabilitation, 20*(3) 104-105.
- Laugeson, E.A., Frankel, F., Gantman, A., Dillon, A. R., & Mogil, C. (2012). Evidence-based social skills training for adolescents with autism spectrum disorders: the UCLA PEERS program. *Journal of Autism and Developmental Disorders, 42*(6), 1025–1036.
- Levy, A., & Perry, A. (2011). Outcomes in adolescents and adults with autism: A review of the literature. *Research in Autism Spectrum Disorders, 5*, 1271-1282.
- Liss, M., Fein, D., Allen, D., Dunn, M., Feinstein, C., Morris, R., Waterhouse, L., & Rapin, I. (2001). Executive functioning in high-functioning children with autism. *Journal of Child Psychology and Psychiatry, 42*, 261–270.
- Lopata, C., Thomeer, M. L., Volker, M. A., & Nida, R. E., (2006). Effectiveness of a cognitive-behavioral treatment on the social behaviors of children with Asperger disorder. *Focus on Autism Other Developmental Disabilities, 21*(4), 237–244.

- Lorenzo, G., Pomares, J., & Lledo, A. (2013). Inclusion of immersive virtual learning environments and visual control systems to support the learning of students with Aspergers Syndrome. *Computers & Education, 62*, 88-101.
- Mandy, W. P. L, Charman, T., & Skuse, D. H. (2012). Testing the construct validity of proposed criteria for DSM-5 Autism Spectrum Disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(1), 41-50.
- Martens, B. K., & Witt, J. C. (2004). Competence, persistence, and success: The positive psychology of behavioural skill instruction. *Psychology in the Schools, 41*(1), 19-30.
- Marszalek, J. M., Barber, C., & Kohlhart, J. (2011). Sample size in psychological research over the past 30 years. *Perceptual and Motor Skills, 112*(2), 331-348.
- Marrens, B., K., & Witt, J. C. (2004). Competence, persistence, and success: The positive psychology of behavioral skill instruction. *Psychology in the Schools, 41*(1), 19-30.
- Matson, J. L., Matson, M. L., & Rivet, T. T. (2007). Social-skills treatments for children with autism spectrum disorders. *Behavior Modification, 31*, 682–707.
- McMahon, C. M., Lerner, M. D., & Britton, N. (2013). Group-based social skills interventions for adolescents with higher-functioning autism spectrum disorder: A review and looking to the future. *Adolescent Health, Medicine and Therapeutics, 4*, 23-38.
- Medalia, A., & Saperstein, A. (2011). The role of motivation for treatment success. *Schizophrenia Bulletin, 37*(2), S122-S128.
- Mitchell, P., Parsons S., & Leonard, A. (2007). Using virtual environments for teaching social understanding to adolescents with autistic spectrum disorders. *Journal of Autism and Developmental Disorders, 37*, 589–600.
- Neely, L., Davis, H., Davis, J., & Rispoli, M. (2015). Review of reliability and treatment integrity trends in autism-focused research. *Research in Autism Spectrum Disorders, 9*, 1-12.

- Ozonoff, S., & Jensen, J. (1999). Brief report: Specific executive function profiles in three neurodevelopmental disorder. *Journal of Autism and Developmental Disorder*, 29(2), 171-177.
- Ozonoff, S., & Miller, J. N. (1995). Teaching theory of mind: A new approach to social skills training for individuals with autism. *Journal of Autism and Developmental Disorders*, 25, 415–433.
- Ozonoff, S., Pennington, B., & Rogers, S. (1991). Executive function deficits in high-functioning autistic children: relationship to theory of mind. *Journal of Child Psychology and Psychiatry*, 32, 1081–1106.
- Parsons, S. (2005). Use, understanding and learning in virtual environments by adolescents with autism spectrum disorders. *Annual Review of Cybertherpay and Telemedicine*, 3, 207-215.
- Parsons, S., & Cobb, S. (2011). State-of-the-art of virtual reality technologies for children on the autism spectrum. *European Journal of Special Needs Education*, 26(3), 355–366.
- Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research*, 46, 430-443.
- Parsons, S., Mitchell, P., & Leonard, A. (2005). Do adolescents with autism spectrum disorders adhere to social conventions in virtual environments. *Autism*, 9(1), 95-117.
- Parsons, S., Mitchell, P., & Leonard, A. (2004). The use and understanding of virtual environments by adolescents with autism spectrum conditions. *Journal of Autism and Developmental Disorders*, 34(4), 449-466.
- Parsons, S., Leonard, A., & Mitchell, P. (2006). Virtual environments for social skills training: Comments from two adolescents with autistic spectrum disorder. *Computers & Education*, 47(2), 186-206.
- Pellicano, E. (2012). The development of executive function in autism. In "Autism: Cognitive Control across the Lifespan" [Special Issue]. *Autism Research and Treatment*, vol. 2012, article id: 146132.

- Plaisted, K., Swettenham, J., & Rees, L. (1999). Children with autism show local precedence in a divided attention task and global precedence in a selective attention task. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 40(5), 733–742.
- Radley, K. C., O’Handley, R. D., Ness, E. J., Ford, W. B., Nattaglia, A. A., McHugh, M. B., & McLemore, C. E. (2014). Promoting social skill use and generalization in children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 8, 669-680.
- Rajendran, G., & Mitchell, P. (2007). Cognitive theories of Autism. *Developmental Review*, 27, 224-260.
- Rao, P. A., Beidel, D. C., & Murray, M. J. (2008). Social skills interventions for children with Asperger’s Syndrome or High-functioning Autism: A review and recommendations. *Journal of Autism and Developmental Disorders*, 38, 353–361.
- Reed, F. D. D., Hyman, S. R., & Hirst, J. M. (2011). Applications of technology to teach social skills to children with autism. *Research in Autism Spectrum Disorders*, 5, 1003-1010.
- Reichow, B., & Volkmar, F. R. (2010). Social skills interventions for individuals with autism: Evaluation for evidence-based practices within a best evidence synthesis framework. *Journal of Autism and Developmental Disorders*, 40, 149-166.
- Rotter, J. B. (1975). Some problems and misconceptions related to the construct of internal versus external control of reinforcement. *Journal of Consulting and Clinical Psychology*, 43(1), 56-67.
- Skinner, C. H., & Daly, E. J. III. (2010). Improving generalization skills: Commentary on the special issue. *Journal of Behavioral Education*, 19(1), 106-115.
- Solomon, M., Goodlin-Jones, B. L., & Anders, T. F. (2004). A social adjustment enhancement intervention for high functioning autism, Asperger’s syndrome, and pervasive developmental disorder NOS. *Journal of Autism and Developmental Disorders* 34, 649–668.

- Spence, S. H., Donovan, C., & Brechman-Toussaint, M. (1994). Practitioner review: Cognitive therapy with children and adolescents: From theory to practice. *Journal of Child Psychology and Psychiatry*, 35(5), 1191-1228.
- Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child and Adolescent Mental Health*, 8, 84–96.
- Stichter, J. P., Laffey, J., Galyen, K., & Herzog, M. (2013). iSocial: Delivering the social competence intervention for adolescents (SCI-A) in a 3D virtual learning environment for youth with high functioning autism. *Journal of Autism and Developmental Disorders*, 44(2), 417-430.
- Strickland, D., Marcus, L., Mesibov, G., & Hogan, K. (1996). Brief report: Two case studies using virtual reality as a learning tool for autistic children. *Journal of Autism and Developmental Disorders*, 26(6), 651-660.
- Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, 10, 349-367.
- Stokes, T. F., & Osnes, P. G. (1989). An operant pursuit of generalization. *Behaviour therapy*, 20, 337-355.
- Sullivan, K., Stone, W. L., & Dawson, G. (2014). Potential neural mechanism underlying the effectiveness of early intervention for children with autism spectrum disorder. *Research in Developmental Disabilities*, 35(11), 2921-2932.
- Travis, L. L., & Sigman, M. (1998). Social deficits and interpersonal relationships in autism. *Mental Retardation and Developmental Disabilities Research Reviews*, 4(2), 65-72.
- Tsai, L. (2014). Impact of DSM-5 on epidemiology of autism spectrum disorder. *Research in Autism Spectrum Disorders*, 8, 1454-1470.
- Wang, P., & Spillane, A. (2009). Evidence-based social skills interventions for children with autism: A meta-analysis. *Education and Training in Developmental Disabilities*. 44(3), 318-342.

- Weissbein, D. A., Huang, J. L., Ford, J. K., & Schmidt, A. M. (2010). Influencing learning states to enhance trainee motivation and improve training transfer. *Journal of Business Psychology, 26*, 423-435.
- Wichnick, A. M., Vener, S. M., Pyrtek, M., & Poulson, C. L. (2010). The effect of script-fading procedure on unscripted social initiations and novel utterances among children with autism. *Research in Autism Spectrum Disorders, 4*, 290-299.
- White, S. W., Keoing, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: A review of the intervention research. *Journal of Autism and Developmental Disorders, 37*(10), 1858–1868.
- World Health Organization (1992). *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. Geneva: World Health Organization.
- World Health Organization (2013). *Autism spectrum disorders and other developmental disorders: From raising awareness to building capacity*. Geneva: World Health Organization.
- Yamhill, S., & McLean, G. N. (2001). Theories supporting transfer of training. *Human Resource Development Quarterly, 12*(2), 195-208.





**A Video-based Virtual Environment for Teaching Social Skills  
to Adolescents with Autism: In Search of Generalisation**

**Part B: Major Empirical Study**

## **1. Abstract**

A novel video-based virtual environment was employed to facilitate social skills training with a group of 18 adolescents with autism. Verbal, non-verbal and paralinguistic skills were taught in the simulated social scenario of ordering at a café counter. Skill generalisation was promoted through explicit cognitive, affective, behavioural and environmental teaching strategies. A waitlist control design was employed. Data were gathered through structured observations in a natural café setting and through questionnaire measures to parents and teachers, pre- and post-intervention. The results revealed that the intervention group's observed social skills improved significantly, in comparison to the control group's. All participants' observed social skills in the target scenario had improved following exposure to the intervention and these effects were maintained one month after the intervention ceased. This research provides support for the further study of VEs for teaching SST to children and adolescents with autism. The implications for the teaching strategies employed to promote generalisation in SST programmes are discussed. Future directions are proposed and the relevance to the practice of an educational psychologist is highlighted.

## 2. Introduction

In 1943, Leo Kanner famously described the behaviour of a set of young patients as demonstrating “autistic aloneness” (Kanner, 1943, pg 242.) and henceforth the term ‘Autism’ entered the mainstream. Research into the validity of Autism Spectrum Conditions (ASC) as a medical diagnosis, as well as exploring neurobiological and psychological models that underpin the condition, has advanced significantly since this paper (Lai, Lombardo & Baron-Cohen, 2013). However, one of the most observable and prominent aspects of ASC continues to be difficulties associated with social communication (Baron-Cohen, 2010; Travis & Sigman, 1998).

Those with ASC struggle to interpret and use non-verbal and verbal communication skills that are required for reciprocal communication (Koning & Magil-Evans, 2003). The presence of Autism often leads to general difficulties in conversation skills (Bauminger-Zviely, Eden, Zancanaro, Weiss & Gal, 2013) and can include difficulties in initiating conversation, asking appropriate questions, commenting on the activity of others, responding when spoken to, and basic attention skills (Chung et al., 2007).

These social skills difficulties do not arise from a lack of interest in social communication (White, Keoing & Scabil., 2007). However, because of difficulties with such skills, those with ASC may present as being uninterested in such activity (Cotugno, 2009). Children and adolescents with ASC struggle to form effective friendships (Bauminger, Shulman & Agam, 2003) and report fewer feelings of companionship, security and support from close peers, along with higher levels of loneliness in comparison to their peers (Bauminger & Kasari, 2000). A significant impact of the inability to form strong relationships with others is a subsequent lack of engagement in home, school and community activities and experiences (Barry et al., 2003).

Life outcomes for those with Autism are significantly better for those who have interventions for developing language, social interaction, communication and self-help skills (Levy & Perry, 2011). The World Health Organisation (2013) highlights that the most effective approaches for meeting the social communication and behaviour needs of those with an ASC are direct psycho-educational, developmental and behaviour interventions. In the absence of these interventions for those with ASC, the difficulties with engaging in social experiences could increase with age (Howlin, Goode, Hutton & Rutter, 2004).

## **2.1 Social Skills Training**

One of the common approaches for developing the social communication skills of those with ASC is through the use of Social Skills Training (SST) programmes (Bellini, Peters, Benner & Hopf, 2007). SST programmes aim to provide learning experiences in order to develop the necessary skills to successfully interact with others in a social environment (Rao, Bediel & Murray, 2008). SST programmes typically attempt to focus on individual social skills and to teach them in small, achievable steps based on the individual's level of development (Cappadocia & Weiss, 2011). Skills are then introduced in increasingly complex and realistic interactions and environments (Flynn & Healy, 2012).

Matson, Matson and Rivet (2007) highlight that effective programmes have key behaviourist elements, such as reinforcement, modelling and behaviour shaping strategies. SST has evolved to include cognitive elements that are designed to develop the ability to perform more complex social problem solving (Solomon, Goodlin-Jones & Anders, 2004). Arguably, these interventions are the most common in school-based settings and are often known as traditional SST (Cappadocia & Weiss, 2011).

A number of reviews and meta-analyses have reported minimal overall effects for SST, but have reported improvements in an array of social skills and

communication skills (Bellini et al., 2007; Wang & Spillane, 2009). A major issue of the research is that the social skills curricula or target behaviours are often poorly defined (Matson et al., 2007). A factor that impacts upon the validity of the current meta-analyses in the area is the vast heterogeneity in the teaching methods employed (Flynn & Healy, 2012).

A significant issue is that many SST programmes have failed to find that the skills taught generalise beyond the teaching setting to real life contexts (White et al., 2007). Arguably, generalisation of skills is the goal of any educational programme of this kind (Ennis-Cole, 2015). Subsequently, many studies have concluded that future research will require the inclusion of specific teaching strategies to promote generalisation in SST and valid measures of skill generalisation (Cappadocia & Weiss, 2011; Rao et al., 2008). There are potential behavioural, cognitive, environmental, affective and attributional style factors that may enable generalisation.

## **2.2 Behaviour Generalisation Strategies**

As SST was originally designed as a behaviour modification programme, a number of behavioural teaching strategies have been proposed to promote generalisation. Stokes and Osnes (1989) offered three categories of strategies that could promote generalisation. These were: (a) exploiting natural contingencies; (b) training diversely; and (c) incorporating functional mediators. To exploit natural contingencies, behaviours are trialled and maintained in natural contexts once the intervention has been removed. Training diversely is the use of numerous examples of behaviours, or can be achieved by changing the context and the order of stimuli as much as possible to train for a variety of potential outcomes. To incorporate functional mediators, stimuli that prompt the subsequent performance and self-monitoring of the performance of the acquired learning should be included.

### **2.3 Cognitive Generalisation Strategies**

Cognitive approaches engage the learner with the environment, rather than see the learner as passively responding to stimuli in the environment. For learners to generalise skills to new situations they will need interpersonal problem solving skills, to be aware of social determinants within situations, to understand the interpersonal factors of the situation (such as the receiver's emotional responses), to make a best judgement accordingly and to evaluate the reactions and responses from the environment (Spence, 2003). In order for this to occur, SST programmes will need to develop the learner's ability to identify problems, to develop solutions and to predict the likelihood of changes in a given situation (Bernard-Optiz, Sriram & Nakhoda-Sapuan; Cornish & Ross, 2004).

### **2.4 Affective and Attribution Style Generalisation Strategies**

Affective and attributional style factors are often greatly overlooked in SST and may impact upon the quality of skill generalisation. In many of the empirical studies of general skills training, it is often assumed that the individual will be motivated to learn and will fully engage with the intervention (Yamnill & McLean, 2001). The level of intrinsic motivation has been found to be a key determinant of the engagement and treatment outcomes of psychosocial interventions in clinical settings (Medalia & Spaerstein, 2011). Medalia and Spaerstein (2011) suggest effective strategies designed to raise intrinsic motivation to learn, such as matching the programme's tasks to the individual's ability, the personalisation of tasks, linking tasks to target contexts and giving the participant control over their own learning.

Other affective and attributional style factors that have been linked to generalisation include the participant's perceived value of the learning content, performance self-efficacy (Bhatti, Ali, Isa & Battour, 2014; Yamnill & McLean, 2001), and locus of

control (Weissbein, Huang, Ford & Schmidt, 2010). Many of these affective factors can be promoted through teaching strategies and have subsequently improved the likelihood of the generalisation of skills in a number of learning environments (Medalia & Spaerstein, 2011; Weissbein et al., 2010).

## **2.5 The Teaching Environment and Generalisation**

Hypothetically, it may be that skills that are taught within the environment in which they need to be performed are more likely to be reproduced in that context. This has been described as the transfer distance principle (Laker, 1999), where the more the learning environment represents the learning context, the more likely that the learning may occur in a similar context. As this distance increases, the context becomes less representative of the target context. Consequently, the learning stimulus may then need to become less particular. The teaching will then need to provide a general heuristic for skill application or include skills that can be applied in a multitude of situations (Goldstein, 1986).

One way to define the distance could be through applying the theory of Baldwin and Ford (1988) who define a distinction between the physical and psychological fidelity of a learning environment. The authors argue that, if the training situation is able to replicate the psychological processes such as psychological determinants and affective responses in the training environment, then the real physical context may not be required.

## **2.6 Virtual Environments for Social Skill training**

A novel technology that could be used to increase the physical and psychological fidelity of the learning environments for SST is Virtual Environments (VE). The most common method of creating VEs for SST for individuals with an ASC has been through the use of virtual reality (Parsons & Cobb, 2011). Virtual reality (VR) consists of a computer generated three-dimensional reality that a user accesses via a

screen and a visual representation of themselves, or through immersive technologies such as headsets and motion sensors (Lorenzo, Pomares & Lledo, 2013). A VR VE can be described as a computer generated, interactive representation of an environment that strives to emulate real life scenarios and interactions in real time (Parsons, Mitchell & Leonard, 2005; Mitchell, Parsons & Leonard, 2007).

There are many a priori arguments as to why using VEs may provide effective teaching environments for SST (Herrera et al., 2008). VEs provide a naturalistic simulation of environments for the training of a wide range of social interactions and contexts (Ke & Im, 2013). VEs are able to respond and react to the participant's responses in different ways and allow for the novel and varying repetition of target interactions (Lorenzo et al., 2013). VEs create teaching situations in which the user feels safe to make mistakes (Parsons & Mitchell, 2002). This is an important element, as those with Autism typically find new or novel social situations distressing and confusing (DeRosier, Swick, Davis, McMillen & Matthews, 2010). VEs could allow for the possible simulation of mental events that can promote the understanding of the mental states of others, and the participant's own mental states (Parsons, Leonard & Mitchell, 2006).

Early studies of VEs have found that those with ASC understand that the VEs are representations of real life (Parsons, Mitchell & Leonard, 2004) and that participants interacted with the environments in similar ways to a matched control group of neurotypical participants (Parsons et al., 2005). Although the current impact of VEs for SST has been evaluated through studies of an exploratory nature, reported outcomes have included improvements in conversation skills that have generalised to real life situations (Kandalaf, Didehbani, Krawczyk, Allen & Chapman, 2013). Furthermore, Mitchell et al. (2007) found that following training to improve social judgements regarding where to sit in a busy café, the participants' skills increased in the café, but they also generalised their new skills to a simulation of choosing where to sit on a busy bus.



There have also been positive findings for the use of VEs in improving facial recognition and facial gaze in adolescents with Autism (Bekele et al., 2014); executive functioning and general social skills with an Asperger Syndrome group (Lorenzo et al., 2013); improvements in pretend play in children with ASC (Herrera, et al., 2008); and improvements in conversation skills for young adults with high-functioning autism (Ke & Im, 2013).

A major issue with these approaches is that the physical and psychological fidelity of the VEs are not well simulated, and users often comment on the VEs' lack of realism (Andersson, Josefsson & Pareto, 2006). This may have resulted from highly structured virtual responses that may not represent the fluid and unpredictable behaviour of real life social interactions (Bauminger-Zviely et al., 2013). If realistic representation of the relevant social elements of real life situations is not achieved in the VE, then it may not create an effective environment for the generalisation of social skills (Parsons et al., 2005). As VEs are designed to make it easier for participants to interact, there are concerns that the use of VEs and computer-based interventions may encourage social isolation and less willingness to interact with the real world (Latash, 1998).

As much of the research of VEs is exploratory, there have been a number of methodological issues in the current research for the use of VEs in SST. These have included small sample sizes, zero-baseline measures and the lack of adequate control trial studies (Grynszpan, Weiss, Perez-Diaz & Gal, 2014). Significantly, there has been little attention paid to how skills are taught with the VE thus far and the teaching approaches used have been heterogeneous in nature (Irish, 2013). It is clear that the teaching methods incorporated with the technology are as important as the technologies themselves (Kerr, Neale & Cobb, 2002) and the affordances of using VEs with different teaching approaches could be explored further (Dunleavy, Dede & Mitchell, 2009).

## **2.7 The Current Study**

The current study explored whether a video-based virtual environment (VVE) could be used for SST for teaching social skills to adolescents with ASC, in a target social interaction. It specifically focused on whether the skills taught would be generalised to a real life social target interaction. The study used a novel technology to maximise the representativeness of the VE through a video-based approach. The current study employed the VVE arrangement as described by Gega, White, Clarke, Turner and Fowler (2013), in a school-based setting.

The teaching approaches included cognitive, affective, behavioural and environmental SST teaching strategies that have been identified to promote skill generalisation. This research aims to provide a pre- and post- test, control trial methodology as suggested by (Grynszpan et al., 2014), with specific measurements of skill generalisation and maintenance over time. In order to assess the effectiveness of a VVE SST intervention for adolescents with ASC, this investigation was designed to answer the following research questions: -

1. When simulating a target social interaction within a video virtual environment social skills training intervention, do the skills taught generalise to the naturally occurring target interaction?
2. If skills do generalise to the naturally occurring interaction, is this effect maintained over time?
3. When simulating a target social interaction within a video virtual environment social skills training intervention, do the skills taught lead to a reported improvement in overall social functioning?

### 3. Methodology

#### 3.1 Research Paradigm

This research was underpinned by a post-positivist research paradigm. The methodology employed attempts to provide controlled and objective study conditions to generate empirical findings in order to support the research questions stated. However, in this paradigm it is acknowledged that research findings cannot be free from contextual variables, such as experimenter values and a priori experience, historical artefacts and cultural variables (Crotty, 1998). The results and conclusions drawn support and provide evidence towards potential effects, rather than inferring causality or claiming absolute verifications.

#### 3.2 Participants

A convenience sample of 18 participants was taken from one centre for adolescents with ASC, attached to a mainstream school in South Wales, UK. A clinical diagnosis of Autism was required to attend the centre and was confirmed by the school to the researcher. These diagnoses included Pervasive Developmental Disorder-NOS (PDD-NOS), Asperger Syndrome, High-Functioning Autism and Autism.

Table 3 *Participant Characteristics*

<b>Gender</b>	<b>N</b>	<b>Mean Age</b>	<b>Range</b>
Male	17		
Female	1		
<i>Total</i>	18	13.3	11.1 – 15.4
<b>Diagnosis</b>	<b>Number</b>		<b>%</b>
Autism Spectrum Disorder	11		61%
Asperger Syndrome	2		11%
High-functioning Autism	4		22%
PDD-NOS	1		6%

All participants' cognitive abilities had been assessed by an Educational Psychologist prior to attending the centre. This school-held data confirmed that all

participants had a cognitive ability standard score above 70. Participants were aged between 12 and 15 years old, and there were at least three participants from each year group (7 to 10). Table 3 provides further details of the sample.

### 3.3 Inclusion Criteria

A clinical diagnosis of ASC was the main inclusion criterion. In order to interact with the VVE, the ability to comprehend three information-carrying words (ICWs) in a sentence was also an inclusion criterion. Comprehension of ICWs is a common measure of receptive language ability (Law et al., 2012). This information was confirmed by school report, which was based on Speech and Language Therapist reports held by the school.

### 3.4 Materials

#### *3.4.1 Technology and Video-based Virtual Environments.*

The VVE system was based on the arrangement employed by Gega et al. (2013) and is illustrated in Figure 4. The arrangement involved the use of a Microsoft Xbox KINECT motion depth camera, a compatible laptop computer and a 20-inch external monitor. The software employed was Xendou's Virtual Learning Environment and VLC Media player.

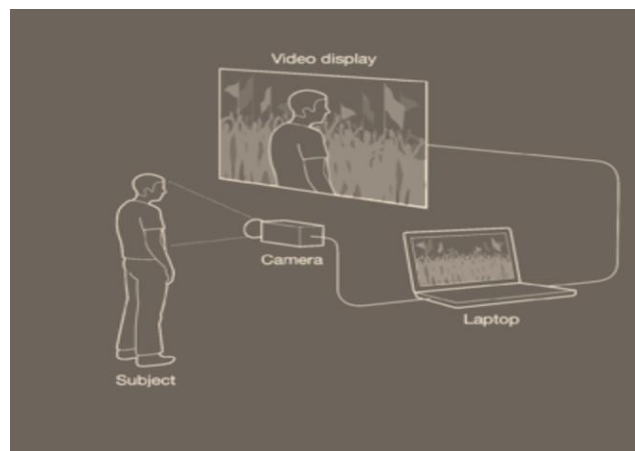


Figure 4. Video-based Virtual Environment Arrangement

Participants stood in front of the external monitor and the depth camera captured a video representation of them. This representation was then layered onto a background video screen. The facilitator had a bank of pre-recorded video responses in which it appears that the individual on the video layer is looking at the participant's on screen representation (see Figure 5).



*Figure 5.* Participant's View of the Video-based Virtual Environment

The participant could see this from a third person perspective. The facilitator could change the responses of the videos based on the participant's responses in the interaction, making the videos a real-time, interactive experience for the participant. Interacting with the VVE did not require training.

This study was interested in training social skills in the specific interaction of ordering at a café. Nine video interactions were used in total, each including a different actor and a variation of a script. Each participant experienced three novel interactions per session. Each interaction could have been used more than once for practice purposes and the VVE could respond differently each time. The initial session was designed to familiarise the participants with the equipment, and incorporated three interactions based on meeting someone for the first time. Six of the available interactions were based on ordering at a café counter. Each video interaction had at least 24 different responses. A physical café menu was provided to participants so that they could decide what they were going to order in the VVE.

### 3.5 Procedure

#### 3.5.1 Training Content and Teaching Approach.

The VVE training consisted of three 50 minute sessions, delivered on a weekly basis. Each participant experienced the VVE training individually. The researcher and one member of school staff administered the training. Session 1 was designed for the participant to become familiar with the materials and with the novelty of the technology. Session 1 focused on developing social skills in the context of meeting someone new. Sessions 2 and 3 were based on developing social skills in the context of ordering from a café counter. An overview of the teaching approach and manual can be found in Figure 6. Three social skills were targeted per session, based on the participant’s areas for improvement from the observation scores at Time 1. Participants were asked which skills they would like to practise from a choice, in order to promote participant autonomy.

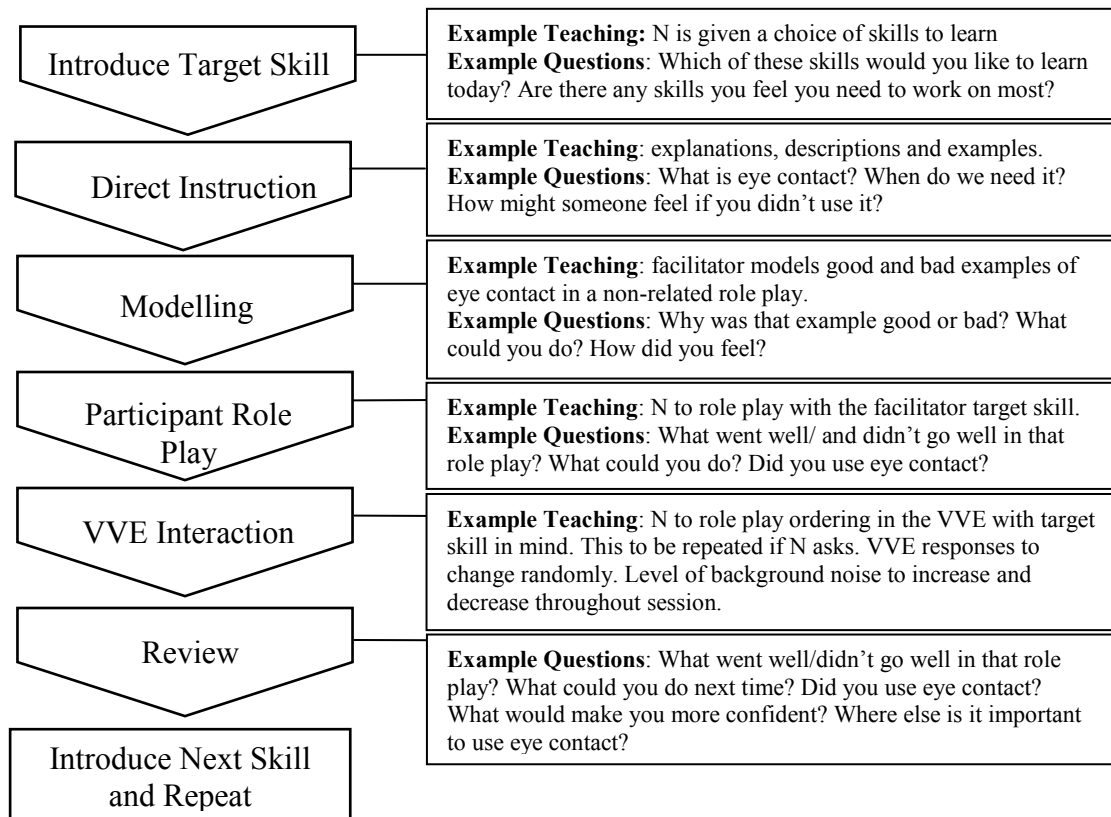


Figure 6. An Example Teaching Strategy Flow Chart for Eye Contact in the VVE

### *3.5.2 Natural Observation Procedure.*

Participants were observed during their timetabled visit to a local café. Participants were scored from the moment they began to order at a café counter, to the point of walking away. It was part of the participant's normal experience to be observed by staff during café visits, so that support could be provided when it was required. Participants were made aware they were being observed in this study, and verbal consent was agreed on each occasion. In order to reduce the levels of anxiety of the participants, they were not made aware that they were being scored. Adjacent staff were able to help the participant if they required support, as this would normally happen during a visit. The same café was used for each observation. Raters positioned themselves on a marked table to the right hand side of the café counter for maximum vision. Observers rated their social skills live during the interaction. Both observers were blind to both each other's scores and the participants' performance from previous observations.

## **3.6 Pre- and Post-Measures**

### *3.6.1 Structured Observation.*

The structured observation measure was adapted from the social skills assessment tool from the Talkabout programme (Kelly, 2011). Both the facilitator and the school-based observers had previously received formal training to employ the measure in a school setting. In total, 17 social skill competencies were judged on a rating scale of 1 to 4 (See Table 4). Composite scores could range from a minimum of 17 to a maximum of 68. Items can be organised into three subscales of non-verbal skills (5 items), paralinguistic skills (5 items) and verbal skills (7 Items).

Table 4 *Items in Social Skill Observation Measure*

<b>Non-Verbal Skills</b>	<b>Paralinguistic Skills</b>	<b>Verbal Skills</b>
Eye Contact	Volume	Listening
Facial Expression	Rate	Starting a Conversation
Gestures	Clarity	Taking Turns
Fidgeting	Intonation	Asking Questions
Posture	Fluency	Answering Questions
		Being Relevant
		Ending a Conversation

### *3.6.2 Social Skills Rating System (SSRS) (Gresham & Elliot, 1990)*

The SSRS questionnaire was administered between Time 1 and Time 2 (a time period of one month) in order to obtain between-group comparisons of overall social functioning. It is a standardised measure of a wide range of social skills in the domains of co-operation, assertion, responsibility and self-control. The parent version of the SSRS was 38 items in length and the teacher version was 40 items in length. The test-retest reliability of the measure was reported at 0.87 and the SSRS reports an internal validity of 0.90.

### **3.7 Design**

A 3 x 2 factorial design was employed, within a wait list control study. Participants' social skills were individually observed three times. At Time 1, all participants were observed and were randomly allocated to two equal groups of nine and were named Group A and Group B. Between Time 1 and Time 2, Group A received the VVE training and Group B received no training and acted as a control group. Between Time 2 and Time 3 Group B received the VVE training and Group A received no training.



### 3.8 Ethical Issues

A number of ethical issues were posed by this study and a summary of the pertinent issues can be found in Table 5.

Table 5 *Overview of Ethical Issues and Researcher Actions*

<b>Ethical Issue</b>	<b>Researcher Actions</b>
<b>Observation Ethics</b>	The BPS (2010) guidelines for observation approaches and human research ethics were considered when planning the observation procedure. Participants were informed that they were being observed. However, to reduce the likelihood of anxiety, they were not told they were being scored.
<b>Informed Consent</b>	Informed consent was gained from all stakeholders involved for all measures and research activities stated. All stakeholders were aware of the title and aims of the research. Parents were invited to meet the researcher on three occasions, to use the technology and to ask questions prior to obtaining written consent. Parents were also sent an information sheet. Participant consent was obtained verbally following a scripted explanation of the study. A visual prompt for consent was available if it was required. Teacher consent was also obtained as the study required a significant contribution of time and resources.
<b>Confidentiality and Anonymity</b>	All participants, including teachers and parents, were made aware that the data collected would be held confidentially before being anonymised once all data had been collected.
<b>Nature of the Intervention</b>	All VVE responses were designed to be neutral or positive in nature. If a participant responded inappropriately to a role play, the VVE was stopped and it was used as a learning opportunity.
<b>Participant Anxiety</b>	In the unlikely event that a participant became anxious or uncomfortable in the VVE, they were made aware that they were able to stop the simulation at any time. They were able to say “stop”, leave the VVE area, or were provide a ‘stop’ card that they could hold up. Their reasons for becoming upset would be reviewed and they would have access to a quiet room and an independent adult at all times.
<b>Debrief</b>	Participants were debriefed following the final observation stage. Opportunities for questions were available at this point and parents had received the researcher’s contact details on the information sheet.

### **3.9 Statistical Analyses**

The advice and methods suggested by Breakwell, Smith and Wright (2012) and Brace, Kemp and Snelgar (2003) were used to guide the following data analysis. In order to analyse the structured observation, a mixed-design analysis of variance (ANOVA) was used as all necessary assumptions for parametric statistics were met. These included the assumptions of homogeneity, sphericity and normality. This was important as this analysis includes an error term that represents the interaction between the between-group and within-group factors.

For the questionnaire data, the teacher data met the necessary assumptions to be analysed through a mixed ANOVA. As the response rate for the parents' data was lower, the data did not meet the assumptions for analysis via parametric statistics as they were not normally distributed. A Shapiro-Wilks test of normality revealed that the Parents' reported SSRS scores were not normally distributed ( $w = .970$ ,  $p = .802$ ). Therefore, Mann-Whitney U tests were employed for the pre- and post-test scores to assess whether the two groups were different from one another at Time 2.

## 4. Results

### 4.1 Inter-rater Agreement (IRA)

The Guidelines for Reporting Reliability and Agreement Studies (GRRAS) (Kotter et al., 2011) were utilised to inform the reporting of IRA. Participants were rated by the researcher and a member of staff from the school. There were a total of 12 observations (four at each Time) and there were eight different raters who were randomly assigned based on their availability at the time.

The raters were blind to the grouping of the participants they were observing. Based on the advice of Hallgren (2012), IRA was assessed using a two-way mixed, absolute, average measures Intraclass Correlation (ICC) to assess the degree to which coders provided consistency in their ratings of social skills across subjects. The resulting ICC was in the ‘excellent’ range (Cicchetti, 1994) (ICC=0.97), suggesting that coders had a high degree of agreement. A high ICC suggests there was a minimal amount of measurement error, and that average ratings of the researcher and staff ratings would provide sufficient power for further statistical analysis (Hallgren, 2012).

### 4.2 Social Skills Observation Results

Table 6 Means and Standard Deviations of Social Skills Observation scores at Time 1, Time 2 and Time 3

<i>Measure</i>	<b>Group A (N= 9)</b>			<b>Group B (N=9)</b>		
	<b>Time 1</b>	<b>Time 2</b>	<b>Time 3</b>	<b>Time 1</b>	<b>Time 2</b>	<b>Time 3</b>
<i>Observation</i>						
Composite	42.06 (7.89)	52.22 (6.97)	52.89 (6.24)	42.06 (8.39)	41.61 (10.30)	53.11 (9.29)

Table 6 displays an overview of the means and standard deviations of both Groups at observation Time 1, 2 and 3. Figure 7 provides a pictorial description of the results.

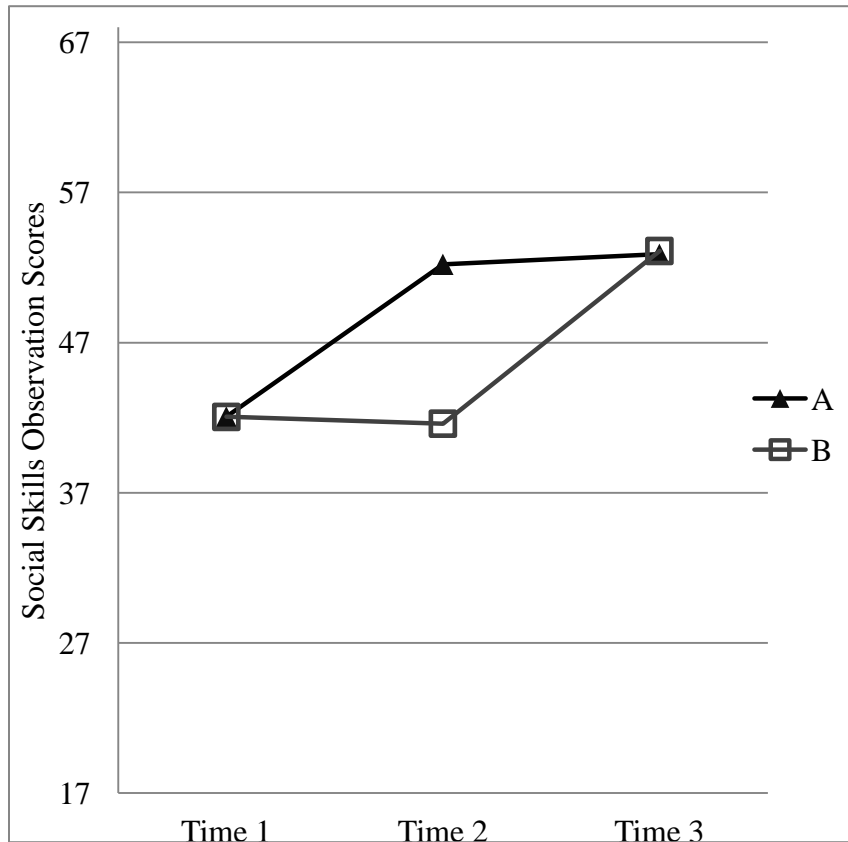


Figure 7. A Line Graph Showing the Mean Differences in Social Skills Observation Scores for Groups A and B, at Times 1, 2 and 3.

A Mixed ANOVA revealed a significant within-subjects main effect of Time ( $F(2, 32) = 26.69, p < .000, \eta^2 = .63$ ) and no significant differences were found between groups overall ( $F(1, 16) = .997, p = .338, \eta^2 = .058$ ). This indicated that there were significant differences across all of the Time data variable points, but there were no differences across the variance of the Group variable levels. The interaction of Group X Time was significant ( $F(2, 32) = 8.5, p < .001, \eta^2 = .35$ ). As the interaction between the Group and Time variables was significant, it indicates that at some levels, one independent factor was dependent on the level of another factor. This indicates that the main effects may not individually explain the

overall effect on the dependent variable (i.e., the observed social skills performance scores). Therefore, simple effects and comparisons were calculated.

A repeated-measures ANOVA revealed a significant simple effect for Time with Group A ( $F(2, 32) = 16.35, p < .01$ ). Simple comparisons revealed a significant increase in scores between Time 1 and Time 2 for Group A ( $t = 3.860, df = 8, p < .005$ , two-tailed) and no significant difference between scores at Time 2 and Time 3 ( $t = .354, df = 8, p = .733$ , two-tailed). This indicated that Group A's observed social skills performance scores improved significantly following the intervention between Time 1 and Time 2. Group A's observed social skills performance scores did not improve or decrease significantly between Time 2 and Time 3.

A repeated-measures ANOVA revealed a significant simple effect for Time with Group B ( $F(2, 32) = 18.82, p < .01$ ). Simple comparisons revealed no significant difference between Time 1 and Time 2 for Group B ( $t = .289, df = 8, p = .780$ , two-tailed), and a significant increase in scores between Time 2 and Time 3 for Group B ( $t = 5.212, df = 8, p = .001$ , two-tailed). This indicated that Group B's observed social skills performance scores did not improve significantly between Time 1 and Time 2. Group B's observed social skills performance improved significantly following the intervention between Time 2 and Time 3.

Follow up tests for Group revealed no significant simple effects of Group at Time 1 ( $F(1, 32) = 0.000, n.s.$ ) or Time 3 ( $F(1, 32) = 0.011, n.s.$ ). Thus, there were no differences between both Groups' average observed social skill performance scores at Time 1 and Time 3. However, a significant simple effect for Group at Time 2 was found ( $F(1, 32) = 24.96, p < .01$ ). Therefore, following Group A receiving the intervention, Group A's average observed social skill performance scores were significantly higher than Group B's, at Time 2.

### 4.3 Social Skills Rating System Results

Table 7 Means and Standard Deviations of SSRS scores at Time 1 and Time 2 (Pre and Post Intervention)

<i>Measure</i>	<b>Group A (N= 9)</b>		<b>Group B (N=9)</b>	
	<b>Time 1</b>	<b>Time 2</b>	<b>Time 1</b>	<b>Time 2</b>
<i>SSRS (Teacher)</i>				
Composite	33.11 (11.19)	35.56 (10.29)	31.11 (13.09)	36.89 (12.303)
	<b>Group A (N=6)</b>		<b>Group B (N=5)</b>	
<i>SSRS (Parent)</i>	<b>Time 1</b>	<b>Time 2</b>	<b>Time 1</b>	<b>Time 2</b>
Composite	42.00 (13.31)	42.33 (9.54)	37.20 (13.79)	39.20 (14.64)

#### 4.3.1 SSRS Teacher Version.

The response rate for the Teacher Questionnaire was 100% (N=18) and an overview of the means and standard deviations for the group can be found in Table 7. Figure 8 provides a pictorial description of the results.

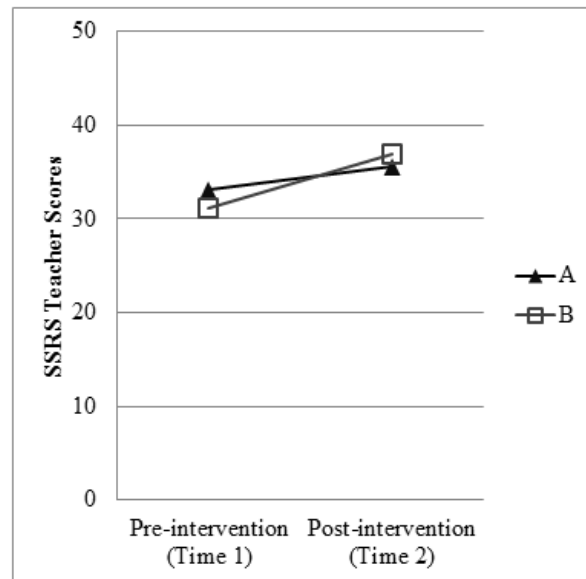


Figure 8. A Line Graph Showing the Mean Differences in SSRS Teacher Scores for Group A and B, Pre- and Post-intervention.

A Mixed ANOVA revealed a non-significant within-subjects main effect of Teacher Scores ( $F(1, 16) = 7.161, p < .017; \eta^2 = .309$ ) and no significant differences were found between Groups overall ( $F(1, 16) = .706, p = .915, \eta^2 = .911$ ). The interaction of Group X Time was not significant ( $F(2, 30) = 1.177, p < .294, \eta^2 = .069$ ). As there were no significant main effects or interactions between both of the Group's SSRS Teacher Scores, there were no significant differences between the groups.

#### 4.3.2 SSRS Parent Version.

An overview of the means and standard deviations for the group can be found in Table 7. The response rate for the Parents' questionnaire was 61% (N=11). Figure 9 provides a pictorial description of mean pre- and post-test scores for each group at Time 1 and Time 2.

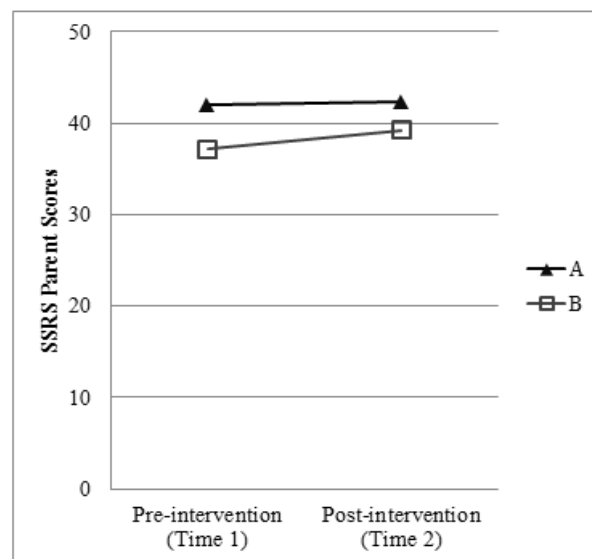


Figure 9. A Line Graph Showing the Mean Differences in SSRS Parent Scores for Group A and B, Pre- and Post-intervention.

Non-parametric analyses revealed no significant difference between the composite scores of Group A and Group B at Time 1 ( $U = 10.50, N_1 = 6, N_2 = 5, p = .662$ , two tailed) or Time 2 ( $U = 12.50, N_1 = 6, N_2 = 5, p = .429$ , two tailed). This indicated that there were no differences between Group A's and B's SSRS parent scores, at Time 1 or Time 2.

## **5. Discussion**

### **5.1 Overview**

This study aimed to explore whether an SST programme that utilised realistic VVE interactions could promote the successful generalisation of skills to a naturally occurring interaction for adolescents with ASC. The teaching methods employed have been described in detail and were designed to promote the generalisation of skills to the target environment. The VE aimed to build on the representativeness of previous VE SSTs by using interactive videos in order to create a virtual version of reality.

### **5.2 Research Question 1: Did the Skills Taught in the Video-based Virtual Environment Generalise to the Natural Environment?**

The results of the study suggest that all 18 of the participants' observed social skill performance scores in a natural café social interaction significantly improved following the VVE training. Group A's observed skill performance in the natural café improved to a greater extent than the Group B (wait-list control group) at Time 2. This supports the hypothesis that the skills taught in the VVE subsequently generalise to a naturally occurring target context. The control group was an important element as it rules out potential confounding variables such as naturally occurring social skill maturity. Group B's observed performance at Time 3 had also significantly improved, adding further evidence to suggest the improvement in social functioning was promoted by the VVE programme.

In the VVE, the participants experienced how their own behaviour may impact upon the responses of others, and this can result in a more realistic set of reinforcers than might be found in a synthetic teaching environment (Mitchell et al., 2007). These findings support the notion that VEs may reproduce the psychological fidelity of situations (Baldwin & Ford, 1988). These findings provide early evidence to support the hypothesis that VEs could create opportunities for the



simulation of mental events that can help flexible thinking in understanding their own and others' mental states (Parsons & Mitchell, 2002). Reviewing, discussing and clarifying the verbal and non-verbal reactions of others following a VVE interaction may help develop theory of mind (Parsons & Cobb, 2011).

### **5.3 Research Question 2: If the Skills are Generalised, was the Generalisation Maintained Over Time?**

The observed performance results for Time 2 and Time 3 suggest that Group A maintained the observed improvement for one month after the VVE programme ceased. This was a crucial finding, as one of the major limitations of the research on VE is the lack of measure of maintenance effects of VE based SST (Irish, 2013). Although this study revealed a maintenance effect one month later, it will be important that future studies are able to provide a measure of skills maintenance over lengthier periods of time, or through longitudinal study designs. Arguably, it may be useful to define the difference between the maintenance of social skill performance in a learning setting, and the maintenance of an individual's ability to generalise a skill to the real world.

### **5.4 Research Question 3: Did the Skills Taught in a VVE Interaction Lead to an Improvement in Overall Social Functioning?**

The outcomes of both the parent and teacher questionnaires suggest that there were no significant differences in the overall social functioning of the intervention group and the wait list control group over time. Therefore, it cannot be concluded that there was a significant improvement in overall social competence. This outcome supports the notion that employing SST programmes within a specific teaching context may not be effective for teaching skills to generalisation for adolescents with an ASC. This would apply to a singular context VE, a classroom or a clinical based setting, and could explain a number of the small effect sizes of SST reported in the literature.

However, the short length and low intensity of the programme in this research should be considered when interpreting these findings. Gresham, Sugai and Horner (2001) highlight that for a SST programme to be effective it must be intense, so that multiple experiences, exemplars and teaching can occur in the learner's environment. The current study focused on one particular interaction, but to impact upon overall social skills, a programme with a greater intensity may be required and may need to include a variety of situations and experiences.

### **5.5 Limitations**

One of the major limitations of this study was that the facilitators were often present during the observations. Although the observers did not engage in direct interaction, or provide any prompting or scaffolding, their presence might have led to a priming effect of the skills that were taught during the VVE training sessions. Further to this point, the participants were aware that they were being observed, and although this regularly occurred during their visits to the café, this could have impacted upon their behaviour over the three observations.

A contributing variable to the outcome of learning in the VVE was the impact of the facilitator's teaching. The facilitator's individual teaching style and skill set may have impacted on the effectiveness of learning (Mitchell et al., 2007; Parsons, 2005). Due to the complex nature of SST, it is likely that in school and community settings the facilitator is more likely to deviate from the intervention manual (Smith et al., 2007). Kerr et al. (2002) emphasise that instruction could be built into VEs to standardise the teaching procedures and remove the need for a facilitator. However, due to the fluid and flexible nature of social interactions, it may be impossible to go beyond a rule based approach in this system. This has led to reports of poor outcomes in studies that have employed this approach (Kerr et al., 2002).

## 5.6 Future Directions

### *5.6.1 Increasing the Number of Learning Contexts.*

As the area of VEs for SST is still very much in its infancy, this study was exploratory in nature and focused on one social interaction. Arguably, this interaction was a pragmatic and a necessary interaction rather than an interaction that would feature in general relationships. Future research studies and programmes will need to include a variety of social contexts and interactions. By increasing the types of contexts and social situations, it may be clearer whether VVEs are effective in managing more complex social scenarios, such as simulating disagreements or apologising behaviours, or social interactions across numerous settings and with varying people.

Increasing the number of learning contexts could produce further benefits for teaching SST. If it is assumed that the learning environments in SST may have to represent the psychological fidelity of a target situation, then practising within multiple VE contexts may improve the likelihood of social skills being applied by the user in a number of contexts. Secondly, it will be important to practise in a variety of settings for the facilitator to promote systematic links between social skill uses in differing social environments (Ranjendran & Mitchell, 2007). This could support learning based on the systemising strengths of those with ASC (Baron-Cohen, 2010). This may not only improve skills in the target scenario, but could help promote the logical transference of skills to new contexts.

### *5.6.2 Evidence of Effective Teaching Approaches.*

The purpose of this study was to maximise the likelihood of generalisation through the implementation of evidenced SST teaching approaches and a VVE. Future studies may be able to discover which teaching approaches are the most effective for use with a VVE system and a population with ASC. As those who develop and evaluate SST programmes come from diverse research and theoretical backgrounds,

there has been little agreement on which teaching approaches are most effective for teaching those with ASC (Rao et al., 2008). This study acknowledged the individual differences in the social skill profiles of those with ASC and included multifaceted teaching approaches for SST. Arguably, a broad range of approaches may be the most effective in developing the skills of a population with heterogeneous social functioning profiles.

### *5.6.3 Representativeness of the Virtual Environment.*

In previous VE studies, the individual was able to explore the VE through an avatar in real time (Irish, 2013; Kandalaf et al., 2013). At this stage in development, the VVE may have been more realistic in terms of the verbal and non-verbal features of social interactions, but it did not allow for the exploration of a social environment. As the technology improves, a video-based virtual world will need to be developed, where skills such as approaching others appropriately can become included in the training. Advances in technology could also lead to the facilitator having further control of the level of difficulty of a social situation, or the level of variables that can be adjusted to alter the situation (e.g., background noise, number of people in view etc.).

## **6. Relevance to the Practice of the Educational Psychologist**

The number of requests for help that educational psychologists (EPs) receive for needs that relate to, or are a result of, ASC have increased over time (Greenway, 2000). Educational settings are increasingly searching for evidence-based interventions for both the learning and the social needs of students with ASC (Wilkinson, 2005). The current research has provided support for one evidence based-approach to developing social skills with pupils with ASC that could be used in educational settings. Arguably, it has also highlighted some of the generalisation strategies could be used as a basis for effectively promoting generalisation in any SST programme.

The SST interventions currently employed in schools often lack both fidelity and an evidence-base, or their link with psychological theory is poorly understood (Tutt, Powell & Thornton, 2000). The unique position of the EP as a scientist-practitioner provides an opportunity to develop evidence-based practice for ASC with schools by empowering staff with the knowledge and psychological understanding of an effective SST programme (Denham, Hatfield, Smethurst, Tan & Tribe, 2006). Furthermore, the EP is able to evaluate the implementation and effectiveness of such interventions for the individual child from a holistic perspective (Wilkinson, 2005). This research has added to the body of knowledge of what may underpin an effective SST programme and adds to the empirical evidence base to support such approaches.

## **7. Conclusions**

This study provides support for the use of video-based virtual environments for social skill training for adolescents with ASC. This exploratory study has provided a basis for teaching approaches that include the cognitive, affective, behavioural and environmental teaching factors that may be crucial for any SST programme to promote the generalisation of skills to natural contexts. Effective SST programmes may need to simulate the psychological fidelity of a target social interaction in order for those skills to occur in the naturally occurring context. Overall, the findings indicate that VEs may provide potentially powerful affordances for teaching social communication skills to adolescents with ASC.

## 7. References

- Andersson, U., Josefsson, P., & Pareto, L. (2006). Challenges in designing virtual environments training social skills for children with autism. In *Proceedings of the 6<sup>th</sup> International Conference on Disability, Virtual Reality, & Associated Technologies*, (pp.35-43), Esbjerg, Denmark: Academic Press.
- Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology*, *41*, 63-105.
- Baron-Cohen, S. (2010). Empathizing, systemizing, and the extreme male brain theory of autism. *Progress in Brain Research*, *186*, 167-175.
- Barry, T. D., Klinger, L. G., Lee, J. M., Palardy, N., Gilmore, T., & Bodin, S. D. (2003). Examining the effectiveness of an outpatient clinic-based social skills group for high-functioning children with autism. *Journal of Autism and Developmental Disorders*, *33*(6), 685–701.
- Bauminger, N., & Kasari, C. (2000). Loneliness and friendship in high-functioning children with autism. *Child Development*, *71*(2), 447-456.
- Bauminger N., Shulman, C., & Agam, G. (2003). Peer interaction and loneliness in high functioning children with autism. *Journal of Autism and Developmental Disorders* *33*, 489–507.
- Bauminger-Zviely, N., Eden, S., Zancanaro, M., Weiss, P. L., & Gal, E. (2013). Increasing social engagement in children with high-functioning autism spectrum disorder using collaborative technologies in the school environment. *Autism*, *17*, 317-339.
- Bekele, E., Crittendon, J., Zheng, Z., Swanson, A., Weitlauf, A., Warren, Z., & Sarkar, N. (2014). Assessing the utility of a virtual environment for enhancing facial affect recognition in adolescents with autism. *Journal of Autism and Developmental Disorders*, *44*, 1641-1659.
- Bellini, S., Peters, J. K., Benner, L., & Hopf, A. (2007). A meta-analysis of school-based social skills interventions for children with autism spectrum disorders. *Remedial and Special Education*, *28*(3), 153–162.

- Bernard-Optiz, V., Sriram, N., & Nakhoda-Sapuan. (2001). Enhancing social problem solving in children with autism and normal children through computer-assisted instruction. *Journal of Autism and Developmental Disorders, 31*(4), 377-384.
- Bhatti, M., Ali, S., Isa, M., & Battour, M. M. (2014). Training transfer and transfer motivation: The influence of individual, environmental, situations training design, and affective reaction factors. *Performance Improvement Quarterly, 27*(1), 51-82.
- Brace, N., Kemp, R., & Snelgar, R. (2003). *SPSS for Psychologists: A guide to data analysis using SPSS for windows* (2<sup>nd</sup> ed). Basingstoke: Palgrave Macmillan.
- Breakwell, G. M., Smith, J. A., & Wright, D. B. (2012). *Research methods in psychology* (4<sup>th</sup> ed). London: Sage.
- British Psychological Society (2010). *Code of Human Research Ethics*. Leicester: BPS.
- Cappadocia, M. C., & Weiss, J. A. (2010). Review of social skills training groups for youth with Asperger Syndrome and High Functioning Autism. *Research in Autism Spectrum Disorders, 5*(1), 70–78.
- Chung, K. M., Reavis, S., Mosconi, M., Drewry, J., Matthews, T., & Tasse, M. J. (2007). Peer-mediated social skills training program for young children with high-functioning autism. *Research in Developmental Disabilities, 28*, 423–443.
- Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological Assessment, 6*(4), 284-290.
- Cornish, U., & Ross, F. (2004). *Social skills training for adolescents with general moderate learning difficulties*. London: Jessica Kingsley Publishers.
- Cotugno, A. (2009). Social competence and social skills training and intervention for children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39*, 1268–1277.



- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. London: Sage.
- Denham, A., Hatfield, S., Smethurst, N., Tan, E., & Tribe, C. (2006). The effect of social skills interventions in the primary school. *Educational Psychology in Practice*, 22(1), 33-51.
- DeRosier, M. E., Swick, D. C., Davis, N. O., McMillen, J. S., & Matthews, R. (2010). The efficacy of a social skills group intervention for improving social behaviors in children with high functioning autism spectrum disorders. *Journal of Autism and Developmental Disorder*, 43(8), 1402–1403.
- Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, 18(1), 7-22.
- Ennis-Cole, D. L. (2015). *Technology for learners with autism spectrum disorders*. London: Springer.
- Flynn, L., & Healy, O. (2012). A review of treatments for deficits social skills and self-help skills in autism spectrum disorder. *Research in Autism Spectrum Disorders*, 6(1), 434-441.
- Gega, L., White, R., Clarke, T., Turner, R., & Fowler, D. (2013). Virtual environments using video capture for social phobia with psychosis. *Cyberpsychology, Behaviour, and Social Networking*, 16(6), 473-479.
- Ghaziuddin, M., & Mountain-Kimchi, K. (2004). Defining the intellectual profile of Asperger Syndrome: Comparison with high-functioning autism. *Journal of Autism and Developmental Disorders*, 34(3), 279-284.
- Goldstein, I. L. (1986). *Training in organizations: Needs assessment, development and evaluation*. Pacific Grove, CA: Brooks Cole.
- Greenway, C. (2000). Autism and asperger syndrome: Strategies to promote prosocial behaviours. *Educational Psychology in Practice*, 16(4), 469-486.
- Gresham, F. M., & Elliott, S. N. (1990). *Social skills rating system*. Circle Pines, MN: American Guidance Service.

- Gresham, F. M., Sugai, G., & Horner R. H. (2001). Interpreting outcomes of social skills training for students with high-incidence disabilities. *Exceptional Children, 67*(3), 331–344.
- Grynszpan, O., Weiss, P. L., Perez-Diaz, F., & Gal, E. (2014). Innovative technology-based interventions for autism spectrum disorders: A meta-analysis. *Autism, 18*(4), 346-361.
- Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in Quantitative Methods for Psychology, 8*(1), 23-34.
- Herrera, G., Alcantud, F., Jordan, R., Blanquer, A., Labajo, G., & De Pablo, C. (2008). Development of symbolic play through the use of virtual reality tools in children with autistic spectrum disorders: Two case studies. *Autism: The International Journal of Research and Practice, 12*(2), 143–157.
- Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 45*, 212–229.
- Irish, J. E. N. (2013). Can I sit here? A review of the literature supporting the use of single-user virtual environments to help adolescents with autism learn appropriate social communication skills. *Computers in Human Behaviour, 29*(5), A17-A24.
- Kandalaf, M., Didehbani, N., Krawczyk, D., Allen, T., & Champman, S. (2013). Virtual reality social cognition training for young adults with high functioning autism. *Journal of Autism and Developmental Disorders, 42*, 1544–1555.
- Kanner, L. (1943). Autistic disturbance of affective contact. *Nervous Child, 2*, 217–250.
- Ke, F., & Im, T. (2013). Virtual-reality-based social interaction training for children with high-functioning autism. *The Journal of Educational Research, 106*(6), 441-461.

- Kelly, A. (2011). *Talkabout for children: Developing self-awareness and self-esteem*. Milton Keynes: Speechmark.
- Kerr, S. J., Neale, H. R., & Cobb, S. V. G. (2002). Virtual environments for social skills training: The importance of scaffolding in practice. *Asssets*, 104-110.
- Koning, C., & Magil-Evans, J. (2003). Social and language skills in adolescent boys with Asperger Syndrome. *Autism*, 5(1), 23-36.
- Kotter, J., Audige, L., Brorson, S., Donner, A., Gajewski, B. J., Hrobjartsson, A., Robert, C., Shoukri, M., & Streiner, D. L. (2011). Guidelines for reporting reliability and agreement studies (GRRAS) were proposed. *Journal of Clinical Epidemiology*, 64, 96-106.
- Lai, M. C., Lombardo, M. V., & Baron-Cohen, S. (2013). Autism. *Lancet*, 383, 896-910.
- Laker, D. R. (1990). Dual dimensionality of training transfer. *Human Resource Development Quarterly*, 1, 209–235.
- Latash, M. L. (1998). Virtual reality: A fascinating tool for motor rehabilitation (to be used with caution). *Disability and Rehabilitation*, 20(3) 104-105.
- Law, J., Lee, W., Roulstone, S., Wren, Y., Zeng, B., & Lindsay, G. (2012). “What works”: *Interventions for children and young people with speech, language and communication needs*. London: DfE.
- Levy, A., & Perry, A. (2011). Outcomes in adolescents and adults with autism: A review of the literature. *Research in Autism Spectrum Disorders*, 5, 1271-1282.
- Lorenzo, G., Pomares, J., & Lledo, A. (2013). Inclusion of immersive virtual learning environments and visual control systems to support the learning of students with aspregers syndrome. *Computers & Education*, 62, 88-101.
- Matson, J. L., Matson, M. L., & Rivet, T. T. (2007). Social-skills treatments for children with autism spectrum disorders. *Behavior Modification*, 31, 682–707.

- Mitchell, P., Parsons S., & Leonard, A. (2007). Using virtual environments for teaching social understanding to adolescents with autistic spectrum disorders. *Journal of Autism and Developmental Disorders*, 37, 589–600.
- Medalia, A., & Saperstein, A. (2011). The role of motivation for treatment success. *Schizophrenia Bulletin*, 37(2), S122-S128.
- Parsons, S. (2005). Use, understanding and learning in virtual environments by adolescents with autism spectrum disorders. *Annual Review of Cybertherapy and Telemedicine*, 3, 207-215.
- Parsons, S., & Cobb, S. (2011). State-of-the-art of virtual reality technologies for children on the autism spectrum. *European Journal of Special Needs Education*, 26(3), 355–366.
- Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research*, 46, 430-443.
- Parsons, S., Mitchell, P., & Leonard, A. (2005). Do adolescents with autism spectrum disorders adhere to social conventions in virtual environments? *Autism*, 9(1), 95-117.
- Parsons, S., Mitchell, P., & Leonard, A. (2004). The use and understanding of virtual environments by adolescents with autism spectrum conditions. *Journal of Autism and Developmental Disorders*, 34(4), 449-466.
- Parsons, S., Leonard, A., & Mitchell, P. (2006). Virtual environments for social skills training: Comments from two adolescents with autistic spectrum disorder. *Computers & Education*, 47(2), 186-206.
- Rajendran, G., & Mitchell, P. (2007). Cognitive theories of Autism. *Developmental Review*. 27, 224-260.
- Rao, P. A., Beidel, D. C., & Murray, M. J. (2008). Social skills interventions for children with Asperger's Syndrome or high-functioning autism: A review and recommendations. *Journal of Autism and Developmental Disorders*, 38, 353–361.

- Solomon, M., Goodlin-Jones, B. L., & Anders, T. F. (2004). A social adjustment enhancement intervention for high functioning autism, Asperger's Syndrome, and pervasive developmental disorder NOS. *Journal of Autism and Developmental Disorders*, *34*, 649–668.
- Smith, T., Scahill, L., Dawson, G., Guthrie, D., Lord, C., Odom, S., Rogers, S., & Wagner, A. (2007). Designing research studies on psychosocial interventions in autism. *Journal of Autism and Developmental Disorders*, *37*(2), 354-366.
- Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child and Adolescent Mental Health*, *8*, 84–96.
- Stokes, T. F., & Osnes, P. G. (1989). An operant pursuit of generalization. *Behaviour Therapy*, *20*, 337-355.
- Travis, L. L., & Sigman, M. (1998). Social deficits and interpersonal relationships in autism. *Mental Retardation and Developmental Disabilities Research Reviews*, *4*(2), 65-72.
- Tutt, R., Powell, S., & Thornton, M. (2000). Educational approaches in autism: What we know about what we do. *Educational Psychology in Practice*, *22*(1), 69-81.
- Wang, P., & Spillane, A. (2009). Evidence-based social skills interventions for children with autism: A meta-analysis. *Education and Training in Developmental Disabilities*. *44*(3), 318-342.
- Weissbein, D. A., Huang, J. L., Ford, J. K., & Schmidt, A. M. (2010). Influencing learning states to enhance trainee motivation and improve training transfer. *Journal of Business Psychology*, *26*, 423-435.
- White, S. W., Keoing, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: A review of the intervention research. *Journal of Autism and Developmental Disorders*, *37*(10), 1858–1868.
- Wilkinson, L. A. (2005). Supporting the inclusion of a student with Asperger Syndrome: A case study using conjoint behavioural consultation and self-management. *Educational Psychology in Practice*, *21*(4). 307-326.

World Health Organization. (2013). *Autism Spectrum Disorders and other developmental disorders: From raising awareness to building capacity*. Switzerland, Geneva: World Health Organization.

Yamhill, S., & McLean, G. N. (2001). Theories supporting transfer of training. *Human Resource Development Quarterly*, 12(2), 195-208.



**A Video-based Virtual Environment for Teaching Social Skills  
to Adolescents with Autism: In Search of Generalisation**

**Part C: Critical Review**

## **1. Introduction**

This critical account is separated into two sections. The first section is a reflection on the process that led to the generation of new knowledge. It includes a personalised account of what led to the theory and research questions generated. The account describes how the current research has contributed to knowledge, whilst acknowledging some of the issues that emerged which could impact upon the general objectivity of the results.

The second section of this account provides a critical description of the development of the researcher-practitioner and outlines a number of the challenges that later impact on the outcome of the research. An overarching theme is how the skills demonstrated relate to both the applied psychologist and to the researcher. The way in which ethical issues were approached is discussed and systemic issues that impacted upon the research processes are addressed.



## **2. Contribution to Knowledge**

### **2.1 Research Positioning**

A logical starting point for this critique is to provide an explanation of the research paradigm that underpinned the research methodology. As researchers, our own paradigms are often shaped by our previous learning experiences. This could include experiences such as the location and positioning of our undergraduate study, or could include how knowledge was presented to us as children and adolescents. I started the professional doctorate with a strong knowledge of different research methodologies, as well as knowledge of the strengths and weaknesses that result from employing certain methodologies. I was aware of how to define research variables and how to employ research designs to capture observed or experimental effects. What I had not needed to consider was my own epistemological and ontological beliefs, and how these should impact upon the research methodologies that I choose to employ in research. Throughout my professional doctorate and this research process I have had to develop my knowledge of these beliefs and reflect upon where I would position myself in relation to various viewpoints.

First, I am an empiricist from the philosophical stance that knowledge is generated through sensory experience of the world. I acknowledge that sensory experiences are bound by our senses and that these can sometimes provide an inaccurate version of reality because of the researcher's limitations and biological factors (Robson, 2002). I also acknowledge that researchers come from particular cultures, have particular values, socio-political and cultural beliefs, and that these will create biases in the research process (Crotty, 1998).

Based on these observations, this research was approached through a post-positivist research paradigm. This would impact upon the methodology employed through a commitment to objectivity and independent scientific enquiry through empirical

processes. Within this, Popper's falsification principles would be adhered to (Crotty, 1998) and the null hypothesis would be tested in an attempt to support that the hypotheses stated might be accepted. Breakwell, Smith & Wright (2012) highlight that a hypothetico-deductive method is the most common research paradigm used in psychology, where theories and hypotheses are tested and where the reliability and the replicability of the findings are vital.

Most importantly, a post-positivist approach would impact on how the subsequent findings were interpreted. In contrast to positivist positions, post-positivists do not claim that the results provide absolute validation, certainty or the complete generalisation of any finding. The findings from this study relate to one particular approach and one perspective that could support the stated technologies for effective SST for adolescents with ASC. Only following further research from differing perspectives and approaches can we apply the SST approaches stated in this research with confidence in their potential effectiveness.

## **2.2 The Research Idea: A Personal Perspective**

My research idea emerged from my own professional experience of running SST groups with adolescents with ASC. In keeping with an empiricist view, I was often perplexed by how individuals with ASC could often demonstrate accurate and fluent knowledge of a social skill within SST interventions and yet subsequently fail to apply the skills in real life circumstances. This observed effect often included the apparent ability to use verbal descriptions of why a skill may need to be used, where it could be used and the different contexts in which it could be applied. It also included excellent role-play and peer-mediated performances of target skills during interventions in school. Yet despite this, observed accuracy in real life was often low for the most basic of social skills. As I came to learn more about the cognitive processes and patterns of ASC mentioned in this paper's literature review, I began to understand the potential reasons for this observation amongst a number of theories. Whether it is that those with an ASC struggle to see the general gist of

situations (Frith, 2003) and do not naturally apply knowledge to appropriate novel contexts (Klinger & Dawson, 2001), or whether it is a lack of a Theory of Mind (Baron-Cohen, Leslie & Frith (1985) and the lack of understanding of why it is important to use social skills, it became clear that moving focus to the learning context and creating naturalistic experiences for SST training would be key for skill generalisation.

What was interesting was that the individuals *had* often learnt a particular set of social skills that they *were* able to generalise to the real world. Some mechanism or process had seemed to help the individual deviate away from the expected generalisation failure pathway, and an array of social skills were applied appropriately. Anecdotally, I felt this was the case for all of the individuals that I worked with, albeit with each individual displaying differing social skill profiles. I felt that the discovery of this process behind these successes would be key to SST, although the likelihood of it being a singular mechanism seemed unduly simplistic and reductionist.

As discussed in the literature review, the vast and complex evidence base for SST had often highlighted the need to include teaching strategies that target generalisation within SST (Rao, Bediel & Murray, 2008). The problem remained that these strategies are not well defined in the literature and are highly context dependent. This led to an initial research question of “What environmental and teaching factors are important to promote the generalisation of skills learnt in SST programmes for adolescents with ASC?”

### **2.3 Arriving at Virtual Environments**

During the literature search on my initial research question, I found the article by Parsons & Mitchell (2002), describing the potential for VEs and SST and the potential for mental simulation. I felt that if the virtual simulation of natural events were enough to reproduce the natural social conditions of a situation, then this

could be a powerful tool for school-based SST. I hypothesised that VEs could provide naturalistic experience that could lead to generalisation of skills. However, I was aware that many of the teaching approaches used for SST overlapped and interacted. As the research in the literature review stated, as long as the researcher was fully transparent in reporting the teaching approaches and materials employed, then there was no best way to teach in VEs, as the area is still exploratory.

As a side note, I felt the idea of psychological fidelity is key in this study and in future research. If I were to carry out another piece of research it would be to define what this term means in a simulation setting. I am interested in what it is about these situations that promote the generalisation of learning. Although we are conscious that they are not real experiences, virtually simulated situations have been used to teach others in medical professions to complete procedures successfully, and for pilots in flight simulations.

## **2.4 Design and Data Collection**

The design of this study aimed to replicate the previous evaluation studies for SST using pre- and post-test control trails (Cappadocia & Weiss, 2002). I chose two separate data collection techniques based on the research questions posed. As discussed, as an empiricist I believe that we must understand the world through observations of phenomena, occurring in situ if possible. Therefore, it seemed appropriate to make an observation of the participants' social skills functioning in a target scenario. As the study also aimed to measure whether the participant would transfer the skills learnt in this setting to general environments, the next best source of information on such transfer may be obtained from the home and school. Therefore, such views were gathered by a structured questionnaire. This has also been a common approach in previous research studies of SST.

### *2.4.1 Structured Observation.*

Following the advice of Bryman (2012) on the use of observation methods in social research, a structured observation was employed. To be able to quantify whether improvements in a set of social skills had been made, it was useful to assign a coding system to each specific social skill. A coding sheet allowed for a systematic, structured, and standardised approach to measuring each individual's overall performance during a live interaction. This measure was used to allow for comparisons to be drawn between the quantifiable differences of scores following each observation (Bryman, 2012; Breakwell et al., 2012). Following the baseline observation, it would also provide a detailed profile of strengths and weaknesses that could be targeted during the intervention phase.

One of the major issues with this approach was the use of the 'focal sample' technique (Martin & Bateson, 1986). In a focal sample, the observer focuses upon an individual and codes the participant's behaviour over a set period of time. Ordering from a café counter is a relatively short interaction (often less than one minute) and the observation measure was of 17 different items. Occasionally, the observer had difficulty in coding and observing the interaction at the same time. In future observations, it may be more useful to rate behaviours directly after observing the intervention.

Although this measure of social skills was based on evidence, there was no evidence of its validity or test-retest reliability. There were concerns that the measure would be too sensitive, or not sensitive enough, to provide an accurate overview of each individual's skills. There was also a chance that a poor inter-rater agreement between the two observers might occur. Obtaining a good inter-rater agreement was important in this study in order to rule out experimenter bias. This was especially true as the facilitator was also a rater in the study and would be aware of those who had received the intervention.

A further issue with the observation measure was the potential for a ‘reactive effect’ (Bryman, 2012) or priming effect due to the presence of the observer. Although the facilitator did not interact with participants, the facilitator’s presence may have indirectly primed the individual to draw upon the SST. This might have been avoided if two independent members of staff had rated the participants’ behaviour. However, due to a lack of resources and the need to ensure that the standardisation of the data collection method was upheld, I felt the need to be present. In future studies, a trained, independent assessor could be used.

In order to reduce the anxiety that might result, participants were not told they were being scored during the observations, but participants were aware that they were being observed. How this impacted upon the participants is unknown, and whether they would have used the skills in the same way if not being observed is impossible to judge in this study. The use of covert video recording in the café was considered, but the technology was not easily available to the researcher and it also posed significant ethical issues.

#### *2.4.2 Questionnaires.*

For future research, it would be useful to outline some of the issues that emerged during this research. Firstly, a number of parents did not respond to both the pre- or post-questionnaire, and this reduced the sample. This may have been due to reasons such as difficulties with literacy skills or the length of the questionnaire. Secondly, when completing research in a school setting, letters that are sent home and subsequently returned to school are often the responsibility of the class teacher. There were some occasions when response slips were lost by the teacher. In future research, it may be useful for the researcher to take ownership of this process by posting questionnaires to parents. However, the researcher will have to consider the cost of this.

In hindsight, it might have been useful to ask parents whether they had seen a difference in functioning in the target setting, in an attempt to gather further data as evidence for skill generalisation to the target setting. However, the researcher could not control for the number of times a café was visited by a participant outside of school between the interventions. This may have had a confounding effect on the results as some participants may have had more natural café experience outside of school during the intervention periods.

## **2.5 Contribution to Knowledge**

This study contributed to knowledge by building upon the evidence for using VEs for SST by addressing a number of methodological issues in the evidence base, such as the lack of control trails (Irish, 2013). It was specifically designed to seek the generalisation of skills to a specific setting. Furthermore, it considered and included the key teaching factors that have been hypothesised to lead to the generalisation of taught skills.

### *2.5.1 Research Question 1.*

In relation to research question 1, the skills that were taught in the VVE did increase the observed level of social skills in the natural café interaction. This suggests that VVEs may be an effective tool for ensuring that the social skills taught in SST are transferred, applied and generalised to a real life context.

Debatably, this research has supported Laker's (1990) transfer distance principle, as the VE reduced the differences between the learning environment (the classroom) and the target environment (the café), and was successful in improving the generalisability of learning. It could also provide support to the idea that reproducing the psychological fidelity (Baldwin & Ford, 1988) of the learning scenario will be paramount in creating and simulating the cognitive, affective and attributional factors that would be present in a real life context.

Although it was concluded that the VE employed in this study represented real life interactions to a greater extent than its predecessors, the question of whether it fully simulates the psychological fidelity of a situation remains. For example, one response of the VE was to tell the participant that the café had run out of what they wanted to order. In the VE, most participants displayed shock, but consequently chose something else, as there was no real life consequence of that interaction. In a real setting, participants might have reacted differently if what they wanted was no longer available as it would have a real life consequence.

The findings of this research support the ideas put forward by Parsons and Cobb (2011), who argue that VEs may help develop skills that lead to improvements in theory of mind ability. Parsons and Cobb (2011) suggest that during a social interaction an individual will experience the outcome of his or her own communication through the respondents' reactions. In addition to this, subsequent discussion and review of an interaction may promote the mental simulation of how the respondent may feel about, experience or react to the participant's own social behaviours in future scenarios.

VEs allow for greater flexibility of thinking and problem solving in social situations than the traditional rule based approaches (Parsons & Mitchell, 2002). The VE employed in this study allowed for multiple, novel and variable versions of the same interaction. In order for a participant to consistently achieve the goal of ordering items from the café counter, they needed to develop an understanding of the most effective social skills or responses to employ, based on the interaction.

### *2.5.2 Research Question 2.*

In relation to research question 2, the results showed that the generalisation of the social skills was maintained over a time period of one month. This maintenance effect provides an outcome measure of two factors. Firstly, the skill had been learnt



in the learning environment and this skill can now be reproduced consistently and this is maintained over time. Secondly, the appropriate application of this skill has been understood and maintained over a period of time. It would be beneficial if future studies measured this maintenance effect using a longitudinal design or over a period of longer than one month.

### *2.5.3 Research Question 3.*

In relation to research question 3, the questionnaire measures did not reveal a significant improvement in overall social functioning, as reported by teachers and parents. This finding may provide support for the theories in the literature review that explored the common finding that those with ASC find it difficult to apply skills and knowledge across different contexts. Based on these theories, the findings from research question 3 may have been expected, as this study provided teaching in a specific context. It may then support the notion that, for an improvement in overall social functioning to be made, skills will need to be taught in a variety of contexts in order for the link between the skill and the context to be made explicit (Happé & Frith 2006). It could be argued that this finding also supports Laker's (1990) transfer distance theory, as the transfer distance between the learning scenario of a café, and the multiple social situations considered by the Social Skills Rating System (Gresham & Elliot, 1990), could be considered as a large distance between the learning and target environments.

### *2.5.4 Engagement with the Virtual Environment.*

It has been suggested that VEs may not be an effective approach for creating learning situations for teaching generalisable social skills if those with ASC were unable to engage with them as they would in a real life situation (Hopkins et al., 2011). The results of the study suggest that the participants with ASC engaged with the VEs appropriately, and understood that they represented real life scenarios.

An anecdotal note that is worthy of mentioning is the positive engagement of the participants who took part in the study. It has been hypothesised in previous papers that those with ASC may be more engaged by interactive technologies and that this could help improve social communication in itself (Parsons & Mitchell, 2002). I felt that the participants were very engaged in the study and all enjoyed working with the technology. In the absence of the experimenter, many of the participants told their teachers that they enjoyed the experience, and many asked staff repeatedly when their next session would be.

## **2.6 Relevance to the Educational Psychologist's Practice: Part 1**

The prevalence of Autism within schools in Wales has been estimated at 60 pupils in every 10,000 (Latif & Williams, 2007), which the Welsh Government (WG) estimated at 2332 five to fourteen year olds in Wales in 2002 (Welsh Government, 2009). The prevalence of the condition continues to rise across the UK (Baron-Cohen, 2009), and therefore, the number of pupils with ASC diagnoses in schools has increased. This increase has led to a significant rise in Autism provisions in the UK, including both inclusive mainstream based provisions or single site centres. This has caused the number of requests for help that Educational Psychologists (EP) receive from centres for ASCs, or for pupils with ASC in the mainstream, to increase dramatically (Greenway, 2000).

Due to this rise, there are now frequent opportunities for EPs to work with individuals with ASC, with their families, and with their school setting. These opportunities are not only related to the assessment of individual needs but also involve supporting the individual's learning, social and emotional interventions (Wilkinson, 2005). Often, the approaches employed in schools lack fidelity, are frequently lacking an evidence-base or their link with psychological theory is poorly understood (Tutt, Powell & Thornton, 2000). The unique position of the EP as a scientist-practitioner provides an opportunity to develop evidence-based

practice for ASC with schools, and subsequently evaluate the effectiveness of such practice in the local context (Wilkinson, 2005).

There are a growing number of standardised programmes available for school use such as the PATHs Programme (Greenberg & Kusch, 1993) or the Talkabout Programme (Kelly, 2011). Many of these programmes can be purchased and employed by schools, often by teaching support staff. Denham, Hatfield, Smethurst, Tan and Tribe (2006) found that EPs played an essential role in the implementation and evaluation of SST interventions. Denham et al. (2006) report that the EP was particularly important in the training of school staff in the chosen SST methods, as the EP had a key role in highlighting the underlying psychology of the approaches. Due to the varying nature of participant needs, and the diversity of teaching methods discussed for SST, Denham et al. (2006) argue that EPs are best placed to help schools implement the most effective teaching approaches based on the needs of the individual pupil.

Furthermore, it may be that there are also opportunities for large-scale multi-agency working to help develop evidence-based SST programmes in schools (Greenway, 2000; Maddern, Franey, McLaughlin & Cox, 2004). This will be important so that SST programmes are implemented with high fidelity, but also so that a strong psychological understanding of the programmes' teaching approach can be gained. For example, many speech and language therapists often deliver social skills training programmes in schools to ASC populations, which are often based on developing 'pragmatic language' or 'behaviour language' (Royal College of Speech and Language Therapists, 2009). It might be important that an EP is involved with such training in order to maintain a holistic view of the intervention.

### **3. Critical Account of the Research Practitioner**

#### **3.1 Introduction**

Each piece of casework that an applied psychologist engages with can often be seen as a piece of research, as it often involves obtaining informed consent, collecting data, generating hypotheses, applying interventions and evaluating practice. In the early models of practitioner psychology, the aim of the profession was to apply scientific methodologies to real life experiences in order to promote positive change (Kelly, Woolfson & Boyle, 2010). The general skills demonstrated in completing this research would often apply to both the academic researcher and the research-practitioner. This is an overarching theme of this account.

#### **3.2 Research Idea Development and Communication**

For the EP, I feel a key process is to ensure that data relating to all of the stakeholders' perspectives, ideas and hypotheses of a given situation are considered before the practitioner generates hypotheses (Rhydderch & Gameson, 2010). Following an initial literature review, a significant process in the development of this research was to make contact with other researchers in the field. I decided that it would be useful to contact researchers who had carried out evaluations of the use of VEs for SST in order to discuss their view of my research questions and the salient confounding and experimental variables for the study.

The communication skills required when working with different stakeholders in EP practice were important in this process. Many of the researchers did not agree that a move away from computer generated images to video and realistic interfaces should be made. They believed it would reduce the control that the facilitator could exert on the environment. Based on the theoretical and empirical reasoning for improving the realism of the interactions to promote generalisation, I remained committed to the video approach. I gathered vital information from these discussions relating to the structure of my design and the challenges of manualising the intervention.

### **3.3 Intervention Materials and Content**

As the VVE employed did not exist, a significant amount of time was spent developing materials for the study. This required the preparation of social scripts, organising a real café 'set', finding willing actors, acquiring recording equipment, recording scenes correctly, and identifying appropriate editing equipment. This process required collaboration with individuals with skills very different to my own. Despite the detailed description of the materials and arrangement included in the empirical report, it may be difficult to reproduce and replicate the VE used in this study accurately.

As a research-practitioner working in schools, I was well placed to understand how the materials and technology could be arranged in a school setting effectively. This is often a concern for the EP, as assessment and intervention materials require sufficient space and adequate materials to carry out assessment and intervention activities. This could possibly be considered as a strength of the research-practitioner, as knowledge of the intervention setting can lead to effective and replicable interventions. Furthermore, it was important that the arrangement was trialled in a school in order to examine the feasibility of such technologies being used in school settings in the future.

However, due to the complex nature of the teaching approaches, the training materials and the technology arrangement, if a second facilitator were to be used then training would need to be provided. This study included one facilitator and future research studies will require two researchers (at the very minimum) in order to separate the roles of the intervention facilitator and the data collector. This also raises the issue that, for VEs to be used in schools, simple assembly instructions will need to be provided, and a concise manual for operation and training will need to be available.

### **3.4 The Organisation of Large Scale Research**

This study required 18 participants with Autism to leave the school site and visit a local café three times, over three months. The organisation of this was difficult and required risk assessments and health and safety reports, as well as the appropriate transport to be organised. Due to the size of the real café and the group numbers, a maximum of six participants could be taken to the café at one time. The school consented to this as the students at the centre regularly visit the café for experiential learning. Future research will need to consider the cost and organisation of transport and food, as well as safe staffing numbers. It is likely that these practical considerations are behind the small sample sizes in ASC research based in schools.

One of the major difficulties for conducting research with a school is the subsequent loss of the researcher's control of the organisational aspects of intervention. For example, the order in which participants needed to experience the intervention was crucial, but it was bound by their school timetable and staff resources. This caused one significant issue for this research, in that the observers in each study were allocated at random. This impacted upon the type of inter-rater agreement statistic that was employed. It also meant that, on occasion, the same rater observed one group on more than one occasion. The school-based raters were blind to the groupings, but this does not rule out the observer trying to predict the grouping of each participant based on the previous rating times.

### **3.5 Statistical Analysis and the Method**

This study was heavily reliant on quantitative data and statistical methods for data analysis. Despite receiving a significant amount of training in quantitative analysis during my undergraduate study, the use of inferential statistics is not often part of the research-practitioner's role. It is my perception that the research practitioner is often aware of key statistical concepts such as normality, z-scores, standard scores, and percentile ranks. However, I feel that the practitioner rarely applies inferential statistics in practice.

When designing this research it was key to use the relevant research method texts in order to choose a methodology most suited to the research question and to determine which analyses may be used following the data gathering (Breakwell et al., 2012). It was important not to carry out a design, collect data, and then attempt to fit a statistical analysis to the data (Bryman, 2012). Furthermore, it was crucial for the researcher to have the analyses checked and for the results to be sufficiently supervised before drawing conclusions from them. It was important to have a good knowledge of why I was using a statistical analysis, prior to seeking supervision.

### **3.6 Relevance to the Educational Psychologist's Practice: Part 2**

It is well recognised that, for research to appeal to its potential audiences, then each audience will need to be specifically defined and the requirements of each audience will need to be met equally (Vipond, 1993). For this research to reach interested individuals, it remained broad in its intended readership. The intended reader of this research could be from a variety of educational or academic professions.

Much of the empirical and theoretical evidence that the applied psychologist applies in practice is often not taken from his or her own field of evidence. It could be argued that a key strength of the research-practitioner is an ability to reflect upon academic research, and to be reflexive in applying that research to the intended context. Rhydderch & Gameson (2010) describe this as informed and reasoned action, where theory and evidence are applied with due consideration of the context in which it is being applied. It may be that the inclusion of such discussion in this document might be considered as evidence of informed and reasoned action through the consideration of how this new knowledge can be applied in EP practice.

### **3.7 Ethical Considerations**

My role as an applied psychologist has helped me to develop an understanding of the importance of identifying ethical issues when working with human participants. The role of an EP is to provide support to facilitate positive change for children and young people. During this research I have had to consider a number of ethical issues, which then had a significant impact on the design and goals of this study. Four key ethical areas that I considered will now be presented in four sections, which are respecting participant's autonomy, gaining informed consent from participants, evaluating the researcher's competence and assessing the potential for participant harm in the interventions.

#### *3.7.1 Participant Autonomy.*

In psychological practice, a participant's autonomy relates to a right to live life as they wish, providing that his or her actions do not interfere with the welfare of others (Koocher & Keith-Spiegel, 1998). A major ethical implication is the important distinction between supporting those with ASC to be able to interact with their social world if they so wish, versus teaching them to function correctly or 'as they should do' in the eyes of the facilitator. The ethical dilemma of this study was determining whether the participants wanted to improve their own social skills. Even if this was the case, were the skills targeted by the intervention the same skills that the individual would want to learn? As discussed, social competence can never be a fully objective phenomenon, and there is no 'correct way' to act socially, but there may be a general set of rules or heuristics. For example, a common rule in the UK is that, when greeting someone for the first time, you may shake their hand and use a verbal greeting. There are a number of cultural and subjective factors that may impact on a participant's social competence and desired social skills. For example, in Japan it is more customary to bow when greeting someone new.



Subsequently, the purpose of this study was not to engineer socially precise and mechanical individuals, but to provide participants with the support to feel confident when interacting with others. On reflection, the VE system itself did not infer a way to respond, but rather reacted to the participant's behaviour in the situation. This issue was of greater significance to the teaching and the facilitator. In order to account for this fact, skills were chosen that seemed to be classed as universal by the literature, such as eye contact and tone of voice (Spence, 2003).

Participant autonomy was also impacted on by the type of interaction that was chosen. If this study chose to teach skills within an interaction of meeting someone new, each participant would have their own approach as to what they would talk about with the on-screen character. Therefore, a highly functional interaction was chosen, which could meet the requirements of the research questions.

### *3.7.2 Informed Consent.*

As an applied psychologist, I am aware of the ethical implication of obtaining informed consent from participants, and I understand that is very important prior to conducting data analysis or any intervention with an individual. It was interesting that gaining written consent from parents to take part in this complex experiment was relatively easy, but I felt this did not ensure that the parent or the participant fully understood the content of the study.

In order for parents to understand the procedure, measures and data collection, I felt it was important for them to experience the intervention first hand. Parents were invited on three occasions and at separate times of the day to hear a presentation about the research and to experience the VE technology. I felt that the parents who attended these opportunities (50% of the sample) fully understood the project and therefore their consent was truly informed. All parents also received an information leaflet, and for some, this detailed information was enough for them to provide their consent.

Informing the participants of what would be involved in the study also posed an ethical challenge. Although all participants had high levels of functional language, it is not uncommon for those with Autism to have difficulties in expressing their emotions and feelings (Travis, 1998). Therefore, all participants had a practise experience with the software in the first session, and were told that it was designed to help develop their social skills. There were chances for questions to be asked throughout the intervention. Debate over the use of social skills was encouraged in the questioning, and participants were in control of their own behavioural responses throughout.

### *3.7.3 Facilitator Competence.*

A major issue that faces both applied psychologists, and researchers who become involved in the planning and delivery of interventions, is the ability to judge their competence to complete the role (Division of Education and Child Psychology, 2002). Competence in delivering an intervention is not always easy to assess (Koocher & Keith-Spiegel, 1998), especially when the intervention itself is not easy to define. This is true of SST, where numerous teaching approaches are involved and the facilitator would need to be competent in teaching all levels of the programme. Seeking supervision in these circumstances is paramount in ensuring that the researcher or practitioner is able to complete the role stated. In this study my supervisor felt that, due to my previous experience in SST, I would be able to complete this role. I felt that this mirrored the ethical conduct that I would adopt as an applied practitioner.

### *3.7.4 Participant Harm.*

It is well established that those with ASC can often find social situations uncomfortable and can also often experience significant social anxiety when in certain social situations and environments (Bellini et al., 2006). This intervention

involved a close dyadic interaction, which forced the individual to talk to another person. This raised the ethical dilemma of whether some participants might become overwhelmed by, or overly anxious about, their experiences in the VVE. In order to avoid this, a neutral exchange was chosen so that responses of the VE were only positive or neutral. Furthermore, students were given many options to withdraw, including leaving the VE area. The area was designed to be very easy to leave and participants were in no way trapped in the VE. The centre in which I completed the study felt that this was a significant strength. School staff reported that all participants seemed relaxed and engaged with the videos, and some were more relaxed than in their school-based SST.

### **3.8 How the Findings will Impact upon my Practice**

The current research poses a number of new research questions for the development of interventions that support adolescents with ASC to develop social-communication skills. It is unlikely that SST programmes will be able to develop all of the skills required to communicate, in isolation. Schools have a role to provide autism-specific approaches to teaching, with emphasis on communicating and learning about the social world, throughout the curriculum (Charman, et al., 2011). SST is one potential approach and must be seen in the wider context of good practice for teaching those with an ASC. This research has supported the idea that SST programmes need to be delivered with fidelity, and should attempt to promote generalisation through targeted teaching tactics and through varying learning environments.

The findings presented have highlighted the need to consider how EPs measure and assess social communication skills. They bring into dispute the definition of social skills and how we may intervene in such difficulties. This may also be true for populations with social communication difficulties who do not have ASC. The emphasis on the generalisation of skills can also be applied in practice, and may have significant implications for academic skills, as well as social. Further research

will need to focus on making links between target knowledge and varying contexts over time to ensure skills that are learnt then generalise to a range of appropriate settings. How these links are created and taught, as well as identifying how quickly the individual has advanced their knowledge in the teaching environment, may be key factors of generalisation for pupils with ASC. These may also be vital areas for future research.

#### 4. References

- Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology, 41*, 63-105.
- Baron-Cohen, S. (2009). Autism: The empathizing-systemizing (E-S) theory. *Annals of the New York Academy of Sciences, 1156*, 68-80.
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a “theory of mind?” *Cognition, 21*, 37–46.
- Bellini, S., Peters, J. K., Benner, L., & Hopf, A. (2007). A meta-analysis of school-based social skills interventions for children with autism spectrum disorders. *Remedial and Special Education, 28*(3), 153–162.
- Breakwell, G. M., Smith, J. A., & Wright, D. B. (2012). *Research methods in psychology* (4<sup>th</sup> ed). London: Sage.
- Bryman, A. (2012). *Social research methods* (4<sup>th</sup> ed). Oxford: Oxford University Press.
- Cappadocia, M. C., & Weiss, J. A. (2010). Review of social skills training groups for youth with Asperger Syndrome and High Functioning Autism. *Research in Autism Spectrum Disorders, 5*(1), 70–78.
- Charman, T., Pellicano, E., Peacey, L. V., Peacey, N., Forward, K., & Dockrell, J. (2011). *What is good practice research in autism education?* London: Autism Education Trust.
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. London: Sage.
- Denham, A., Hatfield, S., Smethurst, N., Tan, E., & Tribe, C. (2006). The effect of social skills interventions in the primary school. *Educational Psychology in Practice, 22*(1), 33-51.
- Division of Educational and Child Psychology (2002). *Professional Practice Guidelines*. Leicester: The British Psychological Society.
- Frith, U. (2003). *Autism: Explaining the enigma* (2<sup>nd</sup> ed). Oxford: Blackwell.

- Greenberg, M. T., & Kusche, C. A. (1993). *Promoting social and emotional development in deaf children: The PATHS project*. Seattle: University of Washington Press.
- Greenway, C. (2000). Autism and asperger syndrome: Strategies to promote prosocial behaviours. *Educational Psychology in Practice*, 16(4), 469-486.
- Gresham, F. M., & Elliott, S. N. (1990). *Social skills rating system*. Circle Pines, MN: American Guidance Service.
- Happé, F., & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 36(1), 5-25.
- Hopkins, I. M., Gower, M. W., Perez, T. A., Smith, D. S., Amthor, F. R., Wimsatt, F. C., & Biasini, F. J. (2011). Avatar assistant: Improving social skills in students with an ASD through a computer-based intervention. *Journal of Autism and Developmental Disorders*, 41(11), 1543-1555.
- Kelly, A. (2011). *Talkabout for children: Developing self-awareness and self-esteem*. Milton Keynes: Speechmark.
- Kelly, B., Woolfson, L., & Boyle, J. (2010). *Frameworks for practice in educational psychology: A textbook for trainees and practitioners*. London: Jessica Kingsley Publishers.
- Klinger, L.G., & Dawson, G. (2001). Prototype formation in autism. *Development and Psychopathology*, 13, 111–124.
- Koocher, G. P., & Keith-Spiegel, P. (1998). *Ethics in psychology: Professional standards and cases* (2<sup>nd</sup> ed). New York: Oxford University Press.
- Laker, D. R. (1990). Dual dimensionality of training transfer. *Human Resource Development Quarterly*, 1, 209–235.
- Latif, A. H., & Williams, W. R. (2007). *Diagnostic trends in Autism Spectrum Disorders in the South Wales valleys*. London: Autism.

- Maddern, L., Franey, J., McLaughlin, V., & Cox, S. (2004). An evaluation of the impact of an inter-agency intervention programme to promote social skills in primary school children. *Educational Psychology in Practice*, 20(2), 135-155.
- Martin, P., & Bateson, P. (1986). *Measuring behaviour. An introductory guide*. Cambridge, UK: Cambridge University Press.
- Parsons, S., & Cobb, S. (2011). State-of-the-art of virtual reality technologies for children on the autism spectrum. *European Journal of Special Needs Education*, 26(3), 355–366.
- Parsons, S., & Mitchell, P. (2002). The potential of virtual reality in social skills training for people with autistic spectrum disorders. *Journal of Intellectual Disability Research*, 46, 430-443.
- Rao, P. A., Beidel, D. C., & Murray, M. J. (2008). Social skills interventions for children with Asperger’s syndrome or high-functioning autism: A review and recommendations. *Journal of Autism and Developmental Disorders*, 38, 353–361.
- Rhydderch, G., & Gameson, J. (2010). Constructing a flexible model of integrated professional practice: Part 3 - the model in practice. *Educational Psychology in Practice*, 26(2), 123–149.
- Robson, C. (2002). *Real World Research* (2<sup>nd</sup> ed). Oxford: Blackwell.
- Royal College of Speech and Language Therapists (2009). *Resource manual for commissioning & planning services for SLCN*. (1st ed., pp. 1-34). Retrieved from [http://www.rcslt.org/speech\\_and\\_language\\_therapy/commissioning/sli\\_plus\\_intro](http://www.rcslt.org/speech_and_language_therapy/commissioning/sli_plus_intro)
- Spence, S. H. (2003). Social skills training with children and young people: Theory, evidence and practice. *Child and Adolescent Mental Health*, 8, 84–96.
- Travis, L. L., & Sigman, M. (1998). Social deficits and interpersonal relationships in autism. *Mental Retardation and Developmental Disabilities Research Reviews*, 4, 65-72.

- Tutt, R., Powell, S., & Thornton, M. (2000). Educational approaches in autism: What we know about what we do. *Educational Psychology in Practice*, 22(1), 69-81.
- Vipond, D. (1993). *Writing and psychology: Understanding writing and its teaching from the perspective of composition studies*. Westport: Praeger.
- Welsh Assembly Government (2009). *The Autism Spectrum Disorder (ASD) Strategic Action Plan for Wales*. Cardiff: Welsh Assembly Government.
- Wilkinson, L. A. (2005). Supporting the inclusion of a student with Asperger Syndrome: A case study using conjoint behavioural consultation and self-management. *Educational Psychology in Practice*, 21(4). 307-326.



## Appendices

### Appendix A Social Skills Observation Schedule

1	2		3		4
Never Good	Not Very Good		Quite Good		Very Good
<b>Body Language</b>					
	1	2	3	4	
<b>Eye Contact</b> Never Good – avoids eye contact at all times during conversations OR continually stares.					Very Good – effective and appropriate use of eye contact in all situations.
<b>Facial Expression</b> Never Good – inappropriate to the situation. May include scowling, grinning, blank expression etc.					Very Good – effective use of a range of facial expressions changing according to the situation. E.g. expresses mood through facial expressions.
<b>Gestures</b> Never Good – uses inappropriate hand gestures excessively or no use of hand gestures.					Very Good – Uses hand gestures appropriately.
<b>Fidgeting</b> Never Good – excessive fidgeting that is distracting and causes a barrier to communication.					Very Good – rarely fidgets.
<b>Posture</b> Never Good – usually inappropriate to the situation.					Very Good – normal posture and gait, appropriate to all situations.
<b>The Way We Talk</b>					
<b>Volume</b> Never Good – mostly uses inappropriate volume, e.g. voice too loud or quiet for the situation.					Very Good – uses and adapts volume appropriately in all situations.
<b>Rate</b> Never Good – consistently inappropriate rate. E.g. too fast/too slow/mixing the two.					Very Good – rate of speech is appropriate and adapted effectively. E.g. increasing during urgency.
<b>Clarity</b> Never Good- never good, habitual use of indistinct speech. E.g. mumbling.					Very Good – speech is consistently clear and easily understood.
<b>Intonation</b> Never Good – consistently inappropriate, e.g. monotonous or exaggerated.					Very Good – intonation is used effectively and appropriately.
<b>Fluency</b> Never Good – severe hesitations in speech, excessive use of um and er.					Very Good – fluent speech.
<b>Conversation Skills</b>					
<b>Listening</b> Never Good – difficulty in listening and lack of non-verbal reinforcements					Very Good – A good listening showing effective and appropriate use of non verbal reinforces.
<b>Starting a Conversation</b> Never Good – Does not initiate conversation/uses inappropriate information at the start.					Very Good – effective and appropriate use of conversation starters.
<b>Taking Turns</b> Never Good – monopolises conversation with minimal listening/ makes few contributions.					Very Good – uses turn taking skills and effectively responds to cues, e.g. natural breaks, eye contact.
<b>Asking Questions</b> Never Good – does not ask questions during conversations or seek further information when needed.					Very Good – ask questions with appropriate frequency especially when gaining information to maintain a conversation.
<b>Answering Questions</b> Never Good – does not answer questions during conversations or makes minimal utterances.					Very Good – responds to questions effectively and appropriately to maintain a conversation.
<b>Being Relevant</b> Never Good – has difficulty in following a topic of conversation.					Very Good – can maintain and develop a topic effectively and appropriately.
<b>Ending a Conversation</b> Never Good – has great difficulty in ending conversations					Very Good – consistently ends conversations effectively and appropriately with appropriate non-verbal and verbal behaviour.

**Appendix B Social Skills Rating Scale (Parent Version)**

FOR OFFICE USE ONLY				PARENT QUESTIONNAIRE Social Skills	How often?		
C	A	R	S		Never	Sometimes	Very often
				1. Starts conversations rather than waiting for others to talk first.	0	1	2
				2. Helps you with household tasks without being told.	0	1	2
				3. Attempts household tasks before asking for your help.	0	1	2
				4. Participates in organised activities such as sports or clubs.	0	1	2
				5. Politely refuses unreasonable requests from others.	0	1	2
				6. Introduces himself or herself to new people without being told.	0	1	2
				7. Uses free time at home in an acceptable way.	0	1	2
				8. Says nice things about himself or herself when appropriate.	0	1	2
				9. Responds appropriately to teasing from friends or relatives of his or her own age.	0	1	2
				10. Responds appropriately when hit or pushed by other children.	0	1	2
				11. Volunteers to help family members with tasks.	0	1	2
				12. Invites others to your home.	0	1	2
				13. Avoids situations that are likely to result in trouble.	0	1	2
				14. Makes friends easily.	0	1	2
				15. Keeps room clean and neat without being reminded.	0	1	2
				16. Completes household tasks within a reasonable time.	0	1	2
				17. Shows concern for friends and relatives of his or her own age.	0	1	2
				18. Controls temper in conflict situations with you.	0	1	2
				19. Ends disagreements with you calmly.	0	1	2
				20. Speaks in an appropriate tone of voice at home.	0	1	2
				21. Acknowledges compliments or praise from friends.	0	1	2
				22. Controls temper when arguing with other children.	0	1	2
				23. Appropriately expresses feelings when wronged.	0	1	2
				24. Follows rules when playing games with others.	0	1	2
				25. Attends to your instructions.	0	1	2
				26. Joins group activities without being told to.	0	1	2
				27. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2
				28. Puts away belongings or other household property.	0	1	2
				29. Waits turn in games or other activities.	0	1	2
				30. Uses time appropriately while waiting for your help with homework or some other task.	0	1	2
				31. Receives criticism well.	0	1	2
				32. Informs you before going out with friends.	0	1	2
				33. Follows household rules.	0	1	2
				34. Is self-confident in social situations such as parties or group outings.	0	1	2
				35. Shows interest in a variety of things.	0	1	2
				36. Reports accidents to appropriate persons.	0	1	2
				37. Is liked by others.	0	1	2
				38. Answers the phone appropriately.	0	1	2
				39. Asks sales clerks for information or assistance.	0	1	2
				40. Appears self-confident in social interactions with opposite-sex friends.	0	1	2
C	A	R	S	SUMS OF HOW OFTEN COLUMNS			

**Appendix C Social Skills Rating Scale (Teacher Version)**

FOR OFFICE USE ONLY			TEACHER QUESTIONNAIRE Social Skills	How often?		
				Never	Sometimes	Very often
C	A	S				
			1. Produces correct schoolwork.	0	1	2
			2. Keeps his or her work area clean without being reminded.	0	1	2
			3. Responds appropriately to physical aggression from peers.	0	1	2
			4. Initiates conversation with peers.	0	1	2
			5. Volunteers to help peers on classroom tasks.	0	1	2
			6. Politely refuses unreasonable requests from others.	0	1	2
			7. Appropriately questions rules that may be unfair.	0	1	2
			8. Responds appropriately to teasing by peers.	0	1	2
			9. Accepts peers' ideas for group activities.	0	1	2
			10. Appropriately expresses feelings when wronged.	0	1	2
			11. Receives criticism well.	0	1	2
			12. Attends to your instructions.	0	1	2
			13. Uses time appropriately when waiting for your help.	0	1	2
			14. Introduces himself or herself to new people without being told to.	0	1	2
			15. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2
			16. Acknowledges compliments or praise from peers.	0	1	2
			17. Easily makes transition from one classroom activity to another.	0	1	2
			18. Controls temper in conflict situations with peers.	0	1	2
			19. Finishes class assignments within time limits.	0	1	2
			20. Listens to classmates when they present their work or ideas.	0	1	2
			21. Appears confident in social interactions with opposite-sex peers.	0	1	2
			22. Invites others to join in activities.	0	1	2
			23. Controls temper in conflict situations with adults.	0	1	2
			24. Ignores peer distractions when doing class work.	0	1	2
			25. Stands up for peers when they have been unfairly criticised.	0	1	2
			26. Puts work materials or school property away.	0	1	2
			27. Appropriately tells you when he or she thinks you have treated him or her unfairly.	0	1	2
			28. Gives compliments to members of the opposite sex.	0	1	2
			29. Complies with your directions.	0	1	2
			30. Responds appropriately to peer pressure.	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS			

## What will the study involve?

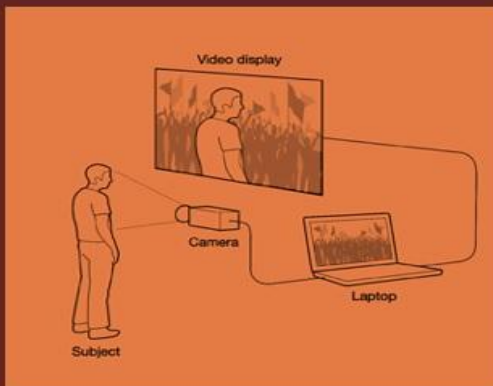
Your son/daughter is already provided with a social skills lesson by the Marion Centre.

In this study your son/daughter will experience three 40 minute training sessions. Each session is designed to teach social skills to pupils and then provide them with an opportunity to practise these skills in a virtual reality role-play. My aim is to find out if virtual reality is an effective method for teaching social skills.

The sessions will happen during the school day and on the school premises. Each session will be delivered by a member of staff from the Marion Centre and the researcher.

Your son/daughter will have one session to practise meeting someone for the first time, and two sessions to practise ordering food and drink at a café counter.

All role-plays will be positive. However, if your son or daughter becomes upset at any time they will be able to leave the role-play and will be able to use a quiet room if needed.



If you have any concerns or complaints about the research you can contact the School of Psychology Research Ethics Committee in writing at:

Secretary to the Research Ethics Committee,  
School of Psychology, Tower Building 70 Park  
Place, Cardiff, CF10 3AT. Tel. 029 20 874007

**Owen Barry**  
Email: [barryOR1@cardiff.ac.uk](mailto:barryOR1@cardiff.ac.uk)

**Lorraine Silver Research Supervisor**  
Email: [silverLJ1@Cardiff.ac.uk](mailto:silverLJ1@Cardiff.ac.uk)

School of Psychology  
Cardiff University  
Tower Building  
70 Park Place  
CF10 3AT

Tel. 029 20 874007



## Parent Information Leaflet

### A Virtual Environment for Teaching Social Skills to Adolescents with Autism

**Owen Barry**  
Educational Psychologist in Training

## Social Skills Training at the Marion Centre

### Who am I?

I am Owen Barry and I am a Trainee Educational Psychologist from Cardiff University. As part of my doctoral research I am carrying out a project using a new technology designed to help deliver social skills training. I am inviting your son/daughter to take part in this study.

### What is the new technology?

The approach uses a type of virtual reality for the pupil to experience a lifelike role-play on a computer screen. It helps pupils to practise their social skills whilst feeling safe in the knowledge that it is not a real conversation.

I will use a special camera to layer a live image of each pupil into a pre-recorded scene (see the photos at the bottom of this page). The other characters on the screen will appear to respond to the pupils, but will be controlled by the researcher.



### How will the effectiveness of the virtual reality training be measured?

To test if the approach is useful I will collect the following information. Firstly, I will observe pupils in a real life café. I will do this during a school visit to a local café. A staff member and I will do this three times over a period of two months to measure the pupil's social skills before and after the virtual reality lessons. This will provide a score of how they perform and will let us know if they have improved. I will not tell the pupils that they are being scored as this may cause anxiety, but they will be made aware that I am observing their social interaction.

### What will I have to do?

I will send you and the class teacher a short questionnaire regarding your son/daughter's general social skill performance. This will happen once before and once after your son/daughter has completed the social skills training. It will take between 5 and 10 minutes to complete.



### What will happen to the information collected?

#### Data

All information will be held confidentially and no one will have access to it other than myself. On completion of the study, the data will be anonymised and no one will be able to trace the data to you or your son/daughter. Once this has happened, the data cannot be withdrawn and it may be kept indefinitely.

#### Consent

If you would like to withdraw your consent for your son/daughter to take part in part of/all of the study, then you can do so at any time. You can do this by contacting me or a member of staff at the Marion Centre.



## Appendix E Parent Consent Form

School of Psychology, Cardiff University  
Parent Consent Form

Please read the following statements and circle your answers.

I have read and understood the information sheet.	Yes	No
I understand that my child's participation in this project will involve a social skills training intervention through the use of a virtual environment.	Yes	No
I understand that my child will be observed on three separate occasions during their timetabled trip to a café.	Yes	No
I am happy to receive a questionnaire once before and once after the observation.	Yes	No
I understand that my child's participation in this study is entirely voluntary and that I can withdraw my child from the study at any time without giving a reason.	Yes	No
I understand that both myself and my child are free to ask any questions at any time (contact details can be found on the information sheet).	Yes	No
I am also free discuss my concerns with Dr Lorraine Silver (contact details can be found on the information sheet).	Yes	No
I understand that the information provided by my child will be held confidentially, such that only the researchers can trace this information back to my child individually.	Yes	No
I understand that my child's data will be anonymised by the 1 <sup>st</sup> August 2013 and that after this point no-one will be able to trace the information back to my child.	Yes	No
The anonymised information will be retained for up to 4 years when it will be deleted/destroyed.	Yes	No
I understand that I can ask for the information my child has provided to be deleted/destroyed or I can request access to the information at any time up until the data has been anonymised.	Yes	No

I, \_\_\_\_\_ (NAME) consent to my child, \_\_\_\_\_  
(NAME) participating in this study conducted by Owen Barry, School of Psychology, Cardiff University with the supervision of Dr Lorraine Silver.

Signed:

Date:

## Appendix F Verbal Script to Gain Consent from Participants

### Pupil Consent (read aloud by the researcher)

I am from Cardiff University and I am doing some research about whether software called virtual environments can help young people get better at talking to others.

Virtual environments create a real life role-play for you to practise social skills. If you agree to help me, we can have three sessions together where we'll practice our role-plays and learn social skills, just like in your social skills lessons. Would you like to try it out?

[GUIDED TOUR]

In these sessions we are going to spend one session on practising meeting someone new, and then two sessions on ordering food and drink from a café. I will come on your real life café trips to see if it's helped.

I will ask your parents and your teacher how well you are doing in with your social skills in school and at home.

You don't have to help me, it's completely up to you about whether you want to stay here or go back to class. You can change your mind at any point if you want to. You can ask me any questions you want, either now or when we're doing the research.

Do you have any questions?

Have a think and decide if you want to be part of this research. You can tell me or show me by pointing to one of the pictures here [see below – pictures will be on separate sheet].

	
Yes, I want to do this!	No, I want to go back to class.

## **Appendix G** Verbal Script for Pupil Debrief

### **Pupil Debrief (read out loud by researcher)**

Thank you for helping me with my study.

I have been trying to find out if virtual environments help young people talk to others in different places. I watched everyone who helped me three times ordering in a café and scored how well you did on a score sheet.

I also asked your teachers and parents how well you have been doing in social skills with a questionnaire. Only I will see what your teacher and parents have told me.

I'm not going to tell anyone about how you did in the cafe, not even your teacher or anyone at home. It will only be me who will know how you did. However, in August, I will completely delete your name from my computer so no one will know how you did.

You have helped me find out if the role-play videos are a good way of helping people to practise their social skills.

Are you happy about everything you've done?

Do you have any questions you might want to ask me?

If you think of any questions once I've gone, or if there's anything you're worried about, you can speak to your teacher.



## Appendix H Gatekeeper Letter

Address

Date

Dear Mr/Mrs Headteacher

I am a doctoral student in the School of Psychology, Cardiff University. As part of my doctoral degree I am carrying out a study on the use of virtual environments and social skills training for students with autism. I am writing to enquire whether you would be willing to allow me to recruit members of the XXXX Centre to participate in this research.

I would need to obtain consent from the parents or guardians for their permission to participate in this research. The research would involve the pupils experiencing a number of social role-plays, within a virtual environment, in order to practice placing an order at a café. Working closely with the Head of the XXXX Centre, the intervention sessions would be timetabled at appropriate times and not during core lessons. The interventions would occur during school time on the school premises. Each pupil will receive three sessions, each lasting 40 minutes, on a weekly basis.

In order to measure the impact of this intervention, the pupils will be observed at three points over time whilst on their regular trip to a local café. A questionnaire will be provided to teachers and parents once before and once after the intervention. The data obtained will remain confidential and only the researcher will have access to the data.

My supervisor is Dr. Lorraine Silver at the School of Psychology, Cardiff University. My research has been approved by both the School of Psychology Ethics Committee and by the XXXX Local Authority Ethics Panel.

Many thanks in advance for your consideration of this project. Please let me know if you require further information. I would be happy to discuss this project with you in person.

Regards,

Owen Rhys Barry

Owen Rhys Barry  
Trainee Educational Psychologist

School of Psychology  
Cardiff University  
Tower Building  
70 Park Place  
CF10 3AT

Tel.  
Email:

Dr. Lorraine Silver  
Professional Tutor

School of Psychology  
Cardiff University  
Tower Building  
70 Park Place  
CF10 3AT

Tel. 029 20 874007  
Email:

## Appendix I Example Actor Scripts

### *Meeting a new person script*

Hello  
Hi  
Nice to meet you  
What is your name?  
My name is \_\_\_\_\_  
What school do you go to?  
Do you like it there?  
What is good about it?  
I work at a restaurant! I like it there.  
It is nearby!  
What do you like to do outside of school?  
Sounds interesting!  
Tell me a bit more!  
Yes  
No  
Wow! Nice!  
What else?  
How many?  
I like to play guitar  
I like to watch movies  
My favourite movie is despicable me.  
My favourite music is Bastille.  
Because they sound great!  
Because it is funny!  
You don't like it/them? What is your favourite?  
That's OK. Everyone's different!  
I need to go now.  
It was nice to meet you.  
Nice to meet you.  
See you again.  
Goodbye!

### *Ordering at a café script*

Hi  
Hello, how can I help?  
Hello what can I get you?  
  
OK!  
What would you like to drink?  
  
Yes we have that.  
Great!  
What flavour would you like?  
Chocolate or strawberry?  
Chocolate on top?  
Cream with that?  
How about a flake?  
  
Would you like anything to eat?  
We have cakes or chocolate bars. We also have sandwich!  
  
I'm sorry we don't have that, can I get you something else?  
Because we have run out!  
Because it isn't on our Menu.  
I'm afraid we don't do that!  
  
Would you like to order something else?  
  
That will be £ XXX please.  
That's £XXXX please.  
£XXX then.  
  
Thank you!  
Where are you sat?  
Take a seat and I will bring it over to you.  
Sit down and it will be over shortly.  
It won't be long!  
Bye!

## Appendix J Teacher Consent Form

School of Psychology, Cardiff University  
Teacher Consent Form

I have read and understood the information sheet.	Yes	No
I understand that my participation in this project will involve me having to complete a questionnaire twice over 2 months for the participating pupils.	Yes	No
I am happy to help to plan a suitable time to release pupils from my class for the intervention.	Yes	No
I am happy to help complete an observation of the pupils when at the cafe.	Yes	No
I understand that my participation in this study is entirely voluntary and I can withdraw from the study at any time without giving a reason.	Yes	No
I understand I am free to ask the researcher questions at any time (contact details can be found on the information sheet).	Yes	No
I am also free to discuss my concerns with the project supervisor, Dr Lorraine Silver at any time (contact details can be found on the information sheet).	Yes	No
I understand that the information provided will be held confidentially.	Yes	No
I understand that the pupil's data will be anonymised on completion of the study and that after this point no-one will be able to trace the information back to your responses.	Yes	No
The anonymised information may be kept indefinitely.	Yes	No
I understand that I can ask for the information that I have provided to be deleted/destroyed or I can request access to the information at any time up until the data has been anonymised.	Yes	No

Please read the following statements and circle your answers.

I, \_\_\_\_\_ (NAME) consent to my participation in this study conducted by Owen Barry, School of Psychology, Cardiff University with the supervision of Dr Lorraine Silver.

Signed: