Using Systemising to Facilitate Social Competence in Autism

An Evaluation of *The Transporters* DVD and LEGO Therapy

This dissertation is submitted for the degree of Doctor of Philosophy by

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Declaration

I confirm that the material in this dissertation is not copied from any published material nor is it a paraphrase or abstract of any published material, unless it is identified as such and a full source of reference given.

I confirm that, other than as specified above, this dissertation is my own work and includes nothing which is the outcome of work done in collaboration except where specifically indicated in the text.

No part of this dissertation has been, or is being, submitted for any other degree, diploma or other qualification at any other university.

The length of this dissertation does not exceed 60 000 words, excluding figures, tables, appendices and references, as per the stipulations of the Degree Committee of Clinical Medicine and Clinical Veterinary Medicine, University of Cambridge.

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Abbreviations

ABA	Applied Behaviour Analysis
ADHD	Attention Deficit Hyperactivity Disorder
ADI	Autism Diagnostic Interview
ADOS	Autism Diagnostic Observation Schedule
AS	Asperger Syndrome
ASC	Autism Spectrum Condition
ASD	Autism Spectrum Disorder
DTT	Discrete Trial Teaching
DZ	Dizygotic
E-S	Empathising Systemising
fMRI	Functional Magnetic Resonance Imaging
GARS AQ	Gilliam Autism Rating Scale Autism Quotient
GARS	Gilliam Autism Rating Scale
GARS-SI	Gilliam Autism Rating Scale Social Interaction Subscale
GF/CF	Gluten Free/ Casein Free diet
HFA	High Functioning Autism
LEAP	Learning Experiences: An alternative program for preschoolers and parents
MZ	Monozygotic
OT	Occupation al Therapy
PDD-NOS	Pervasive Developmental Disorder Not Otherwise Specified
PET	Positron Emission Tomography
RCT	Randomised Control Trial
RPMT	Responsive Education and Prelinguistic Milieu Therapy
SALT	Speech and Language Therapy
SCQ	Social Communication Questionnaire
SULP	Social Use of Language Programme
TD	Typically Developing
TEACCH	Treatment and Education of Autistic and related Communication Handicapped Children
VABS	Vineland Adaptive Behaviour Scale

Abstract

Autism spectrum conditions (ASC) are a group of neurodevelopmental conditions characterised by impaired social interaction and communication alongside narrow interests and repetitive behaviour. Few interventions to improve social competence have a strong empirical basis to support their effectiveness, and skills learned rarely generalise outside the intervention setting. Using children's natural interests may increase motivation and generalisation following intervention. Many individuals with ASC have superior 'systemising' abilities (the ability to analyse and construct systems in the world, e.g. maths) and find systems highly attractive. This thesis focuses on the possibility of using systemising to facilitate social competence in young children with ASC.

Study 1 was a randomised control trial evaluating *The Transporters* DVD, a children's cartoon series designed to teach emotion recognition. This harnesses systemising by putting human emotional expressions onto animated vehicles. Twenty children (mean age = 4.5 yr, sd = 0.8) who watched *The Transporters* for 15 min per weekday over 4 weeks improved more than controls in recognising emotions used in *The Transporters*. However, this did not generalise to recognising emotion in real faces. This contrasts with an earlier study using *The Transporters* that found generalisation to real faces in slightly older children (mean age= 5.9 yr, sd= 1.0). The differences between the studies are discussed. Study 2 was a matched comparison study of a naturalistic social skills approach using collaborative play with LEGO® (a systematic toy) with a non-systematic therapy (the Social Use of Language Programme) and no intervention. Seventeen children with ASC (mean age= 8.2 yr, sd= 1.8 yr) receiving LEGO® therapy for 1hr per week over 18 weeks improved more than controls in autism-specific social skills and maladaptive behaviour. Study 3 reports a pilot baseline study evaluating the use of LEGO® therapy in a school over 6 weeks for 9 children with ASC (mean age = 9 yr, sd = 1.3). Results showed LEGO® therapy to be appropriate and effective in school given sufficient staff training.

The results from all 3 studies are discussed in terms of the empathising-systemising (E-S) theory, and with respect to the status of intervention research in ASC.

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Chapter 1: Introduction to autism

1.1 Description and diagnosis of autism

Autism is classified as a 'lifelong pervasive developmental disorder' and has a neurological basis and genetic causes. It is characterised by atypical development and qualitative impairment in three behavioural domains:

- Reciprocal social interaction. Individuals with autism often show a reduced interest in social interactions and may try to avoid them. Where individuals do participate in social interactions, they are often characterized by a lack of awareness of social rules.

- Verbal and non-verbal communication. A proportion of individuals with autism fail to develop any functional speech. Those who do speak fluently may have problems with the pragmatic aspects of language and may have an unusual quality of speech in terms of tone, pitch or volume. Non-verbal aspects of speech are also affected, manifested in a lack of gestures, poor eye-contact and flat or exaggerated facial expression.

- The presence of restricted, repetitive interests and stereotyped patterns of behaviour. Repetitive behaviours include mannerisms such as hand-flapping and spinning. It is also common for individuals with autism to have narrow and unusual interests which are pursued to an obsessive degree. Individuals can become very rigid in their routines and their obsessions can become very disruptive to their own and their families' lives.

All of these areas may cause significant impairment in the daily life and development of an individual with autism. For the best long term outcome, individuals may require tailored intervention.

1.2 Historical descriptions of autism

Autism was first described by Leo Kanner in 1943 (Kanner, 1943). He described a group of children with features of ‘extreme autistic aloneness’ and ‘an obsessive desire for the preservation of sameness’. He also described several secondary features of autism which included severe language problems (particularly pragmatic language), lack of spontaneous behaviour, the presence of repetitive and stereotyped behaviours and over-sensitivity to certain stimuli. He also noted that the children he observed had excellent rote memory and often came from highly intelligent families. In 1944, Hans Asperger independently described a very similar group of children (Asperger, 1944). The Asperger syndrome (AS) he described was very similar to Kanner’s autism. Both scientists described persistent social difficulties, poor eye contact, stereotyped behaviour, a resistance to change and narrow interests.

Since these initial clinical descriptions, autism is now recognised as a spectrum of behaviours, which may vary in severity, but must include a core triad of impairment in social interaction, communication and repetitive or stereotyped behaviour. The onset of autism occurs before the age of 3 years but it may manifest itself in very different ways both across different individuals and within the same individual’s lifespan. A low functioning child may have little, if any, speech. They may show little interest in people and prefer to play with objects rather than peers or their family. They may also engage in significant repetitive behaviour. At the other end of the autistic spectrum, high functioning individuals may have fluent speech, but might have difficulties with the pragmatic aspects of language. They may engage in social interactions, but in a one-sided or odd way and they might have narrow interests pursued to an obsessive level rather than severe repetitive behaviour. Wherever an individual lies on the autistic spectrum, they will encounter considerable difficulties in their everyday life and a clinical diagnosis is necessary to access suitable health, education and social services.

1.3 Current diagnostic criteria

Thus far, no specific biological markers for autism are known, so autism continues to be defined with behavioural criteria. These criteria are quite wide, and include individuals at all levels of intelligence, severity and language ability. Lorna Wing and Judith Gould coined the term ‘autism spectrum’ in 1979 to highlight the heterogeneity in the symptoms of autism. There are now several pervasive developmental disorders included in the Diagnostic and Statistical Manual of Mental Disorders IV (APA) and the International Classification of Diseases of the World Health Organisation (ICD-10, 1994). These different diagnostic labels are described in Table 1.1 below.

ICD-10	DSM-IV
Childhood autism	Autistic disorder
Atypical autism	
Rett’s disorder	Rett’s disorder
Other childhood disintegrative disorder	Childhood disintegrative disorder
Overactive disorder associated with mental retardation and stereotyped movements	
Asperger’s syndrome	Asperger’s disorder
Other pervasive developmental disorders	
Pervasive developmental disorder, unspecified.	Pervasive developmental disorder not otherwise specified

Table 1.1. Different diagnoses within the group of pervasive developmental disorders.

The term autism spectrum disorder, or ASD, is a collective term generally used to describe diagnoses of childhood autism, autistic disorder, Asperger’s syndrome, Asperger’s disorder, pervasive developmental disorder unspecified and pervasive developmental disorder not otherwise specified (PDD-NOS). The term ‘autism spectrum condition’ (ASC) can also be used to describe the above diagnoses, and is used throughout this thesis. The term ASC is preferable to ASD as it takes into account the fact that individuals with a diagnosis of ASC might not be disordered or disadvantaged in some areas, but may have preserved or superior skill in some cases.

1.4 Asperger syndrome and high functioning autism

The diagnostic relationship of Asperger syndrome (AS) to other ASCs, particularly high functioning autism (HFA), remains a topic of debate (Klin, McPartland, & Volkmar, 2005; Volkmar et al., 2000). Diagnostically, AS is diagnosed instead of HFA when the individual has average cognitive ability and learned to talk on time (i.e. had no language delay and showed communicative speech at 2yrs), yet its validity as a separate diagnostic category remains disputed (Klin et al., 2005). Nevertheless, clinical observation suggest that there are more differences aside from developmental history that render those with a diagnosis of AS qualitatively different in current presentation than those with HFA. For example, those with AS tend to have less severe social difficulties and more obsessive interests. They may desire social contact but their interactions may be one-sided or odd. There is also a significantly higher incidence of AS in first degree relatives of those with AS than those with HFA, suggesting that the genetic associations might be stronger for AS (Volkmar, Klin, & Pauls, 1998). A further pattern of differences has shown that those with AS tend to have better verbal skills than individuals with more severe autism (Volkmar et al., 2000). These differences may have significant implications for treatment, as those with AS might respond better to verbally mediated intervention (e.g. counselling or verbal teaching of problem solving) and interventions that include their obsessive interests than those with other ASCs.

1.5 Co-morbidities and non-diagnostic characteristics of ASC

It is estimated that mental retardation is present in between 25-40% of cases of ASC (Baird et al., 2000; Chakrabarti & Fombonne, 2001). There are also other characteristics of ASC that are not included in the diagnostic criteria of autism, but nevertheless essential to understanding and treating ASC. These include savant skills which are islets of outstanding ability in a specific area (Rimland & Hill, 1984), sensory abnormalities such as hypersensitivity to noise or touch, sleeping and eating disturbances, poor organisational and decision-making skills, and a lack of creativity, spontaneity or initiative.

Autism also co-occurs with various other developmental, psychiatric and medical conditions which may have significant implications for treatment. Medical conditions such as epilepsy and gastrointestinal dysfunction are common, and anxiety, depression, obsessive-compulsive disorder and hyperactivity are frequently observed (Bradley et al., 2004; Militerni et al., 2002; Ming et al., 2008; Sterling et al., 2007). Indeed some of these difficulties reach clinically significant levels in individuals with ASC (Frazier et al., 2001; Goldstein & Schwebach, 2004; Muris et al., 1998) and may become so severe that a child requires psychiatric hospitalisation (Mandell, 2007). These additional characteristics and co-morbid disorders should not be forgotten when developing and evaluating interventions. Children with higher levels of co-morbid symptoms may respond less well to a given intervention. The symptoms may cause considerable distress and difficulty in their own right, and may require additional intervention, or they may impact on a child's ability to learn.

1.6 The aetiology of autism

It can be seen from the previous sections that autism is a complex spectrum of difficulties that commonly co-occurs with other psychiatric and medical conditions, but that is defined purely on behavioural terms. Trying to elucidate the exact aetiology of ASC is therefore extremely difficult. Early theories suggested that ASC was caused by 'refrigerator mothers' who were unloving and threatening to their child (Bettelheim, 1967). Thankfully, such unhelpful theories have not been supported by empirical research. Nevertheless, the exact causes of the behavioural characteristics of ASC are still relatively poorly understood. Substantial research has been carried out to attempt to explain the behaviour of individuals with ASC from a genetic, biological and cognitive level. This research has furthered our understanding of ASC considerably beyond the idea of 'refrigerator mothers', yet the findings about the exact causes of ASC are frustratingly inconsistent.

1.6.1 Genetics of ASC

An important breakthrough for parents of children with ASC has been the research showing that ASC is a highly heritable condition, not a result of poor parenting (Freitag, 2007; Rutter, 2000). Twin studies have shown the concordance rate of ASC between monozygotic (MZ) twins to be 60% compared to only 5% for dizygotic (DZ) twins (Bailey et al., 1995). Concordance for broader cognitive and social phenotypes that are qualitatively similar but milder than those found in autism is 90% in MZ twins versus 10% in DZ twin pairs (Le Couteur et al., 1996). Family studies have found the rate of ASC in siblings of individuals with a diagnosis of autism to range from 3%-5%, significantly higher than the rate of ASC found in siblings with Down syndrome (Bolton et al., 1994). There are a few specific single gene disorders that are associated with autism. Firstly, the rate of autism is significantly increased in individuals who have tuberous sclerosis (Smalley, 1998). Similarly, Fragile X syndrome is present in approximately 2-5% of children and adolescents diagnosed with ASC (Fombonne, 2003).

It is likely that multiple genes that are located on several different chromosomes are involved in the development of ASC (Freitag, 2007) Chromosomes 7, 2, 16 and 17 have all been implicated as potential autism susceptibility gene loci (Consortium, 1998), but so far no specific susceptibility genes have been elucidated. Also, despite this clear genetic influence, there is huge heterogeneity in clinical presentation between MZ twins (Le Couteur et al., 1996) so it seems that ASC is a result of an interaction between multiple genes and the environment. Moreover, each of the social, communication and repetitive/stereotyped behaviour characteristics of ASC might have a different genetic basis. Ronald and colleagues have carried out a series of studies examining the genetic basis of autistic traits in typically developing twins, on the premise that the impairments seen in ASC are dimensional, and occur on a continuum of severity in the normal population (Baron-Cohen & Wheelwright, 2001). They have found that autistic traits in the normal population are highly heritable but that the three areas of impairment in ASC (communication difficulties, social interaction difficulties and repetitive/stereotyped behaviour) are influenced by different, non-overlapping genetic bases (Ronald, Happe, Bolton et al., 2006; Ronald, Happe, & Plomin, 2005; Ronald, Happe, Price et al., 2006). These results suggest that the triad of impairments in ASC have a heterogeneous genetic basis, and that future research examining the genetics of ASC may benefit from examining different symptoms separately.

1.6.2 Neurochemistry

The genetic basis of autism alongside its early onset and pervasive nature suggests that there may be altered functioning of the central nervous system in ASC. Investigating the neurotransmitters and neuroendocrine systems that might be involved in ASC is a promising area of research not only for their ability to explore the aetiology of autism, but also because any findings might point to potential pharmacological interventions for individuals with ASC.

Neurochemicals that have been implicated in the aetiology of autism include serotonin, dopamine, norepinephrine, cortisol, thyroid hormones, sex hormones, neuropeptides, purines and acetylcholine, yet many of the results have not been replicated (Anderson & Hoshino, 2005). Some pharmacological interventions have stemmed from this research, yet none treat every aspect of autism, and not all are suitable for all individuals.

1.6.3 Brain structure

Abnormalities in brain structure have been identified in many areas in individuals with autism. If the exact neuroanatomy of autism can be specified, then this will help inform intervention research. It will help to elucidate the brain functions that are impaired in autism that could be targeted by interventions and could provide a neuroanatomical marker for evaluating the success of different approaches.

Structural imaging studies have been a useful tool for examining the neuroanatomy involved in the aetiology of autism; however, most studies are limited by small sample sizes and the use of adult participants in cross-sectional rather than longitudinal studies. As autism is a developmental disorder, the neuropathology may change over time. The pathology observed in adolescents and adults with autism may be the end result, rather that the developmental aetiology of the disorder. Nevertheless, alongside post-mortem studies of the autistic brain and head circumference measurements, some interesting patterns have emerged in the neuroanatomy of autism. A full review of the literature is beyond the scope of this thesis, so only the most consistent neuroanatomical findings will be covered (for reviews see Amaral, Schumann, & Nordahl, 2008; Brambilla et al., 2003; Palmen et al., 2004).

Brain volume

Head circumference and MRI studies have shown abnormally large brain volumes in individuals with autism compared with typical controls (Hazlett et al., 2005). It has been suggested that the autistic brain may undergo early overgrowth in the first year of life, followed by a deceleration of growth that coincides with the onset of autistic symptoms. (Dawson et al., 2007).

Cerebellum

Post-mortem studies have found a decreased density of Purkinje cells in the cerebellum (Palmen et al., 2004) . This contrasts with the findings from MRI studies that show relatively enlarged cerebellum size in those with autism (Minshew et al., 2005). The reasons behind these differences are likely to be methodological, as the brains in the post-mortem studies also had mental retardation and many had epilepsy, whereas the participants in MRI studies tended to be individuals with high functioning autism without additional epilepsy.

The cerebellum is involved in sensorimotor and motor activity, including eye movements, and has shown abnormal activity in autism (Yukari et al., 2007). These difficulties are not core diagnostic features of autism, yet studies of abnormal cerebellar structure and function suggest that the neuropathology of autism extends to the organisation of brain systems in a generalised, rather than a symptom specific way.

The research into the cerebellum and autism also highlights the difficulties faced by researchers in this field. Researchers need to explain the core features of autism through neuroanatomy that may be symptom specific or more general. However, the heterogeneity of the behavioural manifestation of ASC and the methodological difficulties of post-mortem and MRI studies mean that specifying any neuroanatomical features that are specific to autism is a difficult task.

The limbic system and amygdala

The limbic system, part of which is the amygdala, is critical for understanding social and emotional information and therefore a key target for investigating the neuropathology of autism. Some studies have shown an unusually dense packing of neurons in regions of the limbic system (Bauman & Kemper, 1994), a pattern that is suggestive of an immature brain, whereas other studies have found significantly fewer neurons in the amygdala of individuals with autism (Schumann & Amaral, 2006). The reasons for this are uncertain. Young children with classic autism show an abnormally large amygdala (Sparks et al., 2002), which has been associated with worse social and communication skills (Munson et al., 2006). Taken together, it seems that there is good evidence for the involvement of the amygdala in the aetiology of autism, but the exact nature of the abnormalities is still unclear.

Mirror neurons

Recent studies have found that the mirror neuron system may be impaired in ASC. Mirror neurons fire during the performance and observation of actions, and are thought to constitute a neural mechanism for the understanding of other peoples' actions and intentions. FMRI studies have shown reduced activation in the inferior frontal gyrus (part of the mirror neuron system) in children with autism while imitating and observing emotional expressions. This reduction in activity was related to greater social skills deficits, suggesting that poor functioning of the mirror neuron system may be involved in the aetiology of the social deficits in ASC (Dapretto et al., 2006). Mirror neuron systems in the amygdala, medial prefrontal cortex and superior temporal sulcus may constitute the neural mechanisms involved in simulation, a process thought to underlie the development of normal social cognition (Oberman & Ramachandran, 2007). Impaired mirror neuron systems could therefore underlie the social communication difficulties in ASC. This system cannot yet account for the presence of repetitive and stereotyped behaviours, yet an increased understanding of how the mirror neuron system develops could improve our understanding of its impairment in ASC, and eventually may lead to new intervention strategies.

Abnormal Connectivity

Research has suggested that autistic behaviour may be a result of abnormal neural connectivity in the brain (Belmonte et al., 2004; Just et al., 2004). On a synaptic level, in ASC there may be high local connectivity but impaired long-range connectivity between geographically distant brain regions. For example, Just et al (Just et al., 2004) measured the functional connectivity between brain areas involved in sentence comprehension in adults with ASC and typically developing controls. They found a lower level of functional connectivity between language areas of the brain during sentence comprehension in the participants with ASC. They suggest that autism is characterised by preserved or even enhanced functioning of individual cortical areas, but poor co-ordination among different cortical areas, resulting in difficulties with integrating and co-ordinating information at higher processing levels. This model can explain the social deficits seen in ASC, as social interaction requires the integration of large amounts of different information (e.g. facial expression, context, intent, and body language). A recent fMRI study found that individuals with ASC have lower functional connectivity between the fusiform face area and the left amygdala and posterior cingulate in comparison to typical controls in a face identification task, supporting the idea that social difficulties may be a result of poor functional connectivity (Kleinhans et al., 2008). Moreover, individuals with ASC who had greater social impairment on the Autism Diagnostic Interview had reduced connectivity between the fusiform face area and the amygdala compared to those with milder social impairments. This makes an explicit link between reduced functional connectivity in the limbic system and behavioural social impairments in ASC. This interesting area of research warrants more investigation.

Overall, neuroanatomical studies are beginning to shed some light on the aetiology of ASC, but there is still a long way to go before the exact causes of autism are known. Findings from fMRI and post-mortem studies are helpful, but in need of replication and more advances in methodology. To develop suitable interventions for autism, we have therefore turned to cognitive theories of ASC which are relatively well-established.

1.7 Cognitive theories of autism

In the absence of a comprehensive neurological explanation of ASC, cognitive models provide the best attempts to explain the symptoms of the condition. The diagnostic symptoms of ASC are explained in terms of different cognition that is reflected in behaviour, development and in neuroimaging studies. There are four major cognitive theories of ASC. These are reviewed below and include an impaired theory of mind, executive dysfunction, weak central coherence and empathising/systemising.

1.7.1 Impaired theory of mind

Arguably the most influential cognitive theory of autism is that of ‘Mindblindness’ (Baron-Cohen, 1995; Baron-Cohen, 2000). This theory suggests that the triad of impairments seen in autism are a result of an inability to attribute mental states to oneself and others, i.e. an impaired theory of mind. A theory of mind has been described as one of the quintessential abilities that make us human. It involves the ability to understand and predict other people’s mental states, intentions, beliefs, desires and emotions, and to understand that other people’s beliefs and desires may differ from your own (Premack & Woodruff, 1978). These abilities are clearly vital for normal functioning in society.

Typically developing children usually develop an understanding of theory of mind at around 4yr. Its development is dependent upon the ability to form meta-representations (representations about representations), an ability that is practiced in pretend play. Between 18-24 months, infants start playing with objects as if they were something else, e.g. pretending a banana is a telephone. They also begin to role-play e.g. playing ‘mummies and daddies’. This type of imaginative play helps children form meta-representations about objects and form representations of other people’s mental states that might be different from their own, important building blocks for a theory of mind (Leslie, 1987).

Theory of mind is clearly a vital mechanism for understanding other people’s behaviour. Without it, people are confusing and unpredictable. The ‘Mindblindness’ theory of ASC suggests that an impaired theory of mind is the cause of the social and communication difficulties in ASC. A lack of imaginative play, problems forming relationships and difficulties with understanding others all point to theory of mind difficulties and there is considerable experimental evidence to support the idea. The most thorough experimental tests for an understanding of theory of mind are false belief tasks, which test the understanding that different individuals can have different thoughts about the same situation.

The first attempt to assess theory of mind in individuals with autism was carried out in 1985 using the 'Sally-Anne' false belief task (Baron-Cohen, Leslie, & Frith, 1985). In this task, the child is shown two dolls, and observes one of them, Sally, place her marble into a basket before leaving the room. While Sally is absent, Ann moves Sally's marble from the basket into a box. When Sally returns to find her marble, the child is asked the test question, 'Where will Sally look for her marble?' This task was given to 20 children with autism with mental ages well over 4yr (i.e. after the age at which typically developing children acquire a theory of mind). Results showed that 80% of the children with autism failed the task, saying that Sally would look in the box for her marble, rather than in the basket where she left it. They failed to acknowledge Sally's false belief. In comparison, only 14 % of the Down syndrome control group (matched for mental age) failed the task. This finding has been extensively replicated to rule out more general problems with representations (Zaitchik, 1990), problems with language understanding (Baron-Cohen, Leslie, & Frith, 1986) and to examine a child's own false beliefs (Perner et al., 1989). A failure to pass false belief tasks has also been related to poorer social functioning in everyday life (Frith, Happe, & Siddons, 1994).

Older individuals with autism and those who are higher functioning can learn to pass first order false belief tasks. Perhaps theory of mind develops at a later age in ASC; perhaps individuals can learn alternative strategies for understanding behaviour (Frith et al., 1994). However, difficulties remain for higher functioning individuals in second order false belief tasks. These are more complicated mentalising tasks, in which you are asked to judge what someone thinks someone else will think (e.g. 'If Sally was peeking through the keyhole while Ann moved the marble, where would Ann think Sally will look for the marble?). Children with autism who pass first order false belief tasks fail second order false belief questions (Baron-Cohen, 1989a).

Similarly, more advanced tests of theory of mind such as the 'Reading the Mind in the Eyes' test are more difficult for individuals with ASC. In the 'Reading the Mind in the Eyes' test individuals are asked to choose the label that best describes the mental state of the person in a picture. Only the eye region of the person's face is shown, so only the eyes can be used to infer mental states (see Figure 1.1). Individuals with autism are impaired in these tasks, suggesting they fail to use cues from the eye region to infer mental states (Baron-Cohen, Jolliffe et al., 1997; Baron-Cohen, Wheelwright, Hill et al., 2001).

Figure 1.1. An item from the 'Reading the Mind in the Eyes' test.

Neuroimaging studies also support the idea that individuals with ASC have impaired theory of mind understanding. The 'social brain' network consists of several interconnecting brain regions that are thought to underlie the perception and understanding of social information, including theory of mind (Brothers & Ring, 1992). It is thought to include the amygdala, the orbito-frontal cortex, medial frontal cortex and the superior temporal sulcus and gyrus (see Figure 1.2).

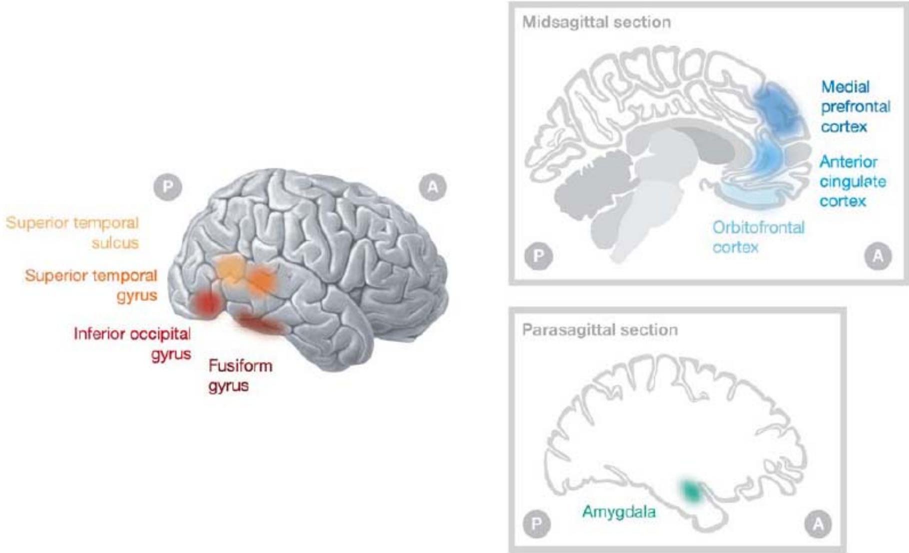

Figure 1.2. The social brain network (from Baron-Cohen & Belmonte 2005)**.**

Less activation was found in the medial frontal area of the brain in individuals with ASC who listened to stories requiring theory of mind or read mentalising stories in comparison to matched controls (Happe et al., 1996; Nieminen-von Wendt et al., 2003). In another PET study, participants were shown silent animations of geometric shapes that moved either randomly, in a goal-directed fashion (e.g. chasing) or with implied intentions (e.g. coaxing, tricking). During the latter condition (which involved mentalising) individuals with autism showed less activation in the medial prefrontal cortex, the superior temporal sulcus and temporal poles than controls (Castelli et al., 2000).

As described in section 1.6.3, structural abnormalities have been found in the amygdala in individuals with ASC. The mirror neuron system also discussed in that section also seems likely to be involved in representing other people's mental states and is functioning atypically in autism (Dapretto et al., 2006). FMRI studies have also shown abnormally low activation of the amygdala during the 'Reading the Mind in the Eyes' test in adults with autism (Baron-Cohen, Ring et al., 1999). Differential activation in social brain areas was also found during fearful face processing between individuals with AS and typically developing adults (Ashwin et al., 2007). Individuals with ASC showed greater activation in areas that are thought to be involved low-level social perception such as recognising facial expressions of emotion (the anterior cingulate gyrus and superior temporal cortex). In contrast, typically developing individuals showed greater activation in areas thought to be involved in higher level social processing such as guiding social decisions and social behaviour (the left amygdala and left orbito-frontal cortex). Individuals with autism were therefore analysing social information using different, more perceptual strategies than typically developing individuals.

Taken together, these studies provide strong evidence for an impaired ability to mentalise in autism, stemming from behavioural and physiological research. ‘Mindblindness’ can account for the core impairment in social communication in ASC: if individuals with ASC fail to recognise the emotions, beliefs, desires and intentions of others then their social communication will be significantly impaired. However, there are non-social aspects of ASC, and the theory of mind deficit does not purport to account for these. Theory of mind deficits cannot explain why individuals with autism engage in repetitive behaviour (Happe, 1994), or focus on the detail of information rather than the whole, or why they focus solely on objects or subjects that particularly engage them while disregarding everything else (Plaisted, 2000). The cognitive model explained in the following section aims to address these elements.

1.7.2 Executive dysfunction

Executive function is an umbrella term used to describe several cognitive functions including the ability to maintain an appropriate problem solving set for the attainment of a future goal, planning (working memory), controlling impulses, flexibility of thought, set shifting, initiating and monitoring actions and inhibiting pre-potent responses (Hill, 2004). These abilities are mediated by the frontal lobes, an area of the brain that is also involved in regulating social and emotional behaviour (Ozonoff, South, & Provencal, 2005). Patients with frontal lobe damage exhibit executive dysfunction (Shallice, 1988), as do individuals with other clinical disorders thought to involve the frontal lobes such as attention deficit disorder, obsessive compulsive disorder, Tourette’s syndrome, phenylketonuria and schizophrenia (Hill, 2004). Several characteristics of autism such as rigid, inflexible and repetitive behaviour, poor planning, and the appearance of being impulsive or unable to inhibit or delay a response seem to indicate that executive function may be impaired in autism.

Individuals with autism are impaired in tasks involving planning a long sequence of moves, such as the Tower of Hanoi and Tower of London. Here, the participant is required to move discs from one pre-arranged sequence along three different pegs to match a desired goal sequence on a different peg to the start peg. This must be done in as few moves as possible, and following some specific rules (e.g. a large disc cannot go on top of a small one). Poor performance on this task is stable over at least a few years, and is predictive of a diagnosis of ASC (Ozonoff & McEvoy, 1994). Tower tasks such as these require planning and therefore, it is assumed, working memory. However, several studies have failed to find working memory deficits in ASC (Ozonoff & Strayer, 2001; Russell, Jarrold, & Henry, 1996) which suggests that the working memory component is not an executive function that is impaired in ASC. Perhaps the skills assessed in Tower tasks are those of resolving goal-subgoal conflicts (i.e. performing moves that are superficially wrong and opposite to the end goal state, but nevertheless important for reaching the goal), which perhaps are more to do with flexibility than planning.

Other executive function tasks such as the Wisconsin card sorting task (WCST) are also poorly performed by individuals with ASC. The WCST requires mental flexibility. The participant is asked to sort a set of cards on one of three possible dimensions (colour, shape or number) by following an un-spoken rule. The examiner tells the participant whether or not they have sorted the card correctly, but does not explicitly state the rule. The rule required to sort the cards changes at various times in the set, requiring the participant to alter their sorting strategy. Relative to typically developing individuals, those with ASC demonstrate significant perseveration on this task. They sort by the previous rule, despite negative feedback and are slow to shift set, demonstrating poor mental flexibility (Hughes, Russell, & Robbins, 1994; Rumsey & Hamburger, 1990).

Further examination of mental flexibility has used the intradimensional-extradimensional shift task, taken from the Cambridge Neuropsychological Test Automated Battery (CANTAB). Here, a shape and a line are used and participants must learn which to respond to (the shape). There is then an intradimensional shift in which the shape changes, but the participant still has to respond to the shape rather than the line. A further extradimensional shift is given, in which participants must change their learned response to the shape, and instead respond to the line. Individuals with ASC perform at similar levels to matched typically developing participants for intradimensional shifts, but showed deficits in extradimensional shifting relative to controls (Ozonoff et al., 2004). This lack of flexibility seems to be reflected in the rigid and inflexible behaviour exhibited by individuals with ASC in daily life.

Neuroimaging studies of individuals with ASC performing executive function tasks have shown significantly less activity in the prefrontal cortex and posterior cingulate cortex compared to matched controls (Luna et al., 2002), suggesting that these brain regions may underlie the executive function difficulties seen in autism.

Despite these findings, there are several problems with the executive dysfunction theory of ASC. Firstly, not all executive functions seem to be impaired. Individuals with autism are not impaired on the Stroop task, one which requires the executive function of inhibition (Russell, Jarrold, & Hood, 1999). In this task a participant reads a list of colour names written in coloured ink, where the ink colour may be congruent or incongruent with the colour name (e.g. BLUE or BLUE). Neither are they impaired on other tasks requiring inhibition, namely negative priming and stop-signal tasks. Negative priming tasks assess interference of previously relevant targets that become distracter targets in subsequent trials. In one study, participants were shown a string of five letters, e.g. FTFTF and are asked whether the second and fourth letters are the same or different. Responses are typically slower and less accurate when distracter stimuli in the previous trial become targets in subsequent trials, a disruption that is a result of actively inhibiting attention to distracter stimuli. If inhibition is impaired in ASC, then you would expect no negative priming effects, but in fact, they show as much negative priming as matched typically developing controls (Ozonoff & Strayer, 1997). Similar results were found in the stop-signal task, in which participants categorize words as animals or objects. In a subset of trials an auditory signal is given to indicate that responses should be inhibited and no response should be given on that trial. Contrary to hypotheses of a lack of inhibition due to executive dysfunction in

ASC, individuals with ASC were equally likely as matched controls to respond when responses should be withheld (Ozonoff & Strayer, 1997).

A second issue with executive dysfunction theory is that it may be a secondary, rather than a primary deficit in ASC. Developmentally, executive function difficulties seem to emerge after the age of 5 years in autism (Ozonoff, South et al., 2005), suggesting that these difficulties may be secondary to other aetiological mechanisms in autism. As autism is a neurodevelopmental condition, it is likely that different impairments may emerge at different ages, and the developmental trajectory of this needs to be further researched in longitudinal studies. There are correlations between executive function difficulties and performance on theory of mind tasks (Perner & Lang, 1999) and further research is needed to elucidate whether these abilities are dependent on each other, are based on a shared impairment or similar neural underpinnings or are independent cognitive operations that are both central to autism.

Furthermore, executive dysfunction is hindered in its use as a diagnostic marker for ASC as it is found in other neurodevelopmental disorders as well (Hill, 2004). Perhaps different disorders show different profiles of executive function difficulties, but at the moment executive function theory falls down due to its lack of specificity. Moreover, some studies have failed to show executive function deficits in some participants with ASC (Hill, 2004). This could be due to the nature of the tasks used, or could indicate that executive dysfunction is not universal in ASC.

A methodological problem with assessing executive dysfunction arises in the strategies for matching control participants (Burack et al., 2004). Due to the cognitive profile of visual-spatial strength and weakness in verbal ability in ASC, it may be difficult to match typically developing control participants adequately. Matching on verbal ability may lead to comparisons with younger typically developing children and a consequent overestimation of the abilities of those with ASC. Matching on visual-spatial ability may lead to comparisons with older, higher functioning typically developing participants and a consequent underestimation of abilities. This methodological issue is relevant for all the theories attempting to study atypical development in ASC.

Overall, the literature suggests that individuals with ASC are impaired in some executive functions, such as planning and mental flexibility, but are not impaired on others, such as inhibition. More specifically, they may be impaired on certain executive function tasks (e.g. the WCST) but not others (e.g. the Stroop task), and they may be impaired at some points in development and not others (Russo et al., 2007). Further research is necessary to find out the exact nature of executive function difficulties in autism, how it develops across the lifespan and how it relates to the core symptoms of autism. One difficulty for answering such questions is that many of the tasks assessing executive functions are complex, and usually assess several aspects of executive function rather than specific skills (for example, the WCST involves flexibility, inhibition, monitoring and working memory). Tasks may also be presented within socially demanding contexts, and findings may be confounded by poor matching to comparison participants (Burack et al., 2004). Determining exactly what is causing the executive function difficulties is an important area for future research. The fact that executive dysfunction is not unique to autism, may not be universal in autism and cannot explain preserved skills in autism suggests that while it is a useful conceptualisation for certain aspects of the condition, other theories are necessary. In the next section, another cognitive theory will be discussed which accounts very well for the preserved skills seen in ASC and the particular cognitive style in autism.

1.7.3 Weak central coherence

A difficulty encountered by both the 'Mindblindness' and executive dysfunction accounts of autism is that they fail to explain what individuals with autism are good at. They have difficulty explaining not only the preserved abilities in ASC but also the presence of superior skills in certain domains. Early studies have shown individuals with ASC to be superior at remembering word strings and unrelated items (rather than sentences and related items), they are better at doing jigsaw puzzles by the shape of the pieces rather than the picture, and are able to recognise faces upside-down much more easily than typically developing individuals (Hermelin & O'Connor, 1970). Striking examples of superior skill in ASC are the embedded figures test, where children with autism are superior at finding a small hidden shape within the context of a meaningful drawing (Jolliffe & Baron-Cohen, 1997; Shah & Frith, 1983; Shah & Frith, 1993), and the block design subtest of the Wechsler Intelligence Scales, in which individual blocks are used to reconstruct a 2-D pattern from its separate parts (Shah & Frith, 1993). Typically developing individuals find the block design subtest much easier if the picture is pre-segmented into separate pieces, however, individuals with autism show no such advantage, suggesting that their superior skill on this task is due to their ability to pre-segment the pieces in their head.

These superior skills in individuals with autism have been interpreted to demonstrate a unique cognitive style in autism, in which information is processed in a piecemeal way, rather than pulling information together for higher meaning (Frith, 1989; Happe, 1999). This ‘weak central coherence’ account of autism suggests that contextual meaning is less salient to individuals with autism than the attention to and memory for details. Further evidence for this processing style comes from homographs, words that have one spelling, but two meanings depending on the context (e.g. a ‘tear’ in her dress or a ‘tear’ in her eye). Individuals with autism do not pronounce homographs correctly using the context of the sentence (Frith & Snowling, 1983; Happe, 1997; Jolliffe & Baron-Cohen, 1999), suggesting they are processing the information without the global meaning. This lack of processing contextual information extends to tasks in which sentences must be ordered according to contextual information. Those with AS or HFA were significantly worse than matched controls at ordering sentences using contextual information, whereas no such deficit was found when ordering sentences with temporal information (Jolliffe & Baron-Cohen, 2000).

Individuals with ASC also find it harder to perceive the coherent whole in non-verbal contexts. When asked to identify a scene made up of several objects and asked to identify the odd object in the scene (e.g. a nursery room with children’s toys in it, and a kitchen knife as the odd object), those with AS or HFA were impaired in both the ability to identify the scene, and the ability to identify the odd object (Joliffe & Baron-Cohen, 2001).

As yet, there are relatively few neuroimaging studies examining the brain mechanisms involved in weak central coherence. One study of individuals with ASC carrying out the embedded figures test (Ring et al., 1999) found that individuals with ASC showed greater activation in the extra-striate regions of the visual cortex (involved in processing low-level perceptual information) while control participants showed greater activation in the prefrontal cortex (involved in integrating information), alluding to poor connectivity through the brain between basic perceptual processes and top-down modulation of information in context (Hill & Frith, 2003).

However, it seems that individuals with ASC are not incapable of processing global information, and can do so when directed to attend to global information. When given explicit instructions about global meaning, (for example, specific instructions about the nature of homographs) individuals with ASC perform equally well as controls (Snowling, 1986). Improved configural processing of facial features has been found after attentional cueing, compared to non-cued conditions where featural processing is used (Lopez et al., 2004). Plaisted et al (Plaisted et al., 2003) compared the performance of children with ASC and typically developing children on visual tasks that required configural processing or featural processing. They found that the groups did not differ in their ability to carry out configural processing, but the individuals with ASC had superior featural processing in comparison to configural processing, whereas typically developing children showed the reverse pattern. This study reinforces the idea that low-level global processing is not impaired in ASC, but that abnormal perceptual processes enhance the salience of individual features of visual stimuli.

Preserved integration of information is also seen in visual search tasks requiring the integration of featural information (O'Riordan et al., 2001). Plaisted explains these findings by suggesting that individuals with ASC process features that objects have in common relatively poorly, but process unique features of an object relatively well (Plaisted, O'Riordan, & Baron-Cohen, 1998a; Plaisted, 2001). This could explain the findings of superior visual search in ASC (O'Riordan et al., 2001; Plaisted, O'Riordan, & Baron-Cohen, 1998b).

These findings of preserved global processing in ASC have prompted a revision of the weak central coherence theory to postulate that a failure to extract global meaning is not a primary deficit, but secondary to a superior local, detail-focused processing style (Happe & Frith, 2006). Research is now required to further elucidate the mechanisms of this local processing style.

Despite its limitations, weak central coherence is an important theory. It can account for the lack of understanding the gist of social situations due to a failure to process global and contextual information without explicit instruction to do so. The piecemeal processing of information at the perceptual level may render emotion recognition from faces more difficult. Weak central coherence can also account for many of the assets of ASC and the presence of savant skills in this population, due to the remarkable detail focus. However, it fails to provide a comprehensive theory of ASC as it may not be universal within participants with ASC (Jarrold & Russell, 1997), nor is it specific to ASC. There is some evidence for a local processing bias in schizophrenia (Chen et al., 2003)and Williams syndrome (Bellugi et al., 2000).

Nevertheless, the weak central coherence theory is of value. The idea that ASC should have some benefits influences the way in which individuals with ASC are perceived in the community, and has important implications for intervention approaches. Perhaps we should not aim to 'cure' autism using a particular treatment approach, rather we should aim to capitalise on the strengths of individuals with ASC while helping them with areas of difficulty. The next cognitive theory of ASC to be discussed takes this idea of strengths in autism even further, and integrates strength in some areas with weaknesses in others.

1.7.4 Empathising-systemising

The empathising-systemising theory of ASC is an extension of the theory of mind model of autism discussed in section 1.7.1. It suggests that individuals with autism have deficits in the normal process of empathising but superior or preserved systemising abilities. First, the evidence for a deficit in empathising will be discussed, followed by evidence for preserved or superior systemising abilities.

Empathising involves the ability to identify mental states in others and respond to these with an appropriate emotion {Baron-Cohen, 2002 #2629; Blair, 2005 #3055; Davis, 1994 #1853}. Thus there are two components of empathy: a cognitive component of identifying mental states in others, which can be thought of as parallel to theory of mind, or mentalising. The affective component involves responding appropriately to other people's mental states and is an equally important aspect of

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empathy in terms of social interaction success. Thus a person might recognise that a child who has fallen over might feel sad (the cognitive component of empathy), but they might also have the motivation to respond with an appropriate emotion or behaviour (e.g. they might feel sorry for the child, or they might help them up and give them a hug).

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The study of empathy goes back many years and has been studied both within human development {INSERT DUNN REF AND EISENBERG REF) and in comparative studies across different species (INSERT PRESTON & DE WAAL REF}. It is thought to be an evolutionary mechanism underlying the human tendency to help others and behave altruistically {Hoffman, 1981 #3263}.

The role of empathy in social functioning is vitally important, yet individuals with ASC are impaired in both the cognitive and affective components of empathy. Children with ASC are less connected with other people and show less positive feelings during joint attention episodes with a caregiver (INSERT KASARI, SIMGMAn and MUNDY REF 1990). Further evidence comes from experimental studies that show 'flat' facial expressions and unique ambiguous facial expressions in individuals with autism (Yirmiya et al., 1989). This suggests that co-ordination of emotional expressions might be abnormal in autism, which might in turn affect their interpersonal relationships. Another study showed short video clips of children experiencing different emotions to children with HFA and matched controls. Participants were asked to say how the child in the film felt, and then state how they themselves were feeling, in an attempt to report on the affective component of empathy. Participants with HFA gave fewer empathic responses (reports of feeling the same way as the child in the film) in comparison to the matched controls (Yirmiya et al., 1992). High functioning adults with ASC also report experiencing lower levels of empathy on the Empathy Quotient, a questionnaire designed to measure empathy (Baron-Cohen & Wheelwright, 2004). A similar result has been obtained using a parent-report version rating children with ASC (Auyeung et al., 2007). Other performance measures of empathy include the 'Reading the Mind in the Eyes' test (Baron-Cohen, Wheelwright, Hill et al., 2001) and the Faux Pas test (Baron-Cohen, O'Riordan et al., 1999), both of which reveal empathy deficits in ASC.

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These deficits in empathising may underlie the social communication difficulties seen in autism, and are likely to be mediated by the 'social brain' and mirror neurons described in section 1.6.3. From a psychological perspective, problems with the cognitive element of empathising (i.e. the ability to identify mental states in others; theory of mind) have been related to a deficit in the cognitive ability to form metarepresentations (Leslie, 1987). Metarepresentation is thought to be an innate ability that allows the individual to mentally represent other people's thoughts and feelings. Without this innate ability, individuals with autism fail to relate to other people.

However, others argue that it is not a deficit in cognitive ability, rather an abnormal developmental pathway, that leads to empathising difficulties in ASC (Hobson, 1993). Hobson (1993) believes that it is a child's experience of persons and an understanding of the nature of people that leads to the development of an understanding of mind. Experience of people and interpersonal relatedness sets typically developing children off on a developmental trajectory by which they can acquire concepts about people's feelings, intentions, thoughts and beliefs. Through emotional enagement with other people, typically developing children begin to see the world according to other people and develop and understanding of symbolic thinking and theory of mind. An understanding of theory of mind is therefore not an innate cognitive ability that is impaired in ASC. Rather, empathising deficits in ASC are a result of missing out on opportunities to learn about people and interpersonal relatedness due to a lack of intersubjective co-ordination with other people from a very early age. This lack of intersubjective engagement in children with ASC starts them off on an aberrant developmental pathway that ultimately leads to a limited understanding of minds and empathising deficits. This pathway can be thought to lead to difficulties with both the ability to recognise emotions and responding to other people in an appropriate fashion.

If children with autism are not engaging in interpersonal relationships, then perhaps they pay more attention to objects in the environment. This may lead to a developmental pathway that is oriented towards objects and 'things' rather than people, and may be a way that preserved or superior abilities in understanding 'how things work' develops in ASC.

Deficits in empathising cannot in and of themselves explain the repetitive behaviour, islets of ability and obsessions seen in ASC, but perhaps an altered developmental pathway with a greater attention to objects could. This is where the concept of 'systemising' comes in.

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Systemising is defined as the drive to analyse and build systems and to understand and predict the behaviour of systems. Systems may be technical (e.g. machines), abstract (e.g. maths), natural (e.g. biological), social (e.g. a football league), motor (e.g. juggling) or organisable (e.g. taxonomy). Systems are all around, and require an understanding of underlying rules and regularities (Baron-Cohen, 2003). Empathising depends on the context of different situations and so is unpredictable (as it depends on the intentions of agents), whereas systemising is very predictable, rule-based and potentially accurate (as it depends on non-agentive events). Implementing the rules of a system will always lead to the same outcome (input-operation-output is always the same). In contrast, empathising involves agentive behaviour, and no matter how well we know the person, empathising is always open to contextual variation and can be very unpredictable (there is no clear relationship between input-operation-output).

Clinical descriptions and parent accounts of autism suggest that individuals with ASC are fascinated by systems (e.g. trains, machines, spinning tops, astronomy), and survey evidence suggests that the obsessive interests of individuals with autism cluster around systems (Baron-Cohen & Wheelwright, 1999). Individuals with autism are detail focused, and prefer predictable routines and rules, features that are all intrinsic to systemising. The observation of a 'little professor' talking in great detail about different types of buses and their workings without realising that the listener is bored of the subject is commonplace in children with HFA and AS, and highlights the fact that an interest in systems is preserved despite a real lack of empathy. Autistic savants who are calendrical calculators and can state the day of the week of any date within seconds, or who can play a piece of music after only hearing it once, or can draw exact copies of buildings brick for brick provide anecdotal examples of an expertise in systems.

Experimental evidence also supports the preserved or superior systemising abilities of individuals with ASC. The evidence for superior block design and embedded figures test performance discussed in the section on weak central coherence can also be interpreted as evidence for good systemising skills. In a picture sequencing paradigm, children with autism performed significantly better than mental age matched controls and controls with Down syndrome at sequencing physical-causal stories (such as a rock rolling down a mountain and hitting a tree), whereas they are significantly worse at sequencing pictures using theory of mind context (as previously discussed in section 1.7.1). Children with autism show superior understanding of a camera (Leekam & Perner, 1991; Leslie & Thaiss, 1992). In a test of folk physics children with AS performed significantly better than controls (Baron-Cohen, Wheelwright, Spong et al., 2001). Adults with AS also perform better on the 'Physical Prediction Questionnaire' (which involves understanding physical systems, such as how levers and cogs move when rotated in certain directions) than typically developing males, who perform significantly better than typically developing females (Lawson, Baron-Cohen, & Wheelwright, 2004). Self-reports of individuals with ASC also show a greater desire to learn about systems and to perform systemising-related behaviours than typically developing adults (Baron-Cohen et al., 2003).

There is also evidence that systemising is part of the 'broader autism phenotype', as research has shown that fathers and grandfathers of children with autism are twice as likely to work in engineering (a clear systemising occupation) than fathers and grandfathers of typically developing children (INSERT BARON-COHEN et al 1997 ref). Mathematicians score highest of all scientists on the Autism Spectrum Quotient, a measure of autistic traits (INSERT BARON_COHEN et al 2001 ref). These findings suggest that a link between systemising and autism might have a genetic basis, however, further molecular genetic studies are needed to investigate this possibility.

It could be argued that superior or intact systemising is only evident in individuals with autism who are higher functioning, or have AS. However, Baron-Cohen argues that systemising is evident in lower functioning individuals who bounce on a trampoline, or twist a bit of string repetitively, or watch a washing machine go around. These apparently 'purposeless' activities are, in his view, behaviour that provides input for a neural mechanism that seeks to find systematic patterns in the world (INSERT BARON-COHEN 2006 ref). In higher functioning individuals, a drive to seek patterns and systems in the world can lead to a superior understanding of how things work, and in extreme cases, can lead to savant skills in areas such as mathematics, music and drawing.

Systemising requires repetition of events, in order to derive and check rules about the world and to evaluate the consistency of patterns. This view conflicts with the idea repetitive behaviour is a result of executive dysfunction (INSERT REF of RUSSELL 1997). Executive dysfunction theory suggests that the repetitive behaviour seen in autism is caused by an inability to stop a behaviour, even though the individual might want to stop. In contrast, hypersystemising explains repetitive behaviour as a need for patterned data, the collection of which can be pleasurable for the individual as it satisfies the drive to understand the world through a series of lawful rules. Human behaviour is not 100% lawful, and does not follow strict rules, therefore individuals with autism will struggle to hypersystemise human emotion and behaviour. Empathy is arguably impossible to systemise and impose rules upon. Individuals with ASC therefore become disabled when faced with social behaviour that is characterised by unlawful changes.

The empathising-systemising model seems to provide an integrative explanation for many of the symptoms of ASC. Social and communication difficulties can be explained by impaired empathising, while obsessive interests, rigid behaviours and superior performance in tasks requiring detail focus can be explained by the drive to systemise and search for underlying rules at the local level. It also explains the need for routine and sameness in autism as it renders some predictability to unsystemisable aspects of the world.

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Nevertheless, further evidence is still required to support this model, particularly in assessing performance of individuals with ASC in understanding systems other than physics. Neuroimaging studies of systemising are also essential. We also need to test E-S theory against the weak central coherence and executive dysfunction accounts of autism. Similar to E-S theory, the weak central coherence theory suggests a different cognitive style in autism, and highlights excellent attention to detail. However, while weak central coherence relates detail focus to a local processing style, E-S theory relates detail focus to a need to understand a system that might be present. Weak central coherence predicts that individuals with autism will get lost in the detail of a system, and never understand the whole, whereas E-S theory predicts that eventually the individual will understand the whole system. Anecdotal evidence from mathematicians with autism who understand an integrative mathematical system suggest that E-S theory wins out on this argument, but further experimental evidence still needs to be collected. Further research needs to be carried out to investigate whether the purpose of repetitive behaviour is to systemise, or whether it is due to an executive function difficulty.

Despite its relative youth, the empathising systemising theory has clear implications for interventions. Like the weak central coherence model, it frames ASC in a positive light, as well as highlighting deficits. The theory suggests that individuals with autism are very interested in systems, motivated by them, and superior in their understanding of them. It has been suggested that we should use this interest and superior skill in systemising to help children with autism understand empathy (Golan & Baron-Cohen, 2006). If provided with systematic methods in which to practice and learn empathising skills, perhaps children with autism will be more motivated. If individuals with ASC are on an object-oriented 'systemising' developmental trajectory, perhaps we can tap into this pathway to try and bring it further towards a person-orientated developmental trajectory and thus improve children with autism's understanding of people. This is the premise of the current thesis. Using systematic methods to motivate children with autism to attend to empathic situations will be evaluated in the context of a DVD designed to teach emotion recognition based on mechanical systems (vehicles). This will evaluate whether presenting materials in a systematic fashion facilitates the cognitive component of empathy. Social skills more generally will be targeted in a social skills group based on a constructional system (LEGO®). Here, the systematic appeal of LEGO® will be used to motivate children to participate in social interactions. In this setting both the cognitive and affective components of empathy can be addressed. If these interventions are found to be more successful than those that do not present materials in a systematic fashion then this will suggest that empathising can be facilitated using the principles of systemising (rules and predictability).

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If, as the research presented in this section suggests, individuals with ASC have a preference for systems, then interventions presented in a systematic framework may be more enjoyable, and therefore individuals might be more motivated to learn. It may also be the case that an innate ability to systemise means that individuals with ASC who are good at systemising perform empathising tasks better when they are presented in a systematic fashion. It remains to be seen which (or both) of these might be the case.

First, in order to evaluate the areas of socialisation that require intervention, the development of social competence in ASC will be discussed. The current status of research evaluating interventions that address the previously discussed social difficulties will then be summarised. Subsequent chapters will then report the effectiveness of *The Transporters* DVD, a systematic approach to teaching emotion recognition, and LEGO® therapy, a systematic approach to teaching social skills.

Chapter 2: Social Competence in ASC

2.1 Introduction

Social impairment forms a fundamental part of the diagnostic classification of autism (APA, 1994) and since Kanner's description in 1943 has come to be regarded as a 'core' component of the condition (Baron-Cohen, 1995; Hobson, 1993; Rutter, 1978; Sigman, 1994). Social difficulty is evident from a very young age, when children with ASC prefer to be alone, prefer objects to people, make poor eye contact, make few gestures, show a lack of a desire to interact with others and fail to make friends (Rutter, 1978; Wing & Gould, 1979). It is clear that in a society that is so dependent on successful social interactions individuals who do not naturally understand these processes need specific education to help develop the social skills necessary to function in everyday life. Several intervention approaches have been developed to help individuals with autism improve their social competence in different areas. Before these are discussed it is necessary to focus in more detail about the specific social difficulties experienced by individuals with ASC.

Describing and explaining the development of social skills is far from straightforward. Quality of social interaction is dependent on a multitude of interacting factors such as cognitive ability, language ability, emotional reactivity, maturational stage, previous experience and current context (Cairns, 1986). Social development does not necessarily follow a cumulative or hierarchical pattern; rather, behaviours have to be adapted or omitted from the social repertoire throughout the course of typical development. Behaviours that might be socially appropriate for a 3yr old may be completely inappropriate if performed by a 13yr old. Nevertheless, social competence is dependent on several key skills that are learned throughout the course of typical childhood, but that are delayed or impaired to some degree in individuals with ASC. The aim of the current chapter is to give a brief overview of these areas of social difficulty. This will be done within a developmental framework. More emphasis has been placed on elucidating the early development of autism, searching for key processes that lead to language, cognitive and social development that are deviant in ASC. In terms of social competence several of these key developmental processes will be discussed. First, the pivotal skills of eye gaze, joint attention, imitation, play and emotion understanding will be evaluated. All of these basic skills are necessary for successful social interaction to develop. Second, more complex social behaviours will be discussed, in the context of peer relationships. Before all this the clinical presentation of social difficulties in ASC will be explored.

2.2 Clinical presentation of social difficulties in ASC

There is considerable heterogeneity in the presentation of social difficulties among children with ASC, which Wing & Gould have categorized into 3 sub-types of social behaviour: 'aloof', 'passive' and 'active but odd' (Wing & Gould, 1979). 'Aloof' children tend to be those with significant mental retardation, and are most likely to be diagnosed as classically autistic. These children actively avoid social contact, they do not initiate communication (even if they can speak) and may appear to be deaf, even if they are not. 'Aloof' children do not initiate interactions with peers or adults but prefer to spend their time occupied with stereotypical or repetitive behaviour. They do not play with other children or show any interest in friendships. Their complete lack of interest and awareness of social signals renders these children particularly socially handicapped.

The 'passive' group described by Wing & Gould includes children who do not actively avoid social contact, but while they do accept the approaches of others, they do not have the skills to respond appropriately. These children might function at a higher cognitive level than children in the 'aloof' group, but their communication and behaviour is nevertheless somewhat rigid and stereotyped, and they need considerable support to engage in successful social interactions.

The third group constitutes children with ASC who are 'active but odd'. These children usually have diagnoses of HFA or AS, and while they actively seek out contact with other people, their social behaviour comes across as odd or one-sided. Despite considerable language skills, the social communication of these children can be very impaired and often focuses exclusively on the interests of the child without any consideration for the interest or needs of the communicative partner. Children who are 'active but odd' may have odd postures, gestures and facial expressions. They may use touch inappropriately during social exchanges and they may have a very literal view of the social world. Their understanding of other people's thoughts, feelings and intentions is impaired, despite adequate or superior cognitive functioning. Due to their impaired mentalising abilities, higher functioning children with ASC in this group may start talking about something without providing the listener with sufficient background information. They may make socially inappropriate remarks (e.g. "You're fat") or might start conversations in odd ways (e.g. "Is 342 a prime number?"). Unlike the 'aloof' and 'passive' children who do not seek out social contact, individuals who are 'active but odd' do desire social interaction, and are often aware of their failure to form friendships. They often become distressed by their lack of acceptance by others and cannot understand why this might be the case. Due to the average or above average cognitive ability of this group of children, they are often placed in mainstream educational settings in which they are unduly expected to demonstrate appropriate social judgment and behaviour. Without suitable support in these educational settings, and due to the heightened awareness that this group has about their difficulties, mainstream inclusion strategies have to provide considerable social education for the child with ASC and the whole school if affective disorders and bullying are to be avoided.

2.3 Pivotal skills central to social development

The social behaviour of individuals with ASC is therefore quite heterogeneous. Despite this, the social difficulties seem to stem from problems in several specific social processes that are impaired throughout ASC. These are eye gaze, joint attention, imitation, emotion understanding, play, and peer relations. These are the focus of the remainder of this chapter.

2.3.1 Eye gaze

Typically developing babies show preferences for faces (Slater & Quinn, 2001) and can recognise their mother's face from a very young age (Bushnell, Sai, & Mullin, 1989). Neonates as young as 5 days old prefer to look at faces that engage them in mutual gaze suggesting that reciprocal gaze is a major foundation for future social development (Farroni et al., 2002). By 2 months of age, infants preferentially scan the eye region of faces (Hainline, 1978). By 6 months, they orient their attention to an object being looked at by another person when it lies within their field of vision

(Morales, Mundy, & Rojas, 1998). By the end of the first year of life infants are capable not only of detecting the direction of an adult's eye gaze, but realise that an adult's gaze and positive emotion towards an object signifies their subsequent grasping of that object, i.e. they seem to recognise that emotional perceptual regard can predict subsequent behaviour (Phillips, Wellman, & Spelke, 2002).

Eye gaze is clearly a vital building block for understanding and predicting people's behaviour, yet it is a process that is impaired in autism. Parental and clinical reports frequently observe poor eye contact in individuals with autism. Osterling & Dawson carried out a retrospective analysis of children's first birthday parties and found that children later diagnosed with an ASC spent less time looking at faces than typically developing children (Osterling & Dawson, 1994). Children with autism also engage in less mutual gaze than typically developing children (Senju et al., 2003; Volkmar & Mayes, 1990). Adults with autism show a reduced amount of time looking at the eye region of faces in naturalistic social situations, and instead spend an increased amount of time looking at the mouth, body and non-social objects (Klin et al., 2002).

Thus individuals with autism from their infancy fail to orient to the eyes and face, and therefore miss out on vital opportunities to learn from information portrayed through the eyes and face. Eye gaze is consequently a potential target for very early intervention in children with ASC. The capacity to attend to the face and follow the gaze of others is a critical component of joint attention, which in turn is a fundamental aspect of social development. It is to joint attention that we turn in the next section.

2.3.2 Joint attention

Joint attention is a preverbal skill that typically develops between 8-12 months of age and involves sharing attention with another person with reference to a common object (Bruner, 1984; Carpenter, Nagel, & Tomasello, 1998). Typical behaviour to initiate joint attention includes an infant smiling at the caregiver and pointing at an object of interest, alternating their gaze between the caregiver and the object. Typically developing infants also respond to joint attention by following the direction of a parent's gaze or a parent's point in order to share attention about an object. The initiation of joint attention is regarded as a pivotal point in early social development and the foundation for language acquisition (Baron-Cohen, 1989b; Baron-Cohen, Allen, & Gillberg, 1992; Charman, 2003).

There are two functions of joint attention. The first is using joint attention to meet the child's needs, for example, requesting a desired object. This is called 'imperative' joint attention. The second is 'declarative' joint attention which serves to share the experience of an event or object with another person (Mundy, Sigman, & Kasari, 1993). Typically developing infants initiate imperative joint attention to request for an object at around 1yr, and develop declarative joint attention by about 16 months (Franco & Butterworth, 1996). It is thought that declarative joint attention emerges when children start to understand other people as agents with intentions, interest and desires. The development of joint attention skills is linked to language development in typically developing children (Morales et al., 2000). During joint attention, a verbal label can be provided about the object of joint interest and thereby facilitate language learning (Tomasello, 1988).

Research has shown that joint attention behaviours are impaired in children with autism. Children with autism show a deficit in joint attention behaviours where no such deficit is found in children with mental retardation or other disorders (Mundy, Sigman, & Kasari, 1990; Mundy, Sigman, & Kasari, 1994). In Osterling & Dawson's retrospective analysis of children's first birthday parties they found that children who later received a diagnosis of autism as well as spending less time looking at faces, also showed fewer joint attention behaviours than typically developing children (Osterling & Dawson, 1994). In a subsequent study using a comparison group of children with mental retardation these results were replicated, showing that a lack of joint attention and social behaviour is specific to ASC and not a result of developmental delay (Osterling, Dawson, & Munson, 2002). These findings suggest that impaired joint attention is characteristic of autism, and indeed, a lack of joint attention skills might be one of the earliest indicators of an ASC in children as young as 18 months (Allison et al., 2008; Baird et al., 2000; Baron-Cohen et al., 1992).

Impaired joint attention is also related to subsequent language learning in autism. Research has found that joint attention behaviours such as gaze and pointing at 45 months are associated with language ability 1 year later, whereas IQ, age and language ability at the start are not (Mundy et al., 1990). More specifically, it has been found that declarative joint attention behaviours (those that serve to share attention about an event or object) at 20 months are predictive of language ability at 42 months, whereas imperative joint attention behaviours (those that serve to request a desired object) are not (Charman, 2003).

Joint attention is also related to social skills in ASC. It has been found that better joint attention behaviours at 4 years are associated with better social and peer group skills at age 8 years (Sigman & Ruskin, 1999). Joint attention does not predict repetitive and stereotyped behaviour (Charman, 2003), suggesting that it is not involved in the development of these aspects of ASC and that the social-communication and repetitive-stereotyped behaviour seen in ASC might follow different developmental pathways.

It seems that joint attention behaviours are a pivotal component of the social and communication impairments in ASC. Joint attention enables the sharing of experiences and the sharing of emotion, the fundamental bases for social relationships. Along with its importance in language development, joint attention is clearly a target for intervention to ameliorate the social difficulties seen in ASC.

2.3.3 Imitation

Imitation is one way that preverbal infants communicate, and is likely to be involved in language and social development. Imitation involves purposefully reproducing another's body movements and in preverbal infants forms one of the earliest forms of social interaction (Nadel & Aouka, 2006).

Typically developing neonates imitate adults' facial expressions (Meltzoff & Moore, 1983). While imitation of actions in older infants is obviously a powerful tool for learning new behaviours, it seems that imitation of facial expressions at such a young age must primarily serve early communicative and interpersonal developmental functions. It has been suggested that the core function of imitation is the sharing of motives and intentions (Nadel & Aouka, 2006). Imitation and the sharing of body movements is thought to help an infant understand themselves as an individual who is separate, though related, to others, and could thereby be an important precursor to theory of mind (Meltzoff & Gopnik, 1993). Infants also imitate each other as well as adults, usually imitating the same actions with identical objects, and taking turns to imitate or be imitated (Nadel-Brulfert & Baudonniere, 1982). Spontaneous imitation and the recognition of being imitated by another person is a non-verbal communicative system by which young children take turns and synchronise their behaviour with that of their partners, and is therefore an important social learning mechanism (Nadel & Aouka, 2006).

Imitation is a vital way of fostering social and cognitive development, yet children with autism show serious deficits in imitation abilities (Walden & Hurley, 2006). Infants with autism show less spontaneous imitation of their parents' actions (Dawson & Adams, 1984; Meltzoff & Gopnik, 1993). They are also impaired in imitating simple actions on objects at as young as 20 months old (Charman et al., 1997). Imitation of simple non-meaningful hand movements is also impaired in ASC compared to matched controls (Ohta, 1987; Rogers et al., 1996). Similarly, individuals with ASC are impaired in imitating oral-facial expressions (Rogers et al., 2003). Children with ASC also engage less in imitative reciprocal social play, such as 'peek-a-boo' and 'pat-a-cake' (Klin, 1992). This lack of imitation of others may have a neurological basis in the mirror neuron system which is impaired in individuals with ASC (Dapretto et al., 2006).

There is consequently considerable evidence for an imitation deficit in individuals with ASC (Rogers, Cook, & Meryl, 2005). Moreover, imitation of body movements seems to predict expressive language skills in children with autism, whereas imitation of object manipulation may predict play skills (Stone, Ousley, & Littleford, 1997). Rogers suggests that early imitation problems contribute to impaired social development in autism and argues that these might be a primary psychological deficit of the condition (Rogers et al., 2005). Given the importance of imitation in language, cognitive and social function it is an important target for early intervention for young children with ASC.

2.3.4 Play

Play skills develop within the first 2 years of life and are vital for learning about the physical and social world. Play starts with simple sensory-motor activities that help the child learn about their own body. Play through object manipulation then emerges in which children learn about the environment and develop fine motor skills. Play then expands to include symbolic or pretend play in which objects can be used to represent something else (e.g. a broom handle can be used as a guitar) and which develops from the child's increasing ability for mental representation. Symbolic play through objects, gestures and language emerges at about 18 months and provides a means for practicing and understanding the social world (Piaget, 1962). Eventually children begin playing socially together and start to form social relationships. It has been found that preschoolers who are able to engage in more complex play have better social competence and are more socially accepted (Cillessen & Bellmore, 2004). Overall it seems that play is vital for learning about the physical environment, but is also of paramount importance for the future development of social competence.

Children with autism have impoverished play, and tend to play with parts of objects in repetitive ways (such as spinning the wheels of a car) rather than using the toy as intended (Stone et al., 1990). There is also a paucity of spontaneous symbolic play in children with autism who are at a developmental level where symbolic play should be present. Where individuals with ASC do demonstrate symbolic play, the quality of play is more repetitive, stereotyped and lacking in variety (Baron-Cohen, 1987; Mundy et al., 1986; Wing et al., 1977). When adults first model symbolic play, performance of symbolic play improves suggesting that scaffolding play and giving children some guidelines improves their symbolic play skills (Riguet et al., 1981).

Symbolic play requires the ability to hold two representations about the same situation in mind: the true identity of the situation (e.g. a banana is a banana) and a pretend identity of the situation (e.g. a banana is a telephone). The pretend world is represented alongside the real world, a meta-representational ability that is also involved in theory of mind tasks (Leslie, 1987). This lack of symbolic play and difficulties with meta-representations is thought to be one of the primary psychological impairments in ASC (Baron-Cohen, 1987).

Problems with the meta-representational account of ASC arose with evidence for intact symbolic play when it was elicited rather than spontaneous. This intact symbolic play suggests that it is not representational difficulties but the executive ability to generate play ideas that is the problem in ASC (Charman & Baron-Cohen, 1997; Jarrold, Boucher, & Smith, 1996; Lewis & Boucher, 1988). Children with ASC can manipulate symbols in play as long as the symbol is suggested by someone else (Rogers et al., 2005). Moreover, functional and sensorimotor play seems to be qualitatively different in ASC, showing more repetition, less novelty and less variation and more immature play than the play of typically developing children (McDonough et al., 1997; Stone et al., 1990; Williams, Reddy, & Costall, 2001). This means that the play deficits in ASC are not limited to symbolic play.

Nevertheless, symbolic pretend play in typical development tends to revolve around daily life events (mummies and daddies, trips to the doctor etc.), and seems to be a social learning mechanism. An impaired ability to generate pretend play ideas in ASC may reflect a lack of social learning or a lack of interest in social routines (Sigman & Ungerer, 1984). A longitudinal study found that preschool play skills (both functional play and symbolic play) predicted adolescent peer engagement in children with autism (Sigman & Ruskin, 1999), suggesting that, as in typical development, play skills in autism are important predictors of later social competence. Interventions to help children with ASC increase their experience of play, their motivation to play and their complexity of play may help improve social engagement, and warrant evaluation.

2.3.5 Emotion understanding

Social competence is inextricably linked to emotional competence. The ability to recognise and respond to the affective signals of others and to communicate your own emotions to others is of paramount importance in social interactions. Emotion recognition and response is a fundamental part of empathy, and provides a basis for understanding the self and others (Hobson, 1993). In order to understand emotion development in ASC, it is first necessary to discuss the typical development of emotion understanding.

Emotion understanding in typical development

Habituation studies have shown that young infants can distinguish between different facial expressions of emotion, based on simple perceptual features of the face (Caron, Caron, & Myers, 1985). Infants begin differentiating facial expressions on the basis of single features (e.g. the curvature of the mouth or shape of eyebrows) and only later use combinations of features to recognise emotions. Thus an infant of 10 months may have a category of 'smile' but may not have any understanding of what happiness feels like (Widen & Russell, 2003). Newborn infants also imitate facial expressions of emotion (Field et al., 1982).

Typically developing children begin to share positive affect with their parents in the first year of life (Carpenter et al., 1998) and become distressed when interactions are disrupted (Tronick & Cohn, 1989). This sharing of emotional state develops further between 10 and 24 months as children use the emotional states of others for information about the environment. For example, infants become more wary when they perceive their mother's fear, and are more adventurous when their mother is *happy* and encouraging (Sorce et al., 1985). By the second year of life, infants begin to connect other people's emotional displays and their desires, and can recognise that someone could want more of a food that the child finds unappealing based on their displays of pleasure (Repacholi & Gopnik, 1997). An ability to understand emotions is related to prosocial behaviour in toddlers, highlighting the importance of emotion recognition in social competence from a very young age (Ensor & Hughes, 2005).

As infants begin to talk in the second year of life, they start to use emotion labels, albeit infrequently (Dunn, Bretherton, & Munn, 1987). Here it becomes useful to distinguish between 'basic' emotions and 'complex' emotions. Basic emotions are those that are universally recognised by all humans, across cultures (Darwin, 1872; Ekman & Friesen, 1971). The basic emotions are *happiness*, *sadness*, *anger*, *fear*, *disgust* and *surprise*. Complex emotions are those that are less automatic, may be culturally dependent, and involve a greater cognitive component (Harris et al., 1989). These complex emotions may be blends of different basic emotions, for example the mix of *fear* and *surprise* could result in the complex emotion of *alarm*. Complex emotions may differ from basic emotions in that they require the attribution of intentionality, belief and desire and social emotions such as *jealousy*, *pride* and *embarrassment* are central and unique to complex emotions (Ben-Ze'ev, 2000). There is a developmental progression of emotion understanding in which basic emotions are understood before complex emotion understanding develops.

Parental reports state that children on their second birthday can only label *good*, and progress to labelling *happy*, *sad*, *angry* and scared by about 36 months (Ridgeway, Waters, & Kuczaj, 1985). In direct study of 2-4yr olds' spontaneous speech, Wellman and colleagues found that at 2yrs, children label *feel good*, *happy* and *love* for positive feelings, and use *fear*, *anger* and *sadness* for negative feelings. The children in this study could also attribute emotions to dolls and imaginary friends and could talk about past and future emotions, and demonstrated a mentalistic concept of emotion (Wellman et al., 1995).

In a study examining emotion labelling of prototypical facial expressions, it was found that 2yr old children added emotion words to their vocabulary in a systematic fashion, starting with *happy* then adding either *sad* or *angry* and thirdly added either *angry* or *sad* about 10 months later. These labels were used for all six 'basic' emotions that were displayed, suggesting that in early emotion labelling, children use their few labels for almost all basic level emotions (Widen & Russell, 2003). In particular, the label *angry* seemed to be much broader than an adult concept of anger, and could include *sad*, *fear* and *disgust* faces (Russell & Widen, 2002). The errors that children make at this age are predominantly those of the same valence as the target emotion. For example, without knowing the exact emotions of *shame*, *gratitude*, *pride* and *jealousy*, children correctly identified their positive or negative valence (Russell & Paris, 1994). Despite limited labelling of emotions, 2yr olds can understand desires, and that fulfilment of desire leads to positive emotions and unfulfilled desires lead to negative emotions. For example; 'Bill who wants a bunny and finds one will be *happy*, whereas Mary who wants a kitten and finds a bunny (the same bunny that Bill found) will be *sad*' (Wellman & Woolley, 1990).

Between the ages of 3 and 5yrs, children begin to add the labels *surprised*, *scared* and *disgust* and this systematic development of emotion labels seems to be very consistent in infant development (Widen & Russell, 2003). Parent report of emotion understanding suggests that by 5yrs of age, over 70% of infants understand and label roughly 50 different feelings and emotions (Ridgeway et al., 1985), and their emotion categories have narrowed considerably (Widen & Russell, 2006). In a questionnaire survey of understanding 845 emotion words in 5–18yr olds, a gradual increase in the ability to label emotions and mental state terms was found, with an enormous 702 emotion and mental state terms being recognised by 6th form students (Golan, 2006).

Overall, it seems that typically developing infants express emotions, label emotions and recognise emotions from a very young age, but that emotion recognition undergoes a distinct developmental pathway into adolescence. Emotion understanding plays a vital role in social development.

Emotion understanding in ASC

Individuals with ASC display emotional responses that seem unusual, inappropriate, excessive or inadequate. They behave in ways that suggest they are not aware of or concerned about other people's feelings. In a study examining interpersonal affect co-ordination, Sigman and colleagues compared the affective responses of children with autism under 4yrs of age with the responses of closely matched typically developing children and children with mental retardation (Sigman et al., 1992). Children's behaviour was coded when an adult pretended to be hurt, showed fear towards a remote control robot or pretended to be ill. It was found that the children with autism looked less at the adult and appeared unconcerned when the adult was ill or hurt. They also looked less at the fearful faces of the adults in response to the robot, and played with the robot for significantly longer than typically developing or mentally retarded children.

This finding was replicated with 20 month old children with autism, in which children's reactions to an adult's feigned hurt were videotaped. It was found that while most of the typically developing children looked at the adult's pained face, less than half of the children with autism did, suggesting they were unconnected to the feelings of other people (Charman et al., 1997). In addition to being uninterested in sharing emotions with others, children with autism also show odd facial expressions. Yirmiya and colleagues coded videotapes of children's interactions with an examiner in four situations: toy play, song-and-tickle, turn-taking and balloon blowing. It was found that the children with autism showed more flat and neutral facial expressions than matched typically developing children during these interactions (Yirmiya et al., 1989). Moreover, the children with autism sometimes produced odd, unique and ambiguous facial expressions that none of the control children produced. This bizarre and mechanical form of emotional expression was also found when children with autism were asked to imitate or produce facial expressions on demand (Loveland et al., 1994).

Taken together, this evidence suggests that individuals with ASC are impaired in their expression of emotions and their ability to empathise. This may render them less easy to understand by others and be less empathetic with others, rendering social interactions difficult on both sides. In addition to this difficulty, individuals with ASC also have problems with recognising emotions, adding to the emotion understanding impairment in this condition. Evidence for emotion recognition difficulties in ASC will be presented next.

Individuals with ASC have difficulty recognising facial expressions of emotion. When asked to match pictures of people according to emotion (*happy*, *unhappy*, *angry* and *afraid*) or according to identity, children with ASC were impaired in emotion matching in comparison to typically developing children (matched for verbal ability) but were not impaired in matching by identity (Hobson, Ouston, & Lee, 1988). More interestingly, the children with autism seemed to be using a non-emotional perceptual analysis of the faces to make their judgements about the emotions. When all but the eyes of the stimuli were blanked out, the performance of children with ASC plummeted, whereas control children were able to pick up the emotional cues just from the eye region (Hobson, 2005).

This lack of ability to perceive emotional information from the eyes is supported by studies of performance on tasks requiring the use of the eyes for mental state judgements. For example, relative to typically developing adults for whom eyes convey as much mental state information as the whole face, individuals with ASC were impaired in attributing complex mental states on photographs showing just the eye region (Baron-Cohen, Wheelwright, & Jolliffe, 1997). Similar results are shown in the ‘Reading the Mind in the Eyes’ task, in which mental state judgements have to be made using information from the eye region only. Adults with ASC are impaired on this task (Baron-Cohen, Wheelwright, Hill et al., 2001), suggesting that individuals with ASC cannot pick up on emotional information portrayed through the eyes.

Other studies have found that individuals with ASC rely on the mouth region for making judgements about emotional states (Bormann-Kischkel, Vilsmeier, & Baude, 1995; Joseph & Tanaka, 2003), and that they use a feature-based approach, rather than a configural approach to recognition of facial expressions of emotion (Teunisse & De Gelder, 1994). These findings relate to the gaze tracking studies that show individuals with ASC show less attention to the eye region and more attention to the mouth region of faces (Klin et al., 2002). The fact that individuals with autism use the mouth region to identify emotions also relates to the earlier discussion of the development of emotion recognition in typically developing infants. Infants begin differentiating facial expressions on the basis of single features and only later use combinations of features to recognise emotions (Widen & Russell, 2006). The fact that individuals with ASC also process emotional information in a piecemeal fashion suggests that they might be developmentally delayed in emotion recognition.

Individuals with severe autism have difficulties recognising the basic emotions of *happy*, *sad*, *afraid*, *angry*, *surprise* and *disgust* (Hobson, 1986a; Hobson, 1986b). Individuals with high functioning autism or AS may not be impaired at recognising these basic emotions, however. One study of children and adolescents with AS required children to label the emotion shown on photographs displaying basic emotions. The participants with AS were equally capable of doing this as the matched controls (Grossman et al., 2000). Furthermore, a gaze tracking study of fixation and recognition of three basic emotions found that children with high functioning autism showed the same fixation patterns as typically developing children and that they had no difficulties labelling the emotions (Castelli, 2005). A similar preserved ability to recognise basic emotions has also been reported in adults with high functioning autism (Adolphs, 2001; Baron-Cohen, Jolliffe et al., 1997). Nevertheless, higher functioning individuals with ASC still seem to be processing faces differently, showing less activation of the fusiform face area during emotion recognition, an area that is extensively active during emotion processing in typically developing individuals (Critchley et al., 2000). It may be that individuals with ASC who have higher cognitive ability can develop compensatory strategies for emotion recognition (Grossman et al., 2000). These compensatory strategies may suffice for basic emotion recognition, but do not work for complex emotions.

Individuals with AS and HFA have difficulties recognising complex emotions, especially emotions that have a social element. For example, compared to matched controls, children with HFA were equally able to label several basic and complex emotions, but for social emotions such as *pride* and *embarrassment*, they required more time, more prompts and demonstrated a limited understanding (Capps, Yirmiya, & Sigman, 1992). Individuals with ASC also find *jealousy* harder to recognise (Bauminger, 2004). Adults with HFA and AS who had intact basic emotion recognition abilities found it hard to judge *trustworthiness* and *approachability* of people using photographs of their faces (Adolphs, Sears, & Piven, 2001). Also, children with ASC are less able to match multimodal emotional information. Loveland and colleagues played videos of two facial expressions on a split screen and asked children with ASC to choose the face that matched a vocal emotional expression played on audiotape. Children with ASC performed significantly more poorly than matched controls with Down syndrome, suggesting that emotion perception from more than one modality is harder for individuals with ASC (Loveland et al., 1995).

More importantly, emotions are never expressed without a context in daily life, and individuals with ASC are impaired at understanding emotions from contextual information. They are impaired at understanding that situations, desires and beliefs are causes of emotion (Baron-Cohen, 1991) and are poor at sequencing pictures depicting emotional situations, as described in Chapter 1 (Baron-Cohen et al., 1986). Thus compensatory mechanisms may help individuals with ASC to learn basic emotions, but complex and particularly social emotions are harder for them to understand, and difficulties remain for multimodal emotion recognition and understanding what causes emotions. Lower functioning individuals with ASC have difficulties with even the basic emotions, and young children with ASC may be delayed in learning to recognise the basic emotions, and use feature-based rather than configural processing of emotional information.

The impact of these emotion recognition difficulties on everyday social understanding is profound. A problem with emotion recognition has implications for all aspects of social behaviour. A person who does not recognize the emotional state of another will not be a sensitive communicative partner: they will not respond appropriately in social situations and will find people's behaviour difficult to understand. Emotion recognition difficulties are likely to contribute to great difficulties with forming peer relationships. In fact, typically developing preschoolers who have better emotion recognition also have higher status with peers (Barth & Bastiani, 1997). Hobson argues that there is a developmental continuity between aspects of an infant's emotional life and subsequent social and cognitive function. Through emotional engagement with other people, infants learn that other people are psychological, intentional agents with feelings and they become less self-oriented and begin to understand others (Hobson, 2005). It is this process that is impaired in ASC. Clearly a vital target for intervention to improve social competence is emotion understanding.

2.4 Peer relations

From a developmental perspective, the aforementioned pivotal skills of eye gaze, joint attention, imitation, play and emotion understanding are vital for social competence in typical development but are impaired in ASC. As a child gets older, these skills become very important for the development of meaningful relationships with peers, but additional social skills also become important. As preschool infants begin to learn to play with other children, they need skills in conflict resolution, sharing, assertiveness, joining in, pro-social behaviour and emotion regulation. Being accepted by peer groups has been linked to the development of a healthy self-concept as well as academic success in typically developing children. Popular peers are those who are highly sociable and who have frequent peer interactions, whereas unpopular peers are those who are unattractive, incompetent and socially isolated (LaFontana & Cillessen, 2002). The ability to take turns, to listen and to communicate clearly with peers is linked to peer acceptance during middle childhood (Semrud-Clikeman, 2007). Successful peer relationships therefore link to future psychological wellbeing and academic achievement, and are therefore important to examine with respect to ASC.

Children and adolescents with ASC are less interested in social interactions. They are less likely to initiate social interactions with peers, spend less time interacting with peers, have lower 'quality' interactions and spend a larger amount of time in non-social play (Bauminger, Shulman, & Agam, 2003; Lord & Hopkins, 1986; Lord & Magill-Evans, 1995; McGee, Feldman, & Morrier, 1997; Sigman & Ruskin, 1999). As well as failing to initiate social interactions, individuals with ASC also fail to respond to social bids from others, and are more likely to interact with adults than with same-age peers (Hauck et al., 1995; Jackson et al., 2003), perhaps because adults are more accepting of odd social behaviour.

This lack of interest in social interactions means that children, adolescents and adults with ASC rarely develop typical peer relationships (Koning & Magill-Evans, 2001; Orsmond, Krauss, & Seltzer, 2004), and report higher levels of loneliness than typically developing children (Bauminger & Kasari, 2000; Bauminger et al., 2003; Howlin, Mawhood, & Rutter, 2000). When they do develop friendships, the quality of the relationship may be poorer and focuses on common circumscribed interests rather than reciprocal social interaction (Bauminger & Kasari, 2000). Also, the more severe the social skills and the younger the age group, the less likely it is for an individual to form peer relationships. Environmental factors, such as family or school inclusion, do not seem to predict the presence of a peer relationship (Orsmond et al., 2004). This finding suggests that it is the poor social skills of individuals with ASC that prevents them forming friendships, rather than their family or school background. Nevertheless, the same study showed that the amount of participation in social and recreational activities of individuals with ASC was related to mother's participation in social activities, the number of services received, and inclusion in school settings (Orsmond et al., 2004).

Social interest often increases during adolescence in individuals with ASC (Rutter, 1970), but difficulties remain with understanding social rules and social reciprocity necessary for friendship (Seltzer et al., 2003). In adults the problems with developing friendships and relating to others can lead to feelings of inadequacy and isolation (Bemporad, 1979). The characteristic deficits in social interaction with peers limits the opportunity of children with ASC to engage with other people, practice social strategies and gain social confidence, skills which are vital for social independence in later life. Interventions to help children, adolescents and adults to improve their relationships with peers and to develop friendships are therefore of extreme importance.

2.5 Interventions to improve social competence in ASC

As it can be seen from the above discussion of social competence in ASC, there are many key social behaviours that seem to be in need of intervention. A large body of research has been conducted to evaluate interventions that help individuals with autism improve their social abilities. Unfortunately, few intervention studies have been conducted using rigorous research designs, rendering the findings difficult to interpret. Moreover, despite a myriad of different interventions being available, no single approach has been found to be effective for every individual. The interventions designed to improve the social competence of children with ASC will be reviewed in the next chapter, before introducing the two approaches that are evaluated in this thesis.

Chapter 3: Interventions to improve social competence

3.1 Introduction

As reviewed in the previous chapter, there are many areas of social difficulty in individuals with ASC that may improve with intervention. The literature on interventions for ASC is somewhat overwhelming. There is a myriad of interventions described on the internet, in books or in peer-reviewed journals. Despite the hundreds of approaches that are available, few have had sufficient empirical research evaluating their effectiveness. This renders the field confusing for parents and professionals who wish to find out the best approach for a recently diagnosed child. Parents are given no option but to choose an intervention they think is good without any access to rigorous research evidence about whether the approach will work for their child. A recent survey of the treatments that parents use for their children with ASC revealed that on average parents try 7 different treatment approaches. These vary from speech and language therapy and applied behaviour analysis (ABA) to special diets, vitamin supplements and medication. Many of the interventions that parents were using lacked empirical support (Green et al., 2006).

It is only recently that randomised control trials (RCTs; the gold-standard method for evaluating interventions) are appearing in the literature on autism intervention (see Table 3.1 for a table of randomized control trials of psychosocial interventions for ASC). RCTs are the only means for eliminating systematic bias between treatment groups, and are the only way to draw causal inferences about the effects of a treatment (Harrington, Cartwright-Hatton, & Stein, 2002). They have been widely encouraged in ASC intervention research (Charman & Howlin, 2003; Lord et al., 2005; Schreibman, 2000), yet most studies do not use this methodology. Many studies still have small sample sizes, poorly described intervention approaches, poorly described participant characteristics and inadequate methodology. Parents are expected to make choices on the basis of this limited information.

Recently, a very useful resource has been set up in the form of the Research Autism website (www.researchautism.net). This website lists the many pharmacological, dietary, behavioural, psychosocial and alternative methods for treating autism and rates each approach in terms of the evidence supporting its effectiveness. This is an extremely valuable tool for parents, professionals and researchers.

A review of all of the interventions for ASC is beyond the scope of this chapter. A good review of interventions can be found in Richard Simpson et al.'s book (Simpson et al., 2005) and an overview can be seen on the Research Autism website (www.researchautism.net/pages/interventions). The aim of this thesis is to examine the empathising-systemising theory as a basis for developing motivating interventions for ASC, i.e. can we harness the attractiveness of systems and superior skills in systemising to promote social competence (empathising) in children? For this reason, only the psychosocial and behavioural interventions that address social competence in children will be described. Only interventions that have had controlled studies evaluating their effectiveness will be included. The only exceptions for this will be the inclusion of poorly evaluated approaches that nevertheless are widely used. Although social competence and communication are highly associated with each other, a review of interventions that teach non-verbal children with ASC to speak will not be discussed as this is not a central theme of this thesis. The interventions to be discussed can be categorised into the following areas:

- Comprehensive programmes which include social skills teaching as part of a holistic autism intervention.
- Interventions that teach pivotal skills vital to the development of social competence that were discussed in Chapter 2 (joint attention, symbolic play, imitation, and emotion recognition).
- Interventions that teach social skills directly (e.g. peer mediated intervention, cognitive scripts and social skills groups).

Study	Intervention	Participants	Outcomes	Limitations/future directions
Hadwin et al (1996; 1997)	Compared three teaching groups: emotion, belief or play. 30 min/day for 8 days.	N= 30 Age= 4-9yr Verbal MA= 5yr	Improvements in areas on which children were trained for emotion and belief group. Play group did not improve on any measures. No generalisation of learning to other domains. Gains maintained at 2 month follow-up.	Short intervention, need more ecologically valid outcome measures.
Smith, Groen & Wynn (2000)	ABA (24 hours/week from therapist and 5 hours/week from parents for 1-2 years), compared to parent training control group.	N= 28 (14 with ASC) Age= 3yrs IQ= 35-75	Greater gains for ABA group in educational placement, IQ, visual-spatial skills and language but not adaptive behaviour. Significantly more children in the behavioural treatment group were in less restrictive educational placements compared to controls at follow-up (age 7-8yrs)	Small sample size, limited validity of outcome measures and need follow-up.
Silver (2001)	Computer programme to teach emotions (*happy*, *sad*, *fear*, *anger*) called *Emotion Trainer*. Ten half hour sessions over 2 weeks compared to no intervention.	N= 22 Age=12-18yr Verbal MA= 11yr	Greater gains in emotion recognition from context in those who used programme. Did not improve in emotion recognition from photographs.	Children at ceiling level on outcome measures. No long term follow-up. No generalisation measures.
Drew et al. (2002)	Home-based parent training programme in speech and language therapy (6 weeks) focuses on joint attention, joint action routines and behaviour regulation. Comparison to standard local provision.	N= 25 Age=22 mo IQ= 74	Modest improvement in receptive and expressive language at 12 month follow-up for intervention group.	Contamination of treatment conditions by parents in control group seeking other intervention. Reliance on parent report.
Aldred et al. (2004)	Parent training program. Monthly therapist for 6 months; further 6 months of twice-monthly consolidation sessions focused on parents promoting intentional communication in their children. Comparison to routine care.	N= 28 Age=51mo McArthur Rec Lang score= 72	Improvement in standardized measures and observational measures of social interaction and expressive language in treatment group. Language improvement most significant in older, lower functioning children.	Need replication on larger independent samples, longer follow-up period and comparison to other interventions.
Kasari et al (2005); Gulsrud et al	Comparison of two interventions and a control. Interventions taught either joint attention or symbolic	N= 58 Age= 3-4yrs Verbal MA= 1.6yr	Measured joint attention (JA), play skills and mother/child interactions. Both interventions were successful at teaching the behaviours	Need to evaluate impact on other areas of social function, independent replication and

(2007); Kasari et al(2008)	play in addition to ABA using behavioural techniques (prompting and reinforcement) for 30mins/day for 5-6 weeks. Comparison with ABA only.		targeted (JA or symbolic play) in comparison to controls. Skills generalized to parent-child interactions. Increased JA to novel probe in JA group only. Both interventions increased language more than ABA only.	evaluation of effectiveness alongside interventions other than ABA.
Yoder & Stone (2005)	Response Education and Prelinguistic Milieu Therapy (RPMT) compared to the Picture Exchange Communication System (PECS) (1hour/week for 6 months)	N= 36 Age= 18-60 months Verbal MA= 7-19 months	RPMT increased the frequency of turn-taking and initiation of joint attention more than PECS, only for children who started treatment with some initiating of joint attention. PECS facilitated generalized requests more than RPMT in children with very little initiation of joint attention prior to intervention.	Data coders not blind to treatment allocation. Need to look at long term outcomes.
Fisher & Happe (2005)	Theory of mind (ToM) training compared with executive function (EF) training and no intervention. 25 min/day for 5-10 days.	N= 27 Age= 6-15yr Verbal MA= 6.4 yr	Improvement in ability to pass false belief tasks in ToM group only. Improvement maintained at 6-12 week follow-up. Limited generalisation. EF group showed improvement in ToM tasks only at 6-12 week follow up.	Short intervention. Need more ecologically valid outcome measures.
Golan & Baron-Cohen (2006)	Teaching emotion understanding using *Mind Reading* emotions software. Exp 1: 2 hr/week over 10-15 weeks compared to no intervention. Exp 2: Use with tutor group compared to social skills group.	N_1= 41; N_2= 26 Age=17-52yrs VIQ= 108	*Mind Reading* users improved significantly more than controls in both experiments in recognising emotions from the software. No generalisation to 'Reading Mind in Eyes' or films tasks.	No standardised measures. Short intervention. More ecologically valid assessments of impact on other social function needed.
Howlin et al (2007)	Picture Exchange Communication System training for teachers (PECS training workshop and 6 half-day follow-up visits to the classrooms by PECS consultants over 5 months)	N= 84 Age= 4-11 yrs No functional language.	Significant increases in observed rates of children's use of pictures for communication and rates of children's spontaneous communication immediately following training. Effects did not persist in a subset of the children followed-up 9 months later. There was no significant increase in speech.	Observations restricted to class snack times. No measure of treatment fidelity. Data coders not blind to treatment groups.

Table 3.1. A table of randomised control trials evaluating psychosocial interventions in ASC

3.2 Comprehensive Intervention Programmes

Applied Behaviour Analysis (ABA) is a comprehensive treatment approach for young children with ASC that can be used to target skills in all three areas of difficulty in autism. It has quite good research evidence evaluating its effectiveness. In ABA, the skills and behaviour of each individual child are assessed and the functional skills the child lacks are taught at an appropriate level for the child's age and ability. The skills identified during initial assessment are taught using principles of operant conditioning using Discrete Trial Teaching (DTT). DTT is a way of teaching behaviour through prompting and reinforcing correct responses. For example, a teacher may give an instruction to the child (e.g. 'give me the brick') and the child is expected to respond appropriately. To help the child respond appropriately, the teacher may prompt the child. When a correct response is given, the child is given a reward to reinforce the response. ABA therapists give short and clear instructions with carefully planned prompts and reinforce closer and closer approximations to correct responses. Complex behaviours are broken down into smaller more manageable components that are taught separately before being 'chained' together into a whole. Problematic behaviours are analysed to evaluate their functions (i.e. the motivation and consequence of a problem behaviour), and more appropriate alternative behaviours with similar consequences are taught to replace them. ABA treatment programmes are usually very intensive (up to 40 hrs per week) and progress from 1:1 interactions between a child and the therapist to small groups and then larger groups. They also progress from very structured settings to less structured, more 'naturalistic' settings.

ABA became popular following an evaluation that claimed children with autism achieved 'normal educational and intellectual functioning' after intensive ABA (Lovaas, 1987). This study claimed that following 40 hrs per week of intensive early behavioural intervention (i.e. ABA), 47% of children with autism improved their IQ scores to average or above average, successfully completed first grade in mainstream school and were 'indistinguishable' from normal peers. Out of the remaining children in this group, 42% improved marginally and two children did not improve at all. Only one child in the comparison groups who received 10 hrs per week of ABA or no intervention showed similar gains to the intensive ABA group. At 3- 6- year follow up, it was found that the gains persisted for the children who had improved to ‘normal’ educational and intellectual level. Children in the other groups were not followed up (McEachin, Smith, & Lovass, 1993). Since these first few studies, ABA has become the most widely studied of all psychosocial interventions for ASC (Volkmar et al., 2004), but these early findings have come under considerable criticism on account of methodological weaknesses (Gresham & MacMillan, 1998; Smith, 1999).

In response to this criticism, attempts have been made to study the effectiveness of early intensive behavioural treatment more systematically. One RCT found that children receiving intensive behavioural intervention made greater gains in terms of educational placement, tests of IQ, visual-spatial skills and language, but not adaptive behaviour (see Table 3.1). Social skills were not assessed (Smith, Groen, & Wynn, 2000).

About 10-20 hr per week of early behavioural intervention is sufficient to show some benefits, but a higher intensity (up to 40hr per week) may be more effective (Eldevik et al., 2006). The effectiveness of early intensive ABA intervention requires further research. Concerns remain about the outcome measures used in studies. For example, using school placement as an outcome measure encounters difficulties as other factors such as parental preference and variation in local educational procedures also influence school placement. Improvements in IQ scores or placement in a mainstream school may not relate to a reduction in pervasive social communication impairments. Also, the extent to which improvements generalise to everyday life and the impact of these approaches on later childhood is not yet fully understood. Definite conclusions regarding the effectiveness of ABA as a treatment for individuals with ASC, particularly with regards social skill, cannot be drawn and the demand for this expensive treatment may not be warranted in all cases.

Other comprehensive programmes do not have as much research evaluating how well they work as ABA. The ‘Son Rise’ programme (Kaufman, 1976; Kaufman, 1994) is a home-based approach where parents are the therapists and work with the child throughout their waking hours. Families attend workshops (usually in the USA) where they are trained over several weeks how to engage with their child through energetic interactive play and imitation of their child's repetitive behaviours. Several parents report that entering their 'child's world' is an optimistic, empowering and successful approach, and the programme makes strong claims about improving social communication and even 'curing' ASC. However, these claims are based on anecdotal reports rather than controlled research. The 'Son Rise' programme involves considerable financial and emotional commitments. Parents have to create a unique therapy room in their home, and sometimes quit work in order to work as a 'therapist' all day everyday. Further research is urgently needed to rigorously evaluate the effectiveness of this popular approach. To date, the only research on this programme has tried to find out the type of people that use 'Son Rise', family experiences of the programme, and the possible methods to measure its effectiveness. These studies have found that the programme is not always implemented as described in the literature (Williams, 2006), more frequently it is used in conjunction with other educational approaches at a much less intense level than suggested. This makes carrying out a rigorous evaluation of effectiveness quite difficult. Suitable measures of treatment fidelity, outcome measures and ways to control for the use of other approaches need to be found. In terms of family experiences, research has shown that 'Son Rise' resulted in more drawbacks than benefits for the families over time, and it does not alter family stress levels (Williams & Wishart, 2003). This suggests that families need to think carefully before embarking on this approach, as it can cause significant family disruption and there are only anecdotal reports of its effectiveness.

The Relationship Development Intervention Programme (RDI) specifically targets the perceptual, cognitive and emotional difficulties of children with ASC to improve children's experience-sharing abilities (such as gaze direction, facial expression and flexible thought). Parents are the principle therapists and are trained to build motivation, modify their communicative style and create opportunities for their child to respond in more flexible, thoughtful ways. Parents receive visits and evaluation from consultants and use video footage to get feedback about their practice. Research evaluating the effectiveness of RDI has shown that sixteen children receiving RDI over 30 months showed a decrease in scores of experience sharing on the Autism Diagnostic Observation Schedule (Lord et al.) and Autism Diagnostic Interview (Lord, Rutter, & Le Couteur). Children became significantly more socially related, engaged in more reciprocal communication and needed less adult support in school following intervention. However, this was an uncontrolled study with no comparison group or no intervention baseline period. Future research with adequate methodology is required to evaluate this approach fully.

The National Autistic Society's Early Bird programme is an early training programme for parents whose child has recently received a diagnosis of ASC. The programme combines group sessions of 6 families with 1:1 professional support over a period of three months and teaches about the nature of autism. Importantly, it also focuses on building up confidence for dealing with the social, communication and behavioural difficulties of raising a child with ASC. It teaches parents communication strategies and how best to build interaction and social communication with their child. As yet, there is only unpublished data supporting its effectiveness (Hardy, 1999) and anecdotal reports of parental satisfaction (Shields, 2001). This promising and widely offered approach deserves empirical evaluation.

The TEACCH programme (Treatment and Education of Autistic and related Communication Handicapped Children) is an educational approach widely used in special education classrooms that focuses on the role of structure in the learning environment of children with ASC (Schopler, Mesibov, & Hearsey, 1995). Visual timetables, work schedules and tasks are provided to make learning more predictable and meaningful for the child. Skills that are taught include academic subjects, communication, social and leisure skill development, communication training and vocational preparation. One controlled study has been carried out evaluating the effectiveness of TEACCH used at home over 4 months in comparison to no intervention for preschool children with ASC (Ozonoff & Cathcart, 1998). Social skills were not included as part of the outcome measures, but children who were allocated to the intervention group improved significantly more on measures of imitation, motor skills, non-verbal skills and overall score on the Psychoeducational Profile- Revised. TEACCH is a useful tool for teachers, as it provides a system for organising work and making the classroom suitable for individuals with ASC. However, only informal measures of its effectiveness in a school setting have been carried out (Mesibov, 1997). Further research is required to assess the effectiveness of this approach particularly in comparison to other comprehensive interventions.

Overall, comprehensive interventions require more systematic investigation focusing on what specific aspects of the programme are effective, which symptoms they effectively address and which children are likely to respond best. It can be seen that several of the comprehensive interventions for ASC require very high levels of commitment in terms of time, energy and emotion. For many parents and families these costs are difficult to meet. While beneficial interventions should be available to all children who need them, in the absence of good evidence of effectiveness, parents should be wary before embarking on any intensive approach.

Interventions that target specific pivotal skills related to social development have been open to more rigorous evaluations of effectiveness. These are discussed in the following section.

3.3 Teaching pivotal skills related to social competence

As discussed in Chapter 2, there are several key skills that are related to social competence and that lend themselves to early intervention in ASC. These include joint attention, symbolic play, imitation and emotion recognition.

Joint attention has received a lot of attention recently, both in terms of its importance for language development and its importance for the development of social competence. A few well-designed research studies have evaluated interventions that specifically target this ability. One of these approaches is called Responsive Education and Prelinguistic Milieu Therapy (RPMT) (Yoder & Warren, 2002) which incorporates parent training with incidental teaching in 1:1 sessions between a child and therapist. The sessions teach children to initiate joint attention and increase their pre-linguistic intentional communication behaviours. Prompts are used to elicit behaviours such as pointing to request something (i.e. imperative communication) and are gradually faded as the child learns the correct response. Modelling is used to teach children to initiate joint attention with another person using gaze switching or pointing. A recent RCT (Table 3.1) showed RPMT was successful at increasing the frequency of initiated joint attention amongst young children with ASC (Yoder & Stone, 2005).

Two further RCTs have been conducted to test the effectiveness of parent training programs on improving joint attention and skills related to this behaviour. Drew et al. (Drew et al., 2002) conducted a RCT of a home-based program where parents received training from a speech and language therapist about how to develop joint attention and joint action routines with their children (Table 3.1). At 12 month follow-up modest but statistically significant improvements in receptive and expressive language were seen in the training group compared to a 'local provision only' group, although the authors did acknowledge the limitations of using parent report as their outcome measure. This study suggests that teaching joint attention does impact on later language development in ASC. It is unfortunate that no measures of social competence were included in this study.

A similarly sized RCT has been done to test the effectiveness of a parent training program that focused on teaching parents about the developmental 'building blocks' of social interaction and communication (Aldred, Green, & Adams, 2004). Parents were encouraged to be sensitive to their child's actions, leading to an increase in joint attention and reciprocity. Repeated scripts and introduction of pauses and teasing were taught to promote children's intentional communication. Compared to routine care, the intervention led to significant improvement on standardized measures of social interaction and expressive language, and in observational measures of parent-child interactions, particularly in younger children.

Kasari, Freeman and Paparella (Kasari, Freeman, & Paparella, 2005) conducted an RCT which compared the efficacy of interventions that targeted joint attention or symbolic play in addition to ABA with ABA intervention alone (see Table 1). Discrete trial teaching, prompting and positive reinforcement were used in 1:1 sessions that lasted about 10 min to teach target behaviours of joint attention or symbolic play. This was followed by a naturalistic play session where in both interventions the therapist followed the child's lead and interest, talked about what the child was doing, repeated and expanded what the child said, and made environmental adjustments to enhance engagement and eye contact with the child. The main difference between the two interventions was the goals focused upon during the sessions. In the joint attention intervention, pointing and showing was taught and children were encouraged to share attention between people and objects using eye contact. In the symbolic play intervention children were taught to engage with toys in a developmentally appropriate way through functional play and pretend play. Joint attention treatment sessions incorporated imitation and engineered play routines, whilst the play treatment session focused on object combinations that were increasingly symbolic but not contingent on joint attention. In terms of measuring outcome, joint attention skills were measured using a semi-structured assessment of early social communication skills. Functional and symbolic play skills were assessed from a 15-20 minute observation of the child playing with a standard array of toys. In addition, a 15-minute videotape of a caregiver-child interaction was also coded for joint attention skills and child's play. Results indicated that the interventions were successful in teaching their target behaviours and that skills generalised to interactions between children and their caregivers.

A further RCT evaluating the effectiveness of these joint attention and symbolic play interventions examined generalisation of learning in the same participants to novel probes for joint attention (a spider that crawled and made noises, a hanging spider that climbed up the wall or a loud bouncing ball with a spinning tail). Children's responses to these probes were coded in terms of affect, eye gaze, non-verbal gestures and verbalisations. Results showed that the children who received the joint attention intervention were more likely to acknowledge the novel probe and engaged in a higher proportion of co-ordinated joint looks with another person about the probe than the children who received the symbolic play intervention or ABA alone. This suggests that co-ordinated joint attention looks were generalised to a novel probe. However, non-verbal gestures (e.g. pointing) that were also targeted in the joint attention intervention did not generalise, perhaps because these are joint attention behaviours that develop at a later age (Gulsrud et al., 2007). A very recent follow-up study of these children has found that children receiving both the joint attention intervention and the symbolic play intervention showed greater increases in language than the control group receiving just ABA at 12 months follow-up (Kasari et al., 2008). This approach for teaching joint attention and symbolic play warrants further study to assess whether the symbolic play and joint attention intervention impacts on other areas of social function. Also, further research is necessary to find out whether the joint attention and symbolic play interventions are only effective in conjunction with ABA, or whether the approaches are effective with other educational approaches or on their own. The manual for carrying out these interventions is only available on request from first author of the study and not yet widely available to the general public. If future independent studies show these approaches to be effective, the manual should be made more accessible.

As discussed in Chapter 2, imitation is a pivotal skill that is impaired in children with ASC, yet it is important for the development of language and social communication (Stone & Yoder, 2001). There have been no RCTs to examine the effectiveness of teaching imitation to children with ASC. Research using a multiple baseline design has found that using a naturalistic behavioural technique to teach imitation with objects improved the imitation abilities of five children with ASC. The intervention here employed following the child's lead, linguistic mapping (giving a running commentary of the child and therapists' actions), physical prompting and reinforcement of correct responses (e.g. with food or a preferred toy). The action to be imitated was taught using a prompting procedure, in which the therapist modelled an action with an object and gave praise and access to play materials if the child imitated the therapist. The imitation skills generalised to novel learning environments, and resulted in improved language, pretend play and joint attention skills (Ingersoll & Schreibman, 2006). The same behavioural approach has been used to teach the imitation of descriptive gestures (such as nodding and shaking the head). Again, a multiple baseline study showed that this approach was successful at increasing spontaneous descriptive gesture imitation for five children with ASC (Ingersoll, Lewis, & Kroman, 2007). Larger scale RCTs or group comparison studies are needed to follow-up these findings.

The final pivotal skill to be discussed that is important in the development of social competence is emotion and mental state recognition. The ability to understand the mental states of others is a core difficulty in ASC and forms the basis of one of the main cognitive theories of the condition, a deficit in theory of mind (Baron-Cohen, 1995). Several studies have been carried out to evaluate the possibility of teaching theory of mind skills to children and adults with ASC. In a recent RCT, short interventions to teach theory of mind and executive function were compared (Fisher & Happe, 2005)(see Table 3.1). Twenty seven children with ASC were randomly assigned to either theory of mind training, executive function training or no intervention. Training happened for approximately 25 min for 5-10 days. Results showed that children receiving theory of mind training improved in their ability to pass a false belief task immediately after training and at follow up 6-12 weeks later. This learning generalised to new theory of mind tasks that were not involved in training, but did not generalise to other emotion recognition tasks such as the 'Reading the Mind in the Eyes' test. In contrast, there were no effects of executive function training on theory of mind tasks or on executive function tasks straight after training, but there was an improvement in theory of mind tasks at 6-12 week follow-up in the group that were trained in executive function. This suggests that teaching theory of mind can help children learn about mental states, and that teaching executive function can also help children with theory of mind, but perhaps indirectly, in a 'trickle-down' effect (Fisher & Happe, 2005). The no intervention group did not improve on either theory of mind or executive function tasks.

These findings support other studies that have not used a RCT design, but have shown success in teaching theory of mind to individuals with ASC. For example, eight children (between 8 and 14yrs old) were successfully taught to pass false belief tasks by teaching a 'photograph in the head' strategy. Children with ASC understand photographic representations (Zaitchik, 1990) and were taught the analogy that people have photos in their heads that represent their beliefs about reality. This analogy was used to train children about false belief tasks (i.e. dolls with false beliefs had a false photograph slotted into their head). Children could understand that the photograph in someone's head could influence their behaviour, and successfully learned how to pass false belief tasks, but the learning did not generalise to other tests of people's mental states (Swettenham et al., 1996). Similar results of learning to pass false belief tasks and other theory of mind tasks but a lack of generalisation occur when children are taught using computers (Swettenham, 1996) or using a 'picture in the head' strategy (McGregor, Whiten, & Blackburn, 1998). Improved generalisation to novel false belief tasks was found when children were taught to use 'thought bubbles' to represent people's mental states (Wellman et al., 2002). Unfortunately, in these last studies, no control groups were included, so it is impossible to work out whether the training was better than nothing (e.g. practising the tests twice) or different to alternative interventions. Also, it would be very interesting and important to evaluate the effects of training on other, more ecologically valid, areas of social functioning and mental state understanding.

One study expanded theory of mind training to skills other than false beliefs. Thirty children with ASC (with a verbal mental age of 5yrs) were randomly allocated to three types of training. One group was trained to understand situation based, desire based and belief based emotions from different contexts. They were trained to recognise the emotions of *happy, sad, anger* and *fear* from schematic drawings and photographs of facial expressions. After this they were given drawings of situations that elicit emotions (e.g. a picture of a large dog chasing a boy to elicit *fear*) and trained in how to understand them. Desire-based *happiness* and *sadness* were taught in different scenarios that elicit these emotions (e.g. the girl who gets the cake she likes best will be *happy*). More complex, belief based emotions were then taught to the same children (e.g. A child believes she will get the cake she does not like. This makes her *sad*, even though she later gets the cake she does like). A second group was trained in understanding beliefs and false beliefs. These children were taught that different people may interpret the same situation in a different way, that seeing leads to knowing and that behaviour is influenced by what you know and what you believe. This group were also trained in understanding false beliefs. All of this training was done using variations of the Sally Ann and Smarties false belief tasks. The third group was taught and encouraged to increase their levels of pretend play using adult modelling and verbal guidance. Training happened over 8 half-hour sessions over 8 days for all groups. After training, children in all groups were assessed on emotion recognition, belief understanding, false belief understanding and pretend play. Results showed that children trained in emotion recognition improved in emotion recognition, children trained in beliefs and false beliefs improved in tasks assessing these areas, and that children trained in pretend play did not improve on any measure. There was no generalisation of learning from the skills taught to other domains. At two month follow-up, gains were maintained, but no generalisation was found (Hadwin et al., 1996). A subsequent study revealed that training in all three groups did not generalise to improvement in conversational skills (Hadwin et al., 1997). It would be of interest to evaluate whether intervention over a longer period of time would improve generalisation.

Other studies have evaluated teaching emotion recognition alongside other social skills. Ozonoff & Miller (Ozonoff & Miller, 1995) evaluated a 4 month group-based intervention to teach theory of mind and conversational skills to 5 boys (average age 13yr) with high functioning ASC compared to 4 boys who received no intervention (the groups were not randomly assigned). In 90 min weekly sessions, discussion, role-play and video feedback were used to teach conversational skills and theory of mind skills. Results showed that the children who received training improved on their ability to pass false belief tasks, and this was a substantial effect size. Those in the no intervention group did not improve. However, no children improved on parent or teacher ratings of social skills. The authors concluded that children were learning rules to pass the false belief tasks rather than improving in a true understanding of mental states.

Solomon et al (Solomon, Goodlin-Jones, & Anders, 2004) evaluated the effectiveness of a 20 week group intervention for 8-12 year olds with HFA or AS. The social adjustment enhancement curriculum they used focused on emotion recognition, theory of mind skills, executive function skills, group problem-solving and basic conversation skills and included psycho-educational training for parents. Following twenty 1 ½ hour sessions in groups of 4 or 5, the nine boys in the intervention group improved significantly in their ability to recognise facial expressions and solve problems compared to a waiting list control.

Other studies that have evaluated interventions to improve emotion recognition have looked at computer programmes designed to facilitate emotion recognition in individuals with ASC. One example is *The Emotion Trainer* (Silver & Oakes, 2001). In an RCT, 22 children with ASC between 12 and 18yrs old were randomly allocated to a group that used *The Emotion Trainer* for 10 half-hour sessions in school over 2 weeks or a no intervention control group. The programme teaches the emotions of *happy*, *sad*, *fear* and *anger* through still photographs of facial expressions. It also includes contexts in which people might experience those emotions (e.g. a child saw a spider in the room) and belief-based reasons for emotions (e.g. the child believes there is a spider in the room). Results showed that children who used *The Emotion Trainer* improved more than controls in their understanding of emotions from contextual information (both reality based and belief based contexts), but did not improve in their recognition of emotions from photographs, probably because this high functioning group were already performing at ceiling level before intervention began (Silver & Oakes, 2001).

The first intervention to incorporate systemising as a way to motivate learning was an emotion recognition teaching tool called the *Mind Reading* DVD-Rom (Baron-Cohen et al., 2004). *Mind Reading* is a systematic, interactive guide to emotions and mental states, and covers a huge 412 of these in a DVD-Rom library. It is designed for adults and children with ASC. The DVD aims to capitalise on individuals with autism's preference for systems, and presents a database of emotions in a systematic framework, designed to appeal to individuals with ASC. Each emotion is organised systematically according to groups of emotions (e.g. *happy*, *fear*) and developmental levels (e.g. basic emotions are at a lower level than complex emotions). For each emotion and mental state, a definition is given, several examples of animated facial expressions of the emotion are shown, several voice recordings of the emotion are given and several situations in which the emotion might be felt are described. These emotions can be viewed in an emotions library, a learning centre that has lessons about each emotion or a games zone in which emotions can be studied within the context of a game. Rewards for success in lessons or games are all based on the appeal of systems: learners can collect flags of the world, types of train, or different species of birds, for example. These rewards are intended to appeal to individuals with ASC due to the fact they are systematic. Emotions presented in a systematic framework might make the information more available to individuals who have a tendency to look for systems and patterns. Presenting emotional information systematically may therefore be more understandable for individuals with ASC, and also more enjoyable.

In an RCT evaluating the effectiveness of *Mind Reading*, 41 adults with high functioning ASC were randomly allocated to a group who used *Mind Reading* at home for 2hr per week over 10 weeks or a no intervention control group. A matched group of typically developing adults who did not use *Mind Reading* were also assessed. Results showed that adults with ASC who used *Mind Reading* improved more than controls in their emotion recognition from faces and voices that were included in the training, however this learning did not generalise to the 'Reading the

Mind in the Eyes' task or a task that assessed emotion recognition from context in films (Golan & Baron-Cohen, 2006). A subsequent study evaluated the use of *Mind Reading* with a weekly group tutor session with a social skills group provided by local clinicians. *The Mind Reading* tutor discussed emotions related to those in *Mind Reading* and the situations in which they occurred within groups of 6. Themes in the social skills groups included conversation rules, emotion expressions, body language, job interviews and friendship and were taught within group discussions, role-play and analysis of pictures. Results showed that 13 adults in the *Mind Reading* group improved significantly more than the 13 adults in the social skills group on measures of emotion recognition from faces and voices that were used in the *Mind Reading* software. Again, learning did not generalise to novel stimuli (Golan & Baron-Cohen, 2006). However, in a study evaluating the effects of *Mind Reading* on emotion recognition in 8-11 year olds with ASC, learning did generalise. Forty two children with high functioning ASC were randomly allocated to an intervention group who used *Mind Reading* at home for 2hr per week over 10 weeks or a no intervention control group. Children who used the software improved significantly more than controls in emotion recognition from faces and voices used in *Mind Reading* and this learning generalised to novel stimuli (Golan, 2006). These findings suggest that using a systematic guide can facilitate emotion recognition, but that generalisation is limited for adults. These studies suggest that using systemising to promote learning is effective, particularly for school-age children, and that this approach to intervention warrants further examination.

Given the importance of emotion recognition in early development, and the current emphasis on early intervention in ASC it was of interest in this thesis to examine systematic ways to facilitate emotion recognition in young children with ASC. The *Mind Reading* software is not suitable for young children, but a new approach, *The Transporters* DVD is a systematic emotion recognition tool specifically designed for young children (Baron-Cohen et al., 2007). *The Transporters* is a children's cartoon designed to teach emotion understanding in 2–8yr olds with ASC. Images of real human faces are grafted onto the front of vehicles, so that the inherent systematic appeal of vehicles can be harnessed to promote learning about facial expressions of emotion. This intervention has been evaluated in an RCT to teach emotion recognition to 2-5yr olds with ASC as part of this thesis and will be discussed in more detail in Chapter 5.

This section has evaluated interventions that address key pivotal skills that are thought to underlie the development of social competence. Results from several studies suggest that teaching joint attention skills through behavioural strategies or parent training have positive effects on language and social interaction outcomes, and that joint attention training has greater effect on language gains than symbolic play training. This is clearly an area warranting further evaluation and dissemination of techniques used. Further research is necessary to evaluate the long-term outcomes of imitation training, which shows some promising outcomes on language but needs independent large scale RCTs to evaluate its effectiveness. Theory of mind training shows little generalisation to tasks outside of the training repertoire and research is needed to evaluate the effects of longer-term training, and the long-term outcomes. Emotion recognition interventions show some success, particularly those that use computer programmes, but again learning does not seem to generalise to new situations easily.

Most of the approaches described in this section are aimed at young children, and do not teach social skills directly. While a developmental approach to teaching precursors to social competence may be the way forward for early intervention in ASC, there are still older children and adults with ASC that experience social difficulties and need help. The next section evaluates interventions that target social skills directly that may be effective in helping older children improve their social competence.

3.4 Interventions teaching social skills directly

3.4.1 Peer Mediated Interventions.

Recent educational guidelines have advocated the inclusion of children with special needs into the mainstream classroom (Florian, 2006). It is thought that including children with disabilities in mainstream classrooms is beneficial as they have access to many positive role models and have wider learning and extra-curricular opportunities. However, children with ASC may not naturally observe the relevant features of positive behaviour in peers and may not pick up on appropriate social behaviour without explicit teaching (Attwood, 1998; DiSalvo & Oswald, 2002). In fact, individuals with ASC who are included in mainstream classrooms are likely to experience rejection from peers, social isolation and bullying (Ochs et al., 2001).

One approach to helping children with ASC to improve their social interactions with peers has been to train typically developing peers to encourage positive social exchanges with target pupils with ASC. The cumulative results from small scale, multiple-baseline studies suggest that peer-mediated approaches are promising for preschool and school-age children with ASC (McConnell, 2002; Rogers, 2000) and can be used to encourage both specific social skills and broader interaction and relationships. Adults train typically-developing peers to initiate, elicit, prompt and reinforce social behaviours in children with ASC. Peers are first taught by an adult how to elicit and reinforce social behaviours in a child with ASC. The adult then prompts the peers to interact with target children during specific activities or play sessions. For example, they may be taught to initiate sharing, helping, giving affection or giving praise. The peers themselves are reinforced for their participation, but these reinforcements can be slowly and systematically reduced so adult prompting of the peers is no longer required (Odom et al., 1992).

Several small scale multiple-baseline and reversal (ABAB) studies have been published showing that peer-mediated strategies are helpful to increase the social initiations, social interactions and turn taking of young children with ASC (Goldstein et al., 1992; Harper, Symon, & Frea, in press; Kamps et al., 1994; Kamps et al., 1997; McGee et al., 1992; Odom et al., 1999; Strain, Kerr, & Ragland, 1979; Whitaker, 2004). Results suggest that using multiple peer trainers improves generalization of skills (Kamps et al., 1994; Mudschenk & Sasso, 1995) and that if the trained peers use self-evaluation strategies to monitor their progress, generalization and maintenance of the skills across settings is improved (Sainato, Goldstein, & Strain, 1992). Parents can also been taught to train siblings to use peer-mediated approaches at home to improve child-sibling interactions (Strain et al., 1994b). Superior outcomes seem to occur when multiple same-age peers with high social status are used as 'interventionists' (Sasso et al., 1998). Whole classes of peers can also be trained how to interact with a child with ASC, with positive results on appropriate social interactions (Laushey & Heflin, 2000).

A variation of peer-mediated training is LEAP (Learning Experiences: An Alternative Program for Preschoolers and Parents; (Strain & Cordisco, 1993). This is an early preschool programme that focuses on the social development of young children with ASC through peer mediation, data-driven educational programming, and behavioural training for parents. In LEAP, peer mediation is prompted throughout the whole school day, rather than only during specific time-periods (Kohler & Strain, 1999; Strain & Hoyson, 2000). Results from longitudinal studies comparing treatment to baseline measures found significant gains for 6 children with ASC in positive social interactions, behaviour and developmental progress.

Peer-mediated interventions appear to be promising, but large-scale, RCT studies are needed to make positive conclusions about their efficacy. Peer-mediated interventions could be beneficial as the skills learned involve child-child interactions directly, rather than adult-child interactions. In theory, this makes generalisation of skills to new peer partners and new contexts easier, however, results suggest that generalisation is still difficult to achieve. This means new peers need to be continually trained or whole classes of children need to be trained to ensure children with ASC reap the most benefits. A further consideration with peer-mediated approaches is that the ability to initiate social contact following intervention does not improve as much as the ability to respond to others' social interactions (Goldstein et al., 1992; Rogers, 2000; Sainato et al., 1992). This may be due to the slightly intrusive and 'adult-like' interactive style that is fostered by peer mediation (Roeyers, 1995). Learning to initiate social contact is a critical skill to master: unless children with ASC learn to initiate social interactions, typically developing children with whom they interact may give up their efforts, and the opportunity for participating in social interaction is reduced. Perhaps other methods are required to promote the initiation of social interactions. Peer mediated approaches can also be complex to deliver. They require socially-competent peers who are willing to participate. They also involve close adult supervision for training and reinforcing the peers and to monitor the target child's interactions. Future studies need to show lasting effects of peer-mediated approaches with generalisation of social skills to untrained peers and new situations.

3.4.2 Cognitive Approaches

In contrast to peer-mediated approaches, cognitive interventions teach children with ASC to monitor and manage their own behaviour through changing their perceptions, self-understanding and beliefs. Cognitive-behavioural interventions therefore require less external prompting and reinforcement of skills. They are based on the assumption that change is most likely to occur when a child is actively involved in their own behaviour management. For this reason, cognitive behavioural methods are most appropriate for children with some degree of self-understanding and self-awareness and are therefore mostly used for school-age children and adolescents with HFA or AS.

Self-monitoring and self-management techniques are two cognitive behavioural approaches used. Here, children are taught to be aware of certain target behaviours and their impact on learning. They are then trained how to monitor these behaviours in order to reduce their frequency by using alternative strategies. The need for external reinforcement from adults or peers is reduced as the child becomes more independent in their behaviour management (Quinn, Swaggart, & Myles, 1994). For example, in one study children were trained to use a wrist counter to tally the frequency of their appropriate verbal responses to other people's social initiations. The frequencies were converted to points and exchanged for rewards. These rewards were quickly faded so that children became more and more independent in their behaviour management (Koegel et al., 1992). Several multiple-baseline studies across settings have shown that such self-monitoring and self-management strategies do improve social interactions of higher-functioning children with ASC (Shearer et al., 1996; Strain et al., 1994a), though there is variable evidence that the skills are maintained once the procedure is stopped.

Cognitive-behavioural techniques have also been used to teach social-emotional functioning in classroom and clinic settings. One study evaluated a 7 month cognitive behavioural intervention that consisted of teaching about friendship, emotion recognition and social initiations. Results showed an increase in interpersonal problem-solving, affective knowledge and social interactions following intervention for 15 children (8-17 yr olds) with HFA (Bauminger, 2002), though there was no comparison group in this study. A small scale baseline study also found a cognitive approach to teaching social thinking was effective at improving social interactions in 6 boys with ASC (between 9 and 11 yrs). This intervention focused on teaching the reasons behind different social skills (e.g. if someone is looking at you when you are talking to them, it signifies that they are thinking about you and what you are saying), and covered looking, behaviour, listening, social memory and how to give opinions (Crooke, Hendrix, & Rachman, 2008).

Cognitive scripts are another method used to teach appropriate interaction in a wide variety of contexts for verbal school-age children. These might be more appropriate for children with lower levels of self-understanding and self-awareness. A cognitive script is a repeated, familiar event that children with ASC can use in a particular set of circumstances, for example, to initiate a social interaction. Scripts are first written by an adult and their correct use is modelled by adults or through videotapes. The child then rehearses the script before using it in the appropriate contexts. The child's reliance on the script is gradually faded until it is not used at all (Odom et al., 1992). Results from small scale, multiple-baseline and reversal studies suggest that the use of scripts has a positive impact on children's pro-social behaviour (Sasso, Melloy, & Kavale, 1990), interaction skills (Goldstein & Cisar, 1992) and the frequency and duration of social interactions (Gonzalez-Lopez & Kamps, 1997; Kamps et al., 1992).

One commonly used variation of cognitive scripts is Gray's social stories (Gray, 1994; Gray, 1998; Gray & Garand, 1993). These are individually written stories that describe social cues, address the feelings and reactions of others and provide appropriate responses to specific social situations. Social stories are widely used and recommended for children with ASC, yet there is very limited controlled research evaluating their effectiveness (Rust & Smith, 2006; Sansosti, Powell-Smith, & Kincaid, 2004). Case studies that have been published demonstrate variable outcomes in terms of social behaviour (Bledsoe, Myles, & Simpson, 2003; Delano & Snell, 2006; Lorimer et al., 2002; Reynhout & Carter, 2006; Swaggart et al., 1995) suggesting that the technique may work for some children but not others. A recent study employing an ABAB design with 3 children with ASC showed that the use of social stories increased appropriate behaviour and decreased inappropriate behaviour for 2 of the participants, though the maintenance of learning after intervention was variable (Crozier & Tincani, 2007). The authors also note that teachers did not continue to use social stories after the study had finished, possibly because reviewing a social story before each activity was very time consuming. Despite very little evidence for their success, social stories are widely used in schools with individuals with ASC. They are low-cost to implement, can be used in multiple settings and are easy to access, but further controlled research is required to evaluate who they work for, for which skills and their comparative effectiveness.

3.4.3 Social Skills groups

Social skills groups are suitable for children and adolescents with HFA and AS, and allow members to practice skills in reasonably naturalistic environments. Social skills groups have the advantage that several children can be taught at once, interactive partners with whom they can socialise are present and cost of intervention is relatively cheap. They have been used as part of the TEACCH programme since its conception and may be used in clinic-based or school-based settings. Several authors have provided suggestions for the participants, schedules and activities for social skills groups for children with HFA and AS (Krasny et al., 2003; Mesibov, 1986). These suggest that curricula for teaching social skills should make abstract concepts more concrete, provide visual structure and routines, support language difficulties, focus on peer interactions as well as self-awareness, focus on strengths while remediating deficits, and teach generalisation by providing a wide variety of learning opportunities. However, as yet there is little empirical evidence to guide how often groups should be held, in which contexts and with which peers. In a recent systematic review of evaluations of social skills groups, out of the 14 studies that met inclusion criteria, none were RCTs, only 4 used a controlled design, 4 used an explicit treatment procedure described in a manual, and only half adequately described the participants who used the intervention (Williams White, Keonig, & Scahill, 2007). A few promising approaches were identified though empirical support was still inconclusive.

A recent study has been published which evaluates two types of feedback within a social skills group (Lopata et al., in press). Fifty four children with ASC (with a mean age of 9yrs) enrolled in a 6 week intensive summer social skills programme (6hrs per day, 5 days a week). This was a group-based intervention which used the

Skillstreaming programme that is not specifically designed for children with ASC, but targets the social skills of listening, conversation, apologising, negotiating, sharing and emotion recognition (amongst others) through modelling and role play (Goldstein et al., 1997). Children were randomly assigned to receiving this intervention with one of two forms of performance feedback. In the response-cost feedback group, children were given points as rewards immediately following the production of a previously defined social skill (e.g. making eye contact). Points were taken away if children violated rules or demonstrated problematic social behaviours (e.g. not sharing). Each child had unique social skills targets for intervention, written on a daily report card. In the non-categorical feedback group, no predetermined skills were targeted. Instead they were rewarded or penalised for previously unspecified social or antisocial behaviours. Results showed that after intervention, both groups improved in the social skills targeted in intervention. However, there were no differences between the different types of feedback. It is a shame that a control group who received no intervention was not included in this study. This means it is difficult to ascertain whether the improvements were a result of intervention or due to maturation or variables outside the intervention.

School-based social skills groups have focused on increasing a broad range of skills in short and frequent classroom sessions (Kamps et al., 1992; Matson et al., 1991), or have focused on teaching specific skills such as eye-contact and play with preferred toys (Baker, Koegel, & Koegel, 1998; Koegel & Frea, 1993). Both approaches have shown improvements in skills taught in small scale, multiple baseline studies. However, most schools in the UK use interventions that have not been empirically evaluated. Social Stories is one previously mentioned example of a popular approach in schools without rigorous research evidence evaluating its effectiveness. The Social Use of Language Programme (Rinaldi, 2004) is another example. SULP is a social-communication teaching approach for children with learning difficulties that is widely available and often used in schools to help children with autism. It has not yet been empirically evaluated for children with autism, despite anecdotal reports of effectiveness (Macaskill, 2004). SULP uses a clear curriculum and a hierarchical learning approach to teach social and communication skills such as looking, listening and turn taking. Teaching starts with stories about monsters that experience social difficulties and progresses to adult modelling, child practice and games within the group setting and carry-over to new situations to encourage generalisation. Training courses and books for the SULP programme are widely available in the UK and it is a programme that is frequently used by speech and language therapists and teachers and warrants evaluation.

As well as in schools, social skills groups have also been carried out in clinic settings. These often differ from the school-based interventions and peer-mediated interventions, as they are delivered less frequently, for a longer amount of time (usually 1hr) and usually without the presence of typically developing peers. Nevertheless, fairly recent evaluations suggest they are effective.

Kroeger et al (Kroeger, Schultz, & Newsom, 2007) compared the effectiveness of the direct teaching of social skills through video modelling with group play for 4-6yr olds with ASC. Intervention happened in 15 hour-long group sessions over 5 weeks. Children were allocated to the direct instruction group or the play group based on availability to attend intervention sessions, but children were matched on autism symptoms and age. The direct instruction group watched video models of typically developing peers performing appropriate social and play skills. The children were required to copy the models and received praise or food as a reward for correct responses. In both the direct instruction and play groups, sessions started and finished with appropriate greetings. Prosocial behaviours were reinforced in both groups, and inappropriate behaviour was addressed in the same way in both groups. There were also identical toys and materials available to both groups. Results from videos coded for social behaviours showed that both groups improved in prosocial behaviours after intervention, but the direct instruction group improved significantly more than the play group. The direct teaching group also improved in their social initiation behaviours, social responding behaviours and interacting behaviours while the play group did not.

Barry et al (Barry et al., 2003) evaluated the effectiveness of an outpatient social skills group for 4 children with HFA between 6 and 9yrs old. The groups were run for 8 weeks for 2hr per week. They focused on teaching initiations and responses in greetings, conversations and play interactions through social scripts and group activities. Improvements were found in play sessions with peers that occurred after the social skills group in greeting and play skills but not conversational skills. The children involved also reported higher feelings of social support from classmates after the group. Parent reports of progress showed improvements only in greeting skills, suggesting that although skills were learned in the clinic setting, the skills did not completely generalise to other contexts.

One social skills group that has used a naturalistic approach and has succeeded in demonstrating generalisation is LEGO® therapy. LEGO® therapy is a social skills intervention for school-age children based around collaborative LEGO® play (LeGoff, 2004; LeGoff & Sherman, 2006). It has the potential to be widely used in both school and clinic settings, and can be considered as an approach that capitalises on the appeal of systems to teach social skills. LEGO® therapy is based on the idea of using the child's natural interests to motivate learning and behaviour change. A typical LEGO® therapy project would aim to build a LEGO® set, importantly with a social division of labour. In a group of three people (which could be comprised of children with autism, peers and/or adults), one person is designated the 'engineer', one the 'supplier' and the other the 'builder'. Individuals have to communicate and follow social rules to complete the LEGO® build. Each activity requires verbal and non-verbal communication, collaboration, joint problem-solving, joint creativity and joint attention to the task. Participating in the group is inherently rewarding and no external rewards are required (LeGoff, 2004).

Previous research evaluating LEGO® therapy reported that following 24 weeks of therapy (90 min group session; 1h individual session per week), significant improvement in social competence was found in 47 children with autism (LeGoff, 2004). No improvement in social competence was made while these children were on the waiting list for therapy. Frequency of initiating social contact and the duration of social interactions in the school playground significantly increased following therapy, suggesting that generalisation occurred, at least to the school playground setting. A subsequent study evaluated the long-term outcome of LEGO® therapy in comparison to unspecified 1:1 paraprofessional support for a similar number of hours. Results showed that at 3yr follow up, participants receiving LEGO® therapy improved significantly more than the comparison group (LeGoff & Sherman, 2006). However, participants in this study were not randomly allocated to the different treatment conditions. An independent evaluation of this approach, comparing LEGO® therapy to an alternative non systematic yet specific social skills programme is warranted and was carried out as part of this thesis.

Overall, it seems that both school-based and clinic-based social skills groups could be effective interventions for children with ASC. However, at this stage research findings are limited. Detailed manuals of the different curricula and intervention procedures need to be written, and large scale, comparative RCT studies need to be carried out.

3.5 Predictors of outcome

In all of the aforementioned studies, there has been considerable heterogeneity in outcome (Schreibman, 2000). Some children improved to a great extent, while others improved marginally and others not at all. Clearly a vital question is why this should be the case. Which children are most likely to improve following intervention?

Several studies have looked at predictors of treatment outcome. Treatment intensity is thought to be an important factor. In ABA, Lovaas (1987) originally found that significant gains were made following 40hr a week of intervention, compared to only 10hr per week, however, more recently it has been suggested that children improve regardless of treatment intensity (Luiselli, Cannon, Ellis & Sisson, 2000). This question has not yet been resolved. A further variable that may influence the success of treatment is the manner and skill with which therapy is delivered. Peers, therapists and parents who are part of intervention programmes may vary in their skill and experience.

IQ at intake has been found to be a reliable predictor of outcome following behavioural intervention (Gabriels et al., 2001; Harris & Handleman, 2000). Good language skills and mild autistic symptoms have also been found to predict better progress (Ozonoff & Cathcart, 1998), as has age of treatment onset (Fenske et al., 1985; Harris & Handleman, 2000). Nevertheless, other studies have found children as old as 7yr can benefit from behavioural intervention (Eikeseth et al., 2002) questioning the assumption that this intervention must start early if it is to be successful.

As discussed in Chapter 1, co-morbid symptoms of anxiety and hyperactivity are common in individuals with ASC. It seems very likely that such symptoms may impact on intervention outcomes, yet none of these characteristics have been evaluated as variables that might predict outcome. It is of interest to evaluate these characteristics as predictors of outcome in the current thesis.

3.6 The current thesis

In the above review of interventions to facilitate social competence in individuals with ASC, it can be seen that there is a wide variety of approaches. Following recommendations for early intervention in ASC (Le Couter, 2003; National-Research-Council, 2001) several researchers have focused on teaching pivotal skills that are central to the development of social competence. Others have focused on teaching social skills directly to older children with ASC. Despite an encouraging increase in the number of RCTs in this area, evaluation studies are still weak and we are still very much in the dark about which interventions work and what child characteristics predict positive outcome.

There is also a large problem with generalisation of skills. Children are capable of learning social skills and reproducing them in the same or very similar context in which they were learned, but they are rarely able to use these skills in wider contexts such as the school playground. Many of the interventions used have been set in artificial laboratory based settings, particularly those that teach the understanding of mental states. These settings are not representative of the complexities of real life situations and so may hinder generalisation to real-life settings. Also several of the techniques rely on artificial reinforcement of behaviour; the social interactions themselves are not reinforcing. Highly structured teaching environments and artificial reinforcers can impede generalisation to the natural environment (Koegel, O'Dell, & Koegel, 1987). This may hinder spontaneous occurrences of desired behaviours and the maintenance of behaviour once reinforcements have been reduced or removed. Fun activities may improve motivation to spend time with peers and to develop friendships (Tse et al., 2007). It has also been recommended to use children’s natural interests to motivate learning (Attwood, 1998; Koegel, 1995). Also, teaching skills within a naturalistic context close to every day life may help generalisation (Delprato, 2001; Kohler et al., 1997). A drive to systemise may also help to explain an inability to generalise, as it is what would be expected if a person is trying to understand each event as a unique system. It is important that measures of generalisation be included in future intervention evaluations.

Another problem with the social skills interventions mentioned is that very few of them are based in theory. The only approaches that are grounded in theories of the aetiology of ASC are those that attempt to teach theory of mind or emotion recognition. More general theoretical basis can be given to those interventions that use learning theory in behavioural approaches. These approaches are employed in comprehensive programmes such as ABA and in interventions targeting pivotal skills related to social competence. None of the interventions that target social skills directly have a theoretical basis for their use that is directly linked to ASC.

There also seems to be a disparity between the interventions that are being researched and the interventions that are being used in the community. Several of the interventions that have evidence supporting their efficacy do not describe the intervention adequately and manuals of how to do the approaches are rare (Williams White et al., 2007). When an approach is well described and has supportive evidence, it often requires large time commitments or specialist training that is too costly for use in schools. These factors make it harder for therapists to provide standardised intervention and harder for researchers to independently replicate results. Parents and professionals therefore turn to approaches that are easy to access, even if they do not have evidence supporting their effectiveness (e.g. Social Stories (Gray & Garand, 1993). There is clearly a need for more research into interventions that are widely available, that require little financial commitment, and that do not require complex training to use. This is of particular relevance for children with HFA or AS who are included in the mainstream classroom. Extra support for social competence that can be provided by teaching assistants and that has empirical research backing up its effectiveness needs to be offered.

The current thesis will attempt to address the above issues of generalisation, lack of theoretical grounding and easy to implement well described interventions by evaluating 2 interventions that are based in the empathising-systemising (E-S) theory of ASC (discussed in Chapter 1). Superior skills in systemising and the appealing nature of systems may be a way to motivate children to learn about social behaviour and may help with generalisation as it is following the recommendation to use the natural interests of the child (Attwood, 1998; Koegel & Koegel, 1995). Two interventions that are based in E-S theory will be evaluated as a test of this hypothesis.

The first intervention to be examined follows a developmental model for the improvement of social competence, and aims to teach the pivotal skill of emotion recognition to very young children with ASC. It is an extension of the work evaluating the *Mind Reading* emotion recognition software and is a children's cartoon series called *The Transporters* designed to teach emotion recognition to young children with ASC. The appeal of systems is harnessed in vehicles which have images of real human faces grafted onto them that express different emotions. As research suggests a preference for systems in ASC, presenting emotional expressions in a systematic framework may facilitate learning. Presenting information in an appealing way is likely to attract more attention. *The Transporters* presents emotions in the context of vehicles that move in predictable, systematic ways. The emotional information itself is not presented in terms of systematic categories (as it is in *Mind Reading*). Thus if the intervention works more than an intervention that does not present information in a systematic context, it will be due to the fact that systems are appealing, rather than the fact that information has to be presented systematically to work.

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The second intervention is one that is designed to teach social skills directly and uses E-S theory as a basis for a social skills group that teaches social interaction through collaborative play with LEGO®. In LEGO® therapy, the systematic appeal of the LEGO® materials is harnessed to motivate 6-11yr olds with ASC to participate in social interactions. Again, the emotional information is not presented in a systematic way, rather the appeal of systematic materials is used to increase the enjoyment and appeal of the learning process.

Both interventions are easy to implement, do not require difficult training and have potential to be used in several community settings. Both are theoretically based and follow recommendations to use children's natural interests to promote learning (Attwood, 1998; Koegel, 1995). LEGO® therapy also follows recommendations to teach skills within a naturalistic context close to every day life to help generalisation (Delprato, 2001; Kohler et al., 1997).

The interventions will be described fully in Chapters 5 and 6. The aim of this thesis was to evaluate whether these two interventions were successful approaches to facilitate social competence in ASC in controlled, well-designed studies. Specifically, *The Transporters* DVD was evaluated as a way to teach emotion recognition to 2-5yr olds with HFA and AS in a home setting using a RCT design. LEGO® therapy was compared to the Social Use of Language Programme (a previously unevaluated, non systematic social skills group) and no intervention in a matched controlled study as a way to improve social competence in 6-11yr olds with HFA and AS in a clinic setting. A pilot baseline study evaluated its effectiveness when used at school. The following chapter will describe the methods employed in this thesis to carry out these evaluations.

Chapter 4: Methods

4.1 Design

As can be seen from Chapter 3, the field of intervention research in ASC is riddled with uncontrolled studies. This makes it very difficult to interpret findings and replicate results. The reasons for the inadequacies in the field and gaps in our knowledge are based in methodological challenges. It may be unacceptable to parents, not to mention unethical, to randomly assign some children to a no intervention control group in a long-term longitudinal study evaluating an intervention. Also, running an intervention with qualified therapists, assessing treatment fidelity and measuring complex outcomes in the long and short term using blind assessors in controlled, large-scale multisite studies is expensive and complex (Lord et al., 2005). Moreover, children often receive more than one intervention at a time, have different intervention histories, different family circumstances and heterogeneous manifestations of ASC. It is therefore not surprising that research into successful and appropriate interventions for ASC is inadequate.

A recent working group supported by the National Institute of Mental Health has provided guidelines for developing, testing and disseminating psychosocial interventions in ASC (Smith et al., 2007). The group concluded that no single research design could address all of the methodological challenges or fill all the gaps in the knowledge. However, they recommended that the evaluation of interventions should happen in several steps:

1. Technique development which can be validated by single subject design.
2. A case series evaluating a set of techniques in a pilot study.
3. Assembling a promising set of techniques into a manual.
4. Pilot test the manual across a number of sites to assess its acceptability to the patient population, to assess whether intervention can be implemented according to the manual by different therapists and to gather primary data on efficacy.
5. Conduct RCTs to test the efficacy of the intervention under controlled conditions in independent studies.
6. Implement the intervention in community settings.

Unfortunately, most interventions for ASC jump straight to step 6 without having been rigorously evaluated in the previous steps. In contrast, the interventions reported in this thesis have attempted to follow these guidelines. *The Transporters DVD* was developed based on theoretical research and pilot testing. As it is a DVD, it is easy to use and it comes with a leaflet describing the DVD and suitable teaching activities that can be implemented in a standardised way. An initial RCT of its efficacy with 4-8yr olds with ASC was carried out and showed it was better than no intervention at improving emotion recognition (Golan et al., in preparation). This research was carried out before it was distributed to families and professionals for use with their child with ASC. Unfortunately, no RCTs evaluating this DVD in comparison to other interventions in a variety of conditions with different populations of children were carried out before its dissemination. Nevertheless, research is ongoing and part of this thesis will examine its effectiveness in comparison to a typical child's cartoon and no intervention for 2-5yr olds with ASC. This approach has gone further than most interventions along the appropriate pathway for evaluation and dissemination.

LEGO® therapy was first described and evaluated by a clinician who first conceptualised the intervention and published a wait-list controlled study showing it was effective at improving social competence in children with ASC (LeGoff, 2004). LeGoff gradually developed the intervention in similar ways to the recommendations in steps 1 and 2 and together with myself has collated a draft manual (see Appendix 1). Following this manual, I carried out an independent replication to evaluate the success of LEGO® therapy in comparison to another social skills intervention as part of this thesis. Participants were randomly assigned to one or other intervention. However, a 'no intervention' control group was not included at this stage due to fears of attrition and unacceptability to parents. At a later date, it became possible to include a matched 'no intervention' control group to this study. It was therefore not an RCT, but nevertheless was a controlled study. To further assess the LEGO® therapy manual and training in this approach a further pilot study was carried out examining setting up and using LEGO® therapy in a school setting. This addressed step 4 in the recommendations for evaluating psychosocial interventions, and began to assess the feasibility and acceptability of using LEGO® therapy in schools.

The exact methodology used in the studies in this thesis are described fully within each chapter as they vary considerably, but in summary, the designs of the studies are as follows:

4.1.1 Study 1: Evaluation of *The Transporters* DVD for 2-5yr olds with ASC

This was a randomised control trial. Participants were randomly allocated to a group who watched *The Transporters,* a group who watched a comparison children's cartoon called *Jimbo* or a no intervention control group. Emotion recognition measures were taken before and after 4 weeks of intervention (15 min per weekday).

4.1.2 Study 2: Independent evaluation of LEGO® therapy for 6-11yr olds with ASC

This was a controlled study using a matched samples design. Initially, participants were randomly allocated to receive LEGO® therapy or the Social Use of Language Programme. Outcome measures of social competence were taken before and after therapy which occurred for 1hr per week over 18 weeks. A matched no intervention control group was then assessed for the same duration (18 weeks) using the same outcome measures.

4.1.3 Study 3: Pilot study of using LEGO® therapy in a school for 7-11yr olds with ASC

This was a baseline study evaluating the development of social skills over a 6 week baseline period in comparison to a 6 week intervention period during which school children received LEGO® therapy for 1hr per week administered by teachers and teaching assistants. Suitability of training, use of the manual and treatment fidelity were assessed as well as child outcomes.

4.2 Participants

Both of the interventions described in this thesis were evaluated for use in children with high functioning ASC. To be included in the studies, participants had to have a diagnosis of autism, high functioning autism, Asperger syndrome, or autism spectrum disorder made by a clinical psychologist, psychiatrist or paediatrician according to

DSM-IV (APA, 1994) criteria. Diagnosis was confirmed either using the Autism Diagnostic Interview {ADI; \Lord, 1994 #959} or the Social Communication Questionnaire {SCQ; \Rutter, 2003 #3051}. Participants who did not reach cut-off criteria for a likely ASC were excluded from the study.

Participants in *The Transporters* study had to have receptive language abilities of above 18 months, as some language understanding was necessary to comprehend the stories in the DVD. Participants in the LEGO® therapy study had to have a verbal IQ greater than 70 as some language abilities were deemed necessary to understand the instructions used in the interventions. The limitation of only assessing efficacy of the interventions in high functioning children is that the results cannot be generalised to lower functioning individuals with autism who also have learning disabilities. Future research needs to address this. Nevertheless, it was deemed important that these interventions be evaluated for higher functioning individuals as both are approaches that could be easily incorporated into school or nursery school settings. It is likely that the children with ASC who are included into mainstream schools and nurseries will be higher functioning. Further details of the participants, recruitment strategies and inclusion criteria can be found within the individual chapters describing the studies.

4.3 Child characteristics and predictors of outcome

IQ, verbal IQ and autism symptom severity were measured in all three studies in order to give a thorough description of participants. For *The Transporters* study, IQ and verbal ability was assessed using the Mullen Scales of Early Learning (Mullen, 1995). For the two LEGO® therapy studies, the participants were older, so the Wechsler Abbreviated Scale of Intelligence was used to assess IQ and verbal IQ (Wechsler, 1999). The Gilliam Autism Rating Scale was a parent questionnaire used in all studies as a measure of autism symptom severity (Gilliam, 1995). Demographic information, previous and current intervention history and diagnostic information were taken using a background information questionnaire.

Child characteristics that might predict outcome were also of interest in this thesis. In particular, IQ, verbal IQ, age, autism symptom severity, anxiety and hyperactivity were examined. IQ and autism symptom severity were measured as described in the previous paragraph. The Spence Children's Anxiety Scale parent rating version (Spence, 2000) was used to assess anxiety symptoms. The self-report version of this scale uses the same items as the parent version and has good concurrent validity (Muris, Schmidt, & Merckelbach, 2000), and adequate test-retest reliability (Spence, Barrett, & Turner, 2003). However, reliability and validity have yet to be established for the parent version. The scale is made up of subscales which include: panic/agoraphobia, social anxiety, separation anxiety, generalised anxiety, obsessions/compulsions, and fear of physical injury. The Conner's ADHD index parent rating scale (Conners, 2001) was used to assess hyperactivity. This scale has good reliability and validity (Conners, 2001).

4.4 Outcome Measures

For all studies in this thesis, standardized measures that are well-established, widely used in the autism literature, easily comparable to other studies and meaningful for families and clinicians were chosen to assess outcome (Lord et al., 2005; Ozonoff, Goodlin-Jones, & Solomon, 2005). In addition, direct outcome measures were also included that may be more sensitive to change in the direct behaviours targeted in intervention. As one single intervention is unlikely to work comparably for all children it was of interest to measure child characteristics that may predict outcomes. Also of interest was an assessment of parent satisfaction with intervention. The measures used in the study will be described in detail below and more briefly in the individual chapters describing the intervention studies.

4.4.1 Parent satisfaction

To evaluate how satisfied they were with the interventions, parents were given satisfaction questionnaires to fill in. These questionnaires are described within the individual chapters for the different interventions.

4.4.2 Indirect measures of social competence

Vineland Adaptive Behaviour Scale (Sparrow, Balla, & Cicchetti, 1984).

This is a semi-structured parent interview or parent rating scale that measures adaptive behaviour in several domains. The 'Socialisation' domain, 'Communication' domain and the 'Maladaptive Behaviour' domain were used as outcome measures in this thesis. The 'Socialisation' domain consists of three subscales: interpersonal relationships, play and leisure skills and social coping skills. The 'Communication' domain is made up of receptive, expressive and written communication subscales. Items in the 'Maladaptive Behaviour' domain are shown in Table 4.1

Test-retest reliability is good, ranging from r= 0.81 to r= 0.88 in the different domains (Sparrow et al., 1984) and concurrent validity is good (de Bildt et al., 2005; Perry & Factor, 1989). Standard scores with a range of 20 -160 (mean= 100, SD= 15) are available for the 'Socialisation' and 'Communication' domains. A score of 20-69 indicates low adaptive level, 70-84 indicates moderately low, 85-115 indicates adequate adaptive level; 116-130 is moderately high and 131 or above is high adaptive level in a given domain. Raw scores only are available for the 'Maladaptive Behaviour' domain due to the fact that maladaptive behaviour does not change with age like the other domains of the scale (Sparrow et al., 1984). A score of 0-6 indicates non-significant levels of maladaptive behaviour, a score of 7-12 indicates an intermediate level of maladaptive behaviour and a score of 13 or more indicates clinically significant maladaptive behaviour (Sparrow et al., 1984).

Is overly dependent
Withdraws
Avoids school or work
Exhibits extreme anxiety
Cries or laughs too easily
Has poor eye contact
Exhibits excessive unhappiness
Is too impulsive
Has poor concentration and attention
Is overly active
Has temper tantrums
Is negativistic or defiant
Teases or bullies
Shows lack of consideration
Lies, cheats or steals
Is too physically aggressive
Swears in inappropriate situations
Is stubborn or sullen
Sucks thumb or fingers
Wets bed
Exhibits an eating disturbance
Exhibits a sleeping disturbance
Bites fingernails
Exhibits tics
Grinds teeth
Runs away
Plays truant

Table 4.1. Items in the maladaptive behaviour scale of the Vineland Adaptive Behaviour Scale

Gilliam Autism Rating Scale Social Interaction Subscale; GARS SI (Gilliam, 1995).

The Social Interaction subscale of this measure was chosen as an indication of social skills specific to autism. It is a standardised rating that has 14 items scored by parents on a Likert scale (0= never observed, 1= seldom observed, 2= sometimes observed, 3= frequently observed). Test-retest reliability is adequate (Gilliam, 1995) and internal consistency good (α= 0.85(Lecavalier, 2005). Items are: Avoiding eye contact; Has flat affect; Resists physical contact; Does not show imitative play; Withdraws from group situations; Shows anxiety; Is unaffectionate; Laughs or cries inappropriately; Uses toys and objects inappropriately; Behaves repetitively; Is upset by routine change; Has temper tantrums and Lines things up in order. Higher scores indicate a higher level of impairment. The raw score is converted into a standard score between 1 and 20 (mean= 10; SD= 1). A score of 10 represents an average disturbance of social interaction for a child with autism (Gilliam, 1995).

4.4.3 Direct outcome measures used to evaluate *The Transporters* DVD

Emotion recognition abilities were assessed before and after intervention using the following direct measures:

Post-box tasks.

Due to the young age of the children involved in this study and the language difficulties experienced by children with ASC, children were assessed on their recognition of emotions non-verbally in a post-box task. In this task, children were asked to post pictures of faces into the correct post-box. This meant that verbal responses were not necessary. There were five post boxes, each with a symbolic 'Smiley' face showing one of the following basic emotions: *happy*, *sad*, *angry*, *afraid* and *surprise*. 'Smiley' symbols were used as they only show emotional information, and have no gender information or other physical features on which faces could be matched (see Figure 4.1). Children were asked to post pictures of *Transporters* characters and photographs of real human faces taken from the Ekman stimuli (Ekman, Friesen, & Ellsworth, 1972) into the correct box.

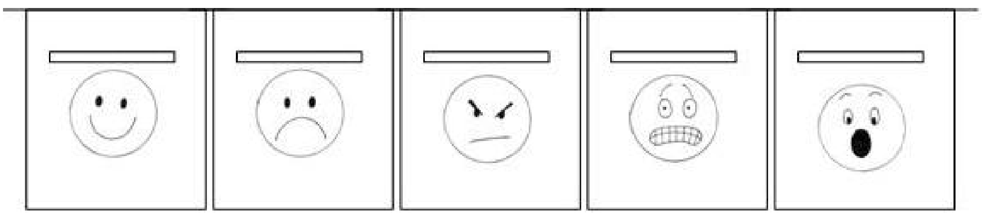

Figure 4.1. The post-boxes and 'Smiley's' used in the posting tasks

The aforementioned five basic emotions were chosen for their developmental age appropriateness (Ridgeway et al., 1985). Although *disgusted* is also a basic emotion, it was not included in this study as it is not usually recognised by typically developing 2-5 year olds, and following pilot studies, it was thought that 5 boxes was the maximum number of choices to give young children without them becoming overwhelmed. *Disgusted* was chosen not to be included as it was the emotion understood by fewest 2-5 yr olds (Ridgeway et al., 1985). The stimuli used in the posting task are shown in Appendix 2.

<u>Stories: Levels 1, 2 and 3</u>

Children with good enough receptive language were also asked to complete three story scenarios to measure their understanding of the causes of different emotions. To ascertain which children had enough receptive language to understand this task, they were given a practice scenario, shown in Figure 4.2. If children successfully completed this task, then they were assessed on the story scenarios. If they could not do this task, then the stories were not completed.

Figure 4.2. The practice story scenario

In the story scenarios there were 3 levels of understanding of 8 different emotions. The emotions used included the same 5 basic emotions as in the post box task, plus *disgusted*, *excited* and *tired*. These eight emotions were chosen because they were the only emotions used in *The Transporters* DVD series that have been shown to be understood by over 80% of 2-5 year olds (Ridgeway et al., 1985). The exception to this was *disgusted* which is understood by an average of 34% of 2-5 year olds but was included because it is one of the basic emotions. The story scenarios were designed such that children had to understand the story, think how the person would feel in the story, and then choose the face that showed the appropriate emotion, i.e. they were required to recognise emotions from contextual information. In all story scenarios, children were shown a picture and told the story that was happening in the picture, for example, “A big dog is barking at Sally. The dog has bitten people before. How does Sally feel when a dog is barking at her?” Children were then shown 3 pictures of the main character’s face, showing 3 different emotions: the correct emotion that corresponds with the scenario, and two incorrect emotions (one with positive valence, the other with negative valence). They were asked to touch the face that corresponded to the emotion felt by the character in the story.

The order in which the responses were presented was randomised between all scenarios, so that the correct answer did not always appear in the same place. The expression on the faces of the characters shown in the pictures that depicted the contextual scenario was not visible so children were unable to choose their responses by copying the emotion from the scenario picture. All the stories were read with appropriate intonation, e.g. with an *afraid* voice if the scenario was frightening. The assessor sat to the side of the child rather than in front of them, and tried not to show any emotion on their face, so that children could not use the facial expression of the examiner to help choose their answers. The order in which the different emotions appeared in the stories was random.

Level 1 stories involved questions about scenarios that occurred in *The Transporters* DVD and used characters from the DVD (see Figure 4.3). This tested whether children could learn and remember the different emotions seen in scenarios on the DVD.

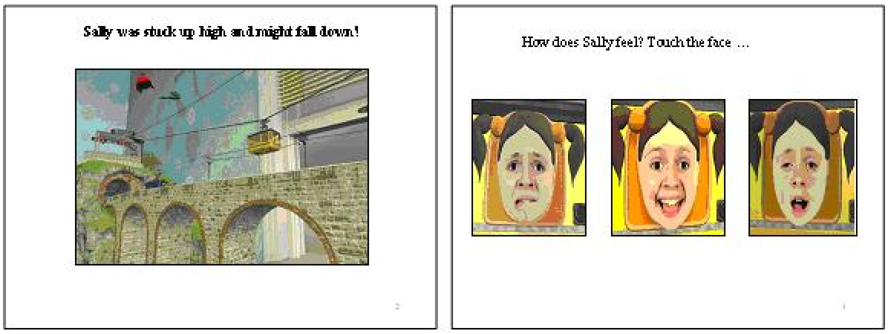

Figure 4.3. An example of a level 1 story.

Level 2 stories were a measure of close generalisation and used the same familiar characters from *The Transporters* DVD but with novel scenarios that were not part of the series (see Figure 4.4).

Figure 4.4. An example of a level 2 story.

Level 3 stories were a measure of more distant generalisation, and involved real human faces (taken from the *Mind Reading* DVD) and new, real life scenarios that the children had no prior experience of from *The Transporters* DVD (see Figure 4.5).

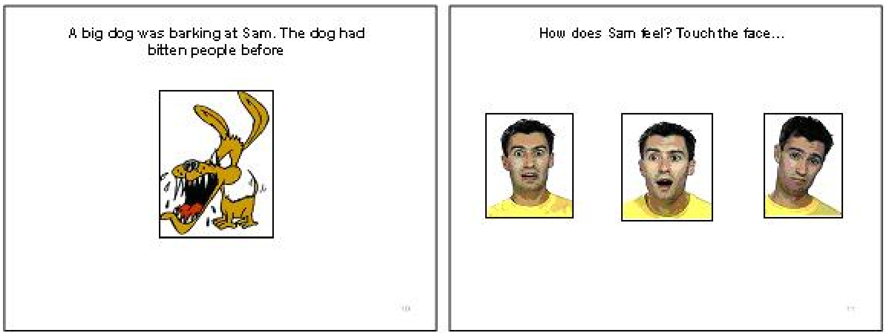

Figure 4.5. An example of a level 3 story.

There were two sets of stimuli for each level of the story scenarios. One set was used for all children at Time 1; the other set was used at Time 2. This was to limit practice effects.

<u>Validating the stimuli used in *The Transporters* study</u>

All the stimuli used in the emotion tasks described above were validated to ensure they were showing the emotion that they were supposed to. Firstly, stimuli were validated by a panel of 20 adults. Volunteers were shown a power-point presentation of a variety of stimuli that could have been used in the study and were asked to categorise them as *happy*, *sad*, *angry*, *afraid*, *surprised*, *disgusted*, *tired* or *excited*. Validation criteria specified that only stimuli that were correctly categorised by at least 70% of the participants were included in the study. This level of agreement was significantly above chance levels using a binomial distribution probability calculation ($p < 0.01$). Following this process, 6 stimuli were discarded and the remaining stimuli were then validated by a class of 20 children between 4-5yrs old who were independent of the main study. The class was shown a power-point presentation of the different faces, and were given a multiple choice answer with 3 options for each face. The options included the correct emotion and two incorrect emotions (one with positive valence, one with negative). Children were asked to circle the emotion they thought was being shown on the face. Of these emotions, a further 6 were discarded as they were not categorised correctly by over 70% of the children. There were a total of 52 faces that were validated for use in the study that included Ekman stimuli (15), stimuli taken from the *Mind Reading* emotions software (17) (Baron-Cohen et al., 2004), 'Smiley's' (5) and *Transporters* faces (15).

Pilot study of stimuli appropriateness and task difficulty

To ensure that the tasks used were suitable for young children (both typically developing children and children with ASC), a small pilot test was carried out with 6 typically developing 4 and 5yr olds. All of these children were asked to do the posting tasks and both versions of the story tasks. One child did not complete the second version of the story tasks as he became very tired. Scores from the Time 1 and Time 2 versions of the stories were compared to check whether both versions were of equal difficulty. Scores for the Time 1 and Time 2 versions of level 1, 2, and 3 stories are shown in Figure 4.6 below. There were no significant differences between the scores on both versions of the task at each level, suggesting that at each time point the stories were of equal difficulty.

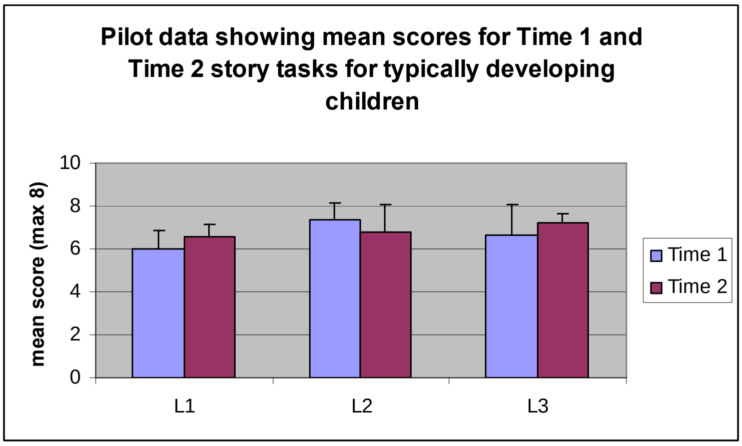

Figure 4.6. Pilot data evaluating Time 1 and Time 2 story tasks [bars show S.D.]

A second pilot test was carried out to assess the feasibility of the tasks with 4 children with ASC who were 4 or 5yrs old. These children had volunteered to take part in the full study, but were asked to be part of a pilot study instead, and gave written consent to do this.

This pilot study showed that it took roughly 2hr to complete the Mullen Scales of Early Learning, the post-box tasks and the 3 story tasks. Scores of the children with ASC are shown in Figure 4.7 on the following page alongside scores for typically developing children. Only the Time 1 version of the stories and the posting tasks were carried out so no pilot data for ASC children was available for the Time 2 versions of the stories. Results showed that as might be expected, the scores of the children with ASC were lower than the scores of typically developing children, though this difference did not reach significance.

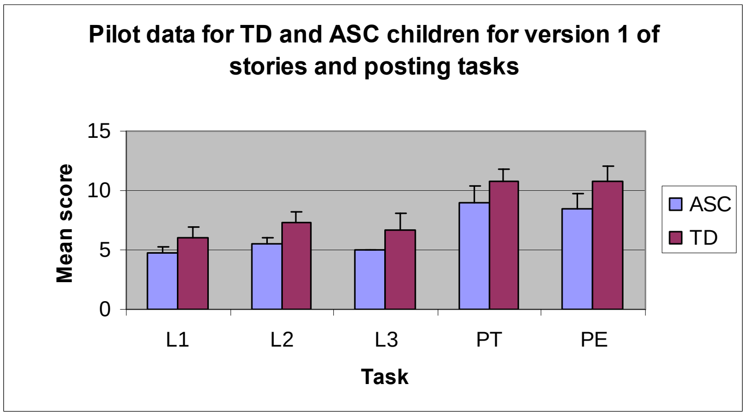

Figure 4.7. Pilot data comparing scores for TD and ASC children [bars show S.D. PT= posting Transporters stimuli; PE= posting Ekman stimuli]

4.4.4 Direct outcome measures used to evaluate LEGO® therapy

To evaluate social competence in naturalistic settings in the first LEGO® therapy study, two direct measures of outcome were used that are described below.

<u>Observation in a structured play setting</u>

Children were asked to attend an hour-long structured play session in an observation room. The observation room was a small playroom with hidden cameras in three corners. The three cameras enabled a particular view of the room to be seen, and a particular camera angle could be selected and recorded onto DVD. When recording, a camera view was chosen in which all children could be seen. When children moved around the play area, the camera angle was changed to ensure that the best view of all children was recorded.

<u>Procedure</u>

Children attended the hour-long play session instead of their usual therapy session at the start, middle and end of the intervention period. This meant that the children were interacting with the same children with whom they attended their particular therapy each week. Unfortunately, the existence of a hi-tech observation room was only discovered half-way through the intervention period for the first recruitment phase of the study. This meant that data for these children could only be collected at the middle and end of the intervention period, and no structured observations were taken at the start of the intervention period. Children who were recruited in the second phase of the study were observed at the start, middle and end of the intervention period.

Children attended the observation session while their parents waited in a separate room. Toys in the observation room were the same in each play session. Toys were selected to promote interaction (turn taking, conversation, imitation, playing in a group) rather than solitary play, although some items were chosen to be desirable but not conducive to group play, so that children might show turn-taking behaviour. Toys in the room were: a trampoline suitable for two children to jump on at a time; a 'chicken croquet' set with four balls and four mallets, in which children could knock balls through a hoop to hit a chicken which then laid an egg; a garage, road and cars set; two policemen's hats which make a sound when a button on the top is pressed; playing cards; toy soldiers; toy insects; magnetix; some toy vehicles and various soft toys. These types of toys have successfully been used in previous studies examining the social interactions of toddlers (Ensor & Hughes, 2005). Children were allowed to play with any of the toys at any time.

Parents were allowed to wait outside the room to observe their children through the one-way window, as long as they remained quiet and the children were not aware of their presence. The therapist (myself) stayed in the playroom with the children throughout the observation for safety reasons. The session was introduced as a 'fun play session' and it was explained how to use the various toys. Children were allowed to play with any toys that were available in the room at any time. After introducing the session, I did not initiate any social interactions with the children. If the children initiated an interaction with me (e.g. asked a question), I would respond appropriately, but would not seek to continue the interaction, so that children were encouraged to interact with peers rather than adults.

Coding

The whole session was recorded on DVD, and 20 minutes of each session was coded for each child. A start time for coding was chosen at random for each child at each time-point. Two research assistants who were blind to therapy allocation coded behaviour over the twenty minutes following the start time. The DVD was paused every 10 seconds and the target child's behaviour was coded using the coding scheme in Appendix 3. The coding scheme was divided into two sections. The first section, Social Play, measured the degree to which children were aware of others around them and interacting with peers. The scheme was based on the Howes peer play coding scheme (Howes, 1979; Howes, Unger, & Beizer Seidner, 1989). This scheme has five categories of behaviour: *unoccupied*; *independent solitary play*; *parallel aware play*; *complementary & reciprocal play* and *complex complementary play*. During training of raters, it was found to be very difficult to distinguish between the categories of *complementary & reciprocal play* and *complex complementary play.* It was therefore decided during training and before coding the observations to condense these into one category called *associative play*. An additional category of *adult interaction* was also included, so that in any single 10 second interval, the child's behaviour could be coded as one of the following: *adult interaction*, *unoccupied*, *independent solitary play*, *parallel aware play or associative play*. Full descriptions of these categories can be found in Appendix 3.

For each 10 second interval, the highest level of social interaction was coded; for example, if a child was playing in parallel but aware of others for 6 seconds of the interval, and spent 4 seconds in associative play, the 10 second interval would be coded as associative play even though the child spent the majority of the interval playing in parallel. Children were only coded as interacting with adults if they spent 8 or more of the 10 second interval interacting with an adult.

The second section of the coding scheme measured how much time children spent in close physical proximity to one another. This was used as an indirect assessment of interaction. In each 10 second interval, a child was coded as being in proximity with another child if they were within approximately 1 metre of another child (not an adult) at any time during the interval. One metre was the size of one of the carpet squares on the observation room floor.

Training Raters

Two volunteer undergraduates were recruited to carry out the blind ratings of behaviour using the coding scheme. They were trained by myself in an initial meeting about the behaviours and the coding scheme to ensure they understood what constituted each behaviour. After the initial meeting, they were asked to code the same tape separately. They then attended another meeting to discuss their individual codes and where they agreed or disagreed with the coding. After this meeting, they were asked to code another tape separately and repeat the discussions about agreement and disagreement. This process was repeated several times. Following a final discussion meeting the raters were asked to code a randomly selected 25% (n= 16) of the total number of observations by themselves without any discussions. Inter-rater reliability was calculated. Inter-rater reliability for social play behaviour was good: kappa= 0.605 (95% CI= 0.578-0.633). Inter-rater reliability for proximity was also good: kappa= 0.680 (95% CI= 0.647-0.714). The observation tapes were then randomly allocated to one of the two raters and all tapes were coded within two months the final meeting.

Observations in the school playground

To provide a measure of skill generalisation in a naturalistic setting, children in the LEGO® therapy and SULP groups were observed in the school playground before and after intervention. Twenty-one children who gave consent were observed in the school playground at break time. Ten minutes of observations were available for each child at both Time 1 and Time 2.

Two aspects of social behaviour were measured following the methods used by LeGoff (2004). The frequency of self-initiated social contact with peers and the duration of social interactions with peers were measured to gain an overall indication of social functioning. A social contact was coded as self-initiated if it did not form part of any routine, was not prompted and was a clear communicative verbal or non-verbal action that was not a response to another's initiation and not with an adult. Duration of all interactions with peers was measured if they were clearly social or play interactions, there was no adult supervision, and the play was interactive and not parallel. See Appendix 4 for a coding scheme.

These observations were carried out by myself due to the restrictions of access to school playgrounds (many primary schools request that individuals have Enhanced Disclosure from the Criminal Records Bureau to observe children in the playground and the volunteer research assistants did not have this at the time of the study). As I was also running the therapy groups I was not blind to group membership. Data from observational measures was collected on a handheld computer using ObsWin (Martin, Oliver, & Hall, 2000), a computer software package designed for direct behaviour observation.

The next Chapter describes the randomised control trial evaluating *The Transporters* DVD. Chapter 6 then describes the matched control study evaluating LEGO® therapy, and Chapter 7 discusses the pilot baseline study to evaluate the use of LEGO® therapy at school. The results of these studies will be discussed in Chapter 8, where the implications, limitations and future directions of this thesis will be examined.

Chapter 5: Using *The Transporters* DVD to facilitate emotion recognition

5.1 Introduction

As discussed in Chapter 2, emotion recognition is impaired in individuals with ASC (Baron-Cohen, 1995; Hobson, 1994) and this is strongly related to the observed deficit in cognitive empathy (Baron-Cohen & Wheelwright, 2004) which is a vital component of successful social interactions.

Previous studies that have evaluated interventions for emotion recognition are discussed in Chapter 3, and while they show success, there is limited generalisation of learning. One relatively successful approach is the *Mind Reading* DVD, a multimedia systematic guide to emotions. This shows generalisation of learning in children over the age of 8yrs (Golan, 2006). This is an exciting result but *Mind Reading* may not be appropriate for very young children or lower functioning children with ASC. It requires the user to be able to play a computer game and use a mouse (or be supervised by somebody who can). Many younger children may not be able to do this, and given the current emphasis on early identification and early intervention (Le Couter, 2003; National-Research-Council, 2001), it was of interest to develop a resource that very young children with ASC could use. The younger children are when they start to learn emotions, the better the outcome may be. *The Transporters* DVD is a cartoon series designed to help young children to recognise emotions.

5.1.1 What is The Transporters DVD?

The Transporters DVD is the most recent addition to the group of interventions that use systemising to help with empathising. It is a high quality, animated children's cartoon series designed to teach emotion recognition to preschoolers with ASC or children with more severe forms of autism (see Figure 5.1). It is suitable for 2–8yr olds with ASC (Baron-Cohen et al., 2007) and was developed by the Autism Research Centre in Cambridge in collaboration with Catalyst Ltd. The work was funded by Culture Online, part of the government Department for Culture, Media and Sport.

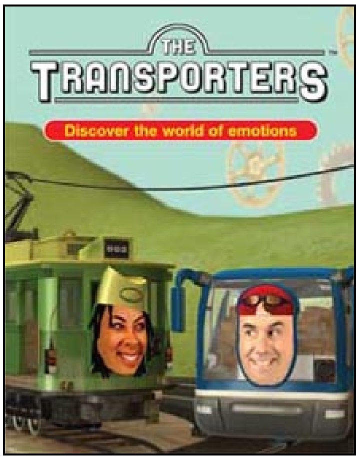

Figure 5.1. Front cover of The Transporters DVD.

The aim of *The Transporters* DVD is threefold:

- To increase the amount of time children with ASC spend looking at faces.
- To teach children to recognise new emotions.
- To link emotions to their causes and consequences.

It makes use of the attraction of systems to help motivate children to attend to faces and to learn emotional expressions. Children with ASC find the mechanical, systematic nature of vehicles that move in predictable ways (e.g. along linear tracks) very appealing. Therefore all the main characters in *The Transporters* are vehicles attached to rails or another fixed track to ensure they move in a limited, systematic and predictable fashion. The vehicles include two trams, two cable cars, a chain ferry, a funicular railway, a tractor and a coach. They all have limited freedom of movement that is predictable; the tractor and coach run on Scalextric-like tracks. The vehicles are set in a boy's bedroom, with the tracks, cables and chains circling around his room. Cogs, wheels and pulleys (other mechanical systems) are included in the stories to further catch the interest of children with ASC.

The DVD is therefore highly systematic and, it is hoped, very appealing and non-threatening for children with ASC. To help children learn about emotions in this systematic framework, images of real human faces were grafted onto the front of the vehicles (see Figure 5.2). These faces show various emotions played by actors, so the emotions on the faces are animated rather than still, as they would be in the real world. Each emotion used in the DVD was validated for the emotion it is meant to convey by an independent panel of 20 judges. Facial expressions not achieving 90% agreement were not included in the series. Each emotion is shown in the context of an entertaining story about the toy vehicles and what happens to them. The story is narrated and the mouths of the characters do not move when they 'speak' in the story. This means the only information portrayed on the faces of the vehicles is emotional information (there is no linguistic information). The use of real human faces ensures the emotional expressions seen are realistic, which should increase the likelihood of generalisation to everyday life. By grafting human faces onto vehicles and presenting them in an appealing and non-threatening systematic environment, it is hoped that children with ASC find the faces more interesting. They may then pay more attention to faces, thus increasing their opportunity to learn about facial expressions of emotion. The context in which the faces are presented is intended to help children link emotions to their causes and consequences.

Figure 5.2.   One of *The Transporters*: a tram named Jennie.

The DVD includes fifteen, 5 minute episodes. Each episode focuses on one key emotion. The emotions covered are the 6 basic emotions of *happy*, *sad*, *angry*, *afraid*, *disgust* and *surprise* and 9 complex emotions: *excited*, *tired*, *unfriendly*, *kind*, *sorry*, *proud*, *jealous*, *joking*, and *ashamed*. These emotions were chosen because of their developmental appropriateness. Typically developing 4yr olds recognise these emotions, so they should not be too hard for children with ASC up to the age of 8yrs to learn (Ridgeway et al., 1985).

The episodes can be watched in order, or specific episodes can be picked out and watched one at a time. There is also a guide for parents and carers that provides ideas to facilitate learning. For example, parents are encouraged to repeat episodes to reinforce understanding, to encourage looking at the characters' faces for emotional information, to discuss the theme of a particular episode or a particular emotion throughout several episodes and to discuss the causes and consequences of emotions. Questions are included to help broaden the child's ideas of particular emotions.

In addition to the individual episodes there is a series of easy and hard quizzes. The questions include deciding which two characters feel the same, identifying which face shows a given emotion or identifying which emotion a situation would provoke. In the easy quizzes, two potential answers are given, in the hard quizzes, three potential answers are given. If the child gives a correct answer they get a reward showing one of the characters with their wheels or cogs turning (this is designed to appeal to children with ASC). If the answer is wrong, the question is repeated until the correct answer is given.

5.1.2 Previous Research into *The Transporters*

Golan et al (Golan et al., in preparation) have recently carried out a study evaluating the effectiveness of *The Transporters* DVD for 4-8yr old children with ASC. They compared 20 children with ASC who watched the DVD for 15 minutes every weekday for 1 month, to 20 children with ASC who did not watch the DVD and 20 typically developing children who did not watch the DVD. Participants were matched for age and verbal IQ and then randomly assigned to the intervention or control group. Children were assessed on four different emotion recognition tasks. The first was a simple emotional vocabulary task in which children were asked to define the 15 emotion words from the DVD and give examples of situations that evoked them. The second was a familiar matching task, in which children were told a familiar scenario that they would have seen in *The Transporters* DVD and were asked to choose the correct facial expression from a choice of three animated familiar *Transporters* faces. The third task was testing close generalisation of skills and involved children matching animated familiar *Transporters* faces to novel situations. The fourth task measured distant generalisation to real human faces and involved matching animated unfamiliar faces to unfamiliar situations. Results from this study were very exciting, as in all four tasks the children with ASC who watched *The Transporters* significantly improved in their emotion recognition abilities up to levels of the typically developing children in the study. Children with ASC who did not watch the DVD remained below typically developing levels.

These results suggest that *The Transporters* DVD is an effective way to teach emotion recognition to children with ASC and that the learning generalises to new faces and new situations. In the current study we wished to extend this research to evaluate the DVD for a younger age group (2-5yr olds) in order to test if emotion recognition can be improved at the earliest point. This would be important if early intervention leads to better prognosis. It has been recommended that targeted interventions be started as early as possible (Le Couter, 2003; National-Research-Council, 2001).

In terms of emotion recognition, typically developing children begin to discriminate between emotions during the first year of life (Klinnert, 1984) and become aware of the causes and consequences of emotions in their second and third year (Denham, 1998). Considering the early developmental nature of emotion recognition abilities and the delayed and impaired learning of emotion recognition skills in ASC alongside the recommendations for early intervention, it seems important to investigate the effectiveness of *The Transporters* DVD for very young children.

5.2 Method

5.2.1 Design

This study was a randomized control trial. Participants with ASC were stratified by age into 2 and 3yr olds, 4yr olds and 5yr olds. Children in each age group were then randomly assigned to one of three intervention conditions: Group 1 watched *The Transporters* DVD every day for 4 weeks; Group 2 watched a comparison DVD not designed to teach emotion recognition called *Jimbo* every day for 4 weeks; Group 3 were not asked to watch any new DVD over the 4 weeks. A group of typically developing children, matched on verbal mental age were also asked to watch *The*

Transporters DVD every day for 4 weeks. Repeated measures were taken at the start and end of the 4 week period.

5.2.2 Participants

Participants were recruited through the www.transporters.tv website, in which parents were able to request a free copy of the DVD. On the website there was a tick box where parents could indicate whether they wanted to receive information about this research project. The names, addresses, and email addresses of the parents who asked for information about the research were sent an email or a letter explaining the study in detail. Participants were also recruited through the Autism Research Centre database and through an advertisement in the National Autistic Society magazine, *Communication*. Seven hundred and ninety eight people were interested in hearing about research. Emails and or letters were sent to individuals who were suitable for the study and they were asked to send back informed written consent along with a background information questionnaire. A total of 73 parents gave consent for their child to participate in the study.

Inclusion criteria stated that children must be between the ages of 2 and 5yrs at the start of the study and have a diagnosis of autism, AS, high functioning autism or an autism spectrum condition made by a clinical psychologist, psychiatrist or paediatrician. Inclusion criteria also specified that participants reach the cut off score of 15 on the Social Communication Questionnaire {SCQ; \Rutter, 2003 #3051}, have receptive language of at least 18 months and no additional diagnoses of childhood psychiatric disorders. A consort diagram showing randomisation to groups for the participants with ASC and the attrition rates in each group is given in Figure 5.3.

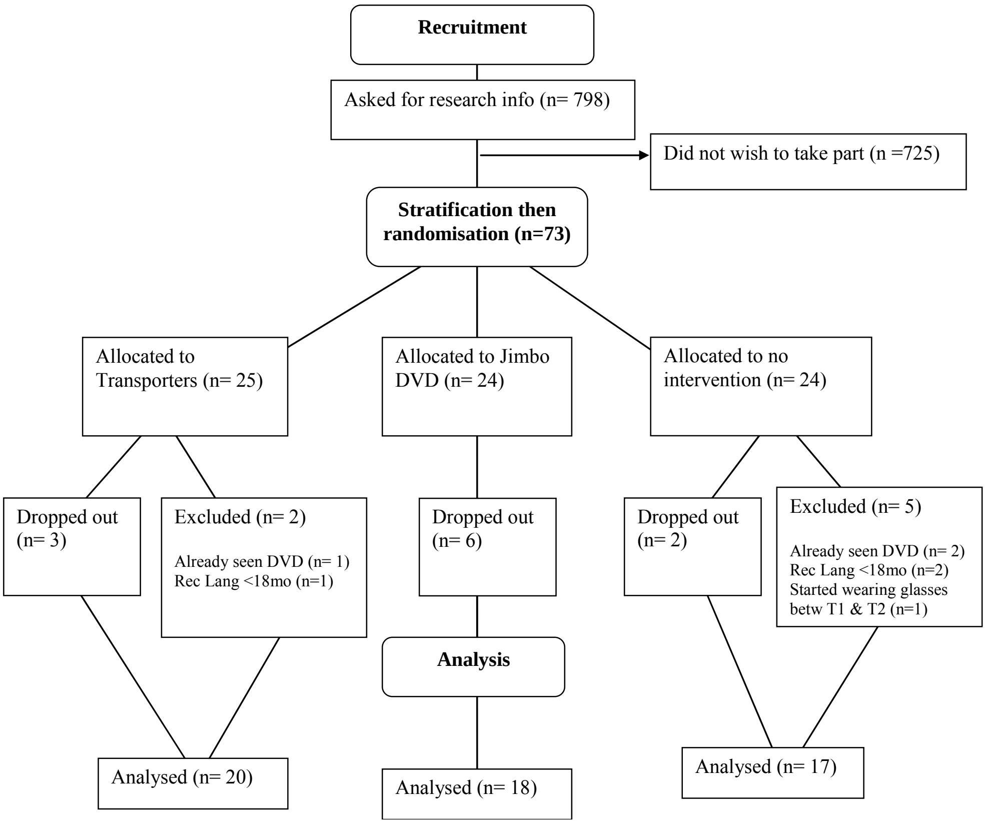

Figure 5.3. Consort diagram of randomisation and attrition for ASC participants

Typically developing children were recruited through the Autism Research Centre database and by using posters in local nursery schools. A total of 17 typically developing children took part and were matched to the participants with ASC on receptive and expressive language mental age. Table 5.1 shows the characteristics of all participants in the study.

Characteristic		No intervention	Transporters	Jimbo	Typically Developing
N		17	20	18	17
Age (months)	mean	54.11	57	55	42.53
	SD	9.81	11.5	9.89	10.44
	ANOVA	*F(2,52)=0.30, p=0.74*			*F(1,70)=20.29, p<0.001*
SES	mean	2	1.26	2.29	1.82
	SD	0.37	0.18	0.39	0.38
	Chi Square	*X_2 (8)= 8.42, p = 0.39*			*X_2 (4) = 2.66, p = 0.62*
Gender	Male	17	19	17	12
	Female	1	1	1	5
Gilliam Autism Rating Scale AQ	mean	92.63	87.55	96	not assessed
	SD	14.09	16.33	12.82	
	ANOVA	*F(2,48)=1.47, p=0.24*			
SCQ Score	mean	20.29	20.45	20.78	3.18
	SD	4.7	6.3	4.26	2.77
	ANOVA	*F(2,52)=0.04, p=0.96*			*F(1,70)=177.08, p<0.001*
Mullen Early Learning Composite	mean	78.22	75.65	79.72	115.88
	SD	23.77	20.57	21.4	13.58
	ANOVA	*F(2,52)=0.16, p=0.85*			*F(1,70)=46.38, p<0.001*
Receptive Language Standard Score	mean	39.72	38.5	38.72	57.65
	SD	14.43	13.22	14.2	10.52
	ANOVA	*F(2,52)=0.03, p=0.97*			*F(1,70)=26.44, p<0.001*
Expressive Language Standard Score	mean	36.72	35.75	38.67	58.12
	SD	10.92	13.12	12.92	9.49
	ANOVA	*F(2,52)=0.29, p=0.75*			*F(1,70)=42.84, p<0.001*
Receptive Language Age Equivalent	mean	44.22	46.1	47.78	45.94
	SD	16.46	13.17	14.14	11.38
	ANOVA	*F(2,52)=0.23, p=0.80*			*F(1,70)=0.002, p=0.96*
Expressive Language Age Equivalent	mean	41.83	42.2	46.44	46.59
	SD	13.31	14.95	13.79	11.45
	ANOVA	*F(2,52)=0.60, p=0.55*			*F(1,70)=0.70, p=0.41*
Diagnoses	Autism	0	1	1	0
	ASD	14	15	13	0
	AS	3	3	3	0
	HFA	1	1	1	0
Additional diagnoses	Glue ear	1	1	2	0
	Hyperlexia	1	0	0	0
	Hypertonia	0	0	1	0
	Dyspraxia	1	1	1	0
Additional intervention	SALT	4	4	7	0
	OT	1	2	1	0
	Play groups	1	2	2	0
	GF/CF diet	1	5	3	0
	Medication	1	0	0	0

Table 5.1. **Participant characteristics in *The Transporters* DVD study. [**HFA= high functioning autism; AS= Asperger Syndrome; ASD= autism spectrum disorder; SALT= speech and language therapy; OT= occupational therapy; GF/CF= gluten free, casein free**]**

5.2.3 Procedure

Prior to starting the study, parents were sent an information letter describing the study in detail and were asked to give written consent for their child to take part. Parents also completed a background information questionnaire which included information about age, gender, diagnosis, interventions, education and socio-economic status of the parents using the National Statistics Socioeconomic Classification questionnaire

(ONS, 2002). Volunteers who reached all inclusion criteria (apart from language ability and SCQ cut-off which could only be assessed after meeting with the families) were stratified into age groups (2yr, 3yr, 4yr and 5yr) before being randomly assigned to the *Transporters*, *Jimbo* or no intervention groups. Typically developing participants were also recruited.

All participants were invited to the Autism Research Centre in Cambridge for the assessments at Time 1 (before intervention) and Time 2 (after intervention). If travel was a problem, the assessments were carried out at the child's home. Assessments were carried out either by myself or a research assistant and took between 1hr 30 and 2hr 30 depending on the ability and concentration of the child. At Time 1 and Time 2, children were assessed on one or both of the measures of emotion recognition outlined below (only the post box task was used with children with low receptive language). Half of the Mullen Scale of Early Learning (Mullen, 1995) was also completed with the child at each time point (due to the length of this measure it was split into two so that the duration of the whole assessment session was no more than 2hr 30). While the child was being assessed, parents completed the parent rating scale version of the socialisation domain of the Vineland Adaptive Behaviour Scale 2nd edition (Sparrow, Cicchetti, & Balla, 2005). At Time 1 only, parents completed the Gilliam Autism Rating Scale (Gilliam, 1995), the SCQ (Rutter, Bailey, & Lord, 2003), the Spence Children's Anxiety Scale (Spence, 2000) and the Conner's ADHD index, (Conners, 2001). Plenty of breaks and refreshments were given throughout the assessment sessions.

Following the assessments, parents were given a copy of the appropriate DVD (or no DVD if they were randomly allocated to the no intervention group). Those families in the *Jimbo* or *Transporters* groups were also given a record sheet in which to record the number of episodes their children watched per day and to give any comments they had about the DVDs. They were asked to watch at least 3 different 5 min episodes (15 min) every week day for 4 weeks. This short intervention was shown to be sufficient in previous research evaluating the DVD for 4-8yr olds (Golan et al., in preparation). Those in *The Transporters* group were also given the option to do the quizzes on the DVD if they wished and were asked to record how many quizzes their child did each day.

At Time 2, parents were asked to complete a satisfaction questionnaire that asked for their opinions about the success of the DVD and their satisfaction with it. Parents in the no intervention group did not complete this questionnaire; neither did the parents of typically developing participants. All participants were allowed to keep the DVD they were given. Those in the *Jimbo* and the no intervention group were given a copy of *The Transporters* DVD at the end of the Time 2 assessment. All parents were also given a copy of the *Mind Reading* emotions library at Time 2 as a thank you present for taking part in the study.

5.2.4 Intervention

The intervention period for this study was 4 weeks, though due to circumstances out of the control of the study, for some children the intervention period was up to 5 weeks. Children in the typically developing group and *The Transporters* DVD group were asked to watch a minimum of 3 episodes (15 min) of the DVD every weekday. Parents were encouraged to use the material in the guide book to help their children learn, but the quizzes at the end of the DVD were optional.

Children in the comparison DVD group were asked to watch a minimum of 3 episodes (15 min) per weekday of *Jimbo and the Jet Set*. This DVD was not designed to teach emotion recognition skills, but has similar appeal for children with ASD as it uses vehicles as the basis for their stories. Similar to most children's cartoon series, *Jimbo* does contain emotional information, but this is not the aim of the DVD and it does not contain any real human faces. It could be possible that the emotional information in typical children's cartoons is sufficient to improve emotion recognition skills. Also, simply watching a DVD as part of an emotion recognition study with your parents could increase the amount of time the family spends talking about emotions. For these reasons, a control group who simply watched any DVD with their family was necessary as well as a control group who watched no extra DVDs. Children in the *Jimbo* group were asked to watch 2-3 episodes (10-15 min) of the DVD per weekday for four weeks. A comparison of the features of *Jimbo* with *The Transporters* is shown in Table 5.2.

"The Transporters"	"Jimbo and the Jet Set"
Produced in 2006	Produced in 1987
Computer animation	Drawing animation
Main characters 8 vehicles	Main character an airoplane
Designed to teach emotion recognition	Children's cartoon not designed to teach emotion recognition
Main focus of stories is emotions and consequences	Main focus of stories is 'Jimbo's' adventures, but some emotions mentioned
Vehicles have real human faces	Vehicles have animated faces
Contains close-up of emotion expressions	No close up of emotion expressions
Vehicles face only shows emotion	Vehicles face shows verbal and emotional information
Human characters do not move	Human characters move
Vehicles move predictably on fixed track	Vehicles move freely in any direction
Cogs, wheels and pulleys included to attract viewer	No specific systematic attractions

Table 5.2. A comparison of *Jimbo* and *The Transporters*

Children in the control group who did not watch any DVD over the intervention period were not asked to do anything differently over those four weeks. This group was included to enable us to rule out maturation or practice with the tasks as reasons for any potential improvements in emotion recognition.

5.2.5 Outcome Measures

Emotion recognition abilities were assessed using the following measures. Please see Chapter 4 for further details of these measures:

Post-box tasks.

In this task, children were asked to post pictures of faces into the correct post-box. This meant that verbal responses were not necessary. There were five post boxes, each with a symbolic 'Smiley' face showing one of the following basic emotions: *happy*, *sad*, *angry*, *afraid* and *surprise* (see Figure 5.4)

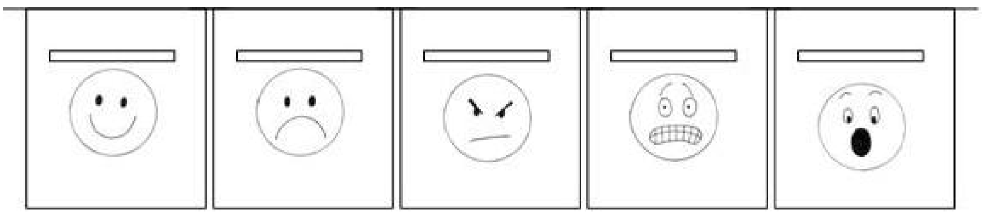

Figure 5.4. The post-boxes and 'Smiley's' used in the posting tasks

During the assessment, children were shown the post boxes which were always presented in the same order: *happy*, *sad*, *angry*, *afraid* then *surprised*. Their recognition of the emotions on the front of the post boxes was tested prior to posting. The assessor asked the child, "Look at these post boxes. Can you find a box with a *happy* face on? Can you touch the box with the *happy* face?" If children touched the correct *happy* box they were praised then asked to find the subsequent boxes, "Well done! That's right! Can you find the box with a *sad* face now?" If the children did not find the correct box, the experimenter pointed it out to the child saying, "I think that's the *angry* box, not the *happy* box. Here's the *happy* box! You can see his smiley face". The child was then asked to find the *sad* post box and the subsequent emotions in the same way.

The assessor then went over the different boxes again, saying "So, we have the *happy* box here, the *sad* box here, then the *angry* box, the *afraid* box and the *surprised* box." All children included in the study recognised the different faces on the different boxes. The only children who could not do this were the children that were subsequently excluded from the study due to their receptive language being too low (below 18 months). It was very obvious that these children did not understand what they had to do in the task, and were choosing boxes in which to post the faces at random.

After checking understanding of the different post boxes, children were given one example of the five emotions of Ekman faces to practice posting in the correct post box. They were told "Let's post these faces into the right box. *Happy* faces go in the *happy* post box; *sad* faces go in the *sad* post box [and so on]. It's like Postman Pat!" The child was always given the *happy* face first, and was told "Look at this woman. How does she feel? Do you think she is *happy*? Can you post her in the right box?" If the child posted her in the correct box, they were praised, “Wow! That’s right! The *happy* woman goes in the *happy* post box!” The subsequent four practice cards were then given to the child in a random order, so that children did not think that all cards would be presented in the same order of *happy*, *sad*, *angry*, *afraid* and *surprised*. If the child posted the practice face in the incorrect box, they were stopped before they posted it in, and said in a friendly tone, ‘Oh, that’s not the *happy* box! We need to put the *happy* woman in the *happy* box. Here’s the *happy* box. She goes in there’. The same was done for any incorrect box choice for all five practice cards.

After the practice cards, children were presented with 15 cards with real human faces taken from the Ekman stimuli (3 examples of each of the 5 emotions). The cards were presented in a random order. Children were asked, “Now, can you post these cards in on your own?” They were shown the first card and told, “Look at the face. How does he/she feel? Which box do they go in?” The card was held up in front of each box in turn, so the child could easily compare the face on the card with the face on the post box. Each post box was labelled with the emotion as the card was held in front of it, “Is s/he *happy*, *sad*, *angry*, *afraid*, or *surprised*?” The boxes were labelled and the cards were held in front so that children were certain which post boxes were showing which emotions. Any errors they made would therefore be a result of difficulty recognising the emotion on the card, rather than a failure to remember which post box was which. Children’s responses and errors were noted down on a piece of paper throughout the task. No help was given to the children for the 15 test faces.

Following the Ekman faces, children were then given 15 cards with faces from *The Transporters* DVD characters to post into the correct box (3 examples of each of the five emotions). The cards were presented in a random order, and instructions were given in exactly the same way as for the Ekman faces. These two versions of the posting task measured whether children simply learned the faces they watched in the DVD series or whether the learning generalised to real human faces as well.

The same 30 cards were used in the post-box tasks at Time 1 and Time 2. Two sets of stimuli were not available for the posting tasks, due to the limited number of validated faces. However, no feedback was given to children in the posting tasks after the first 5 practice cards so that children did not know whether they were putting the faces in the correct boxes or not.

Stories: Levels 1, 2 and 3

Children with good enough receptive language were also asked to complete three story scenarios to measure their understanding of the causes of different emotions. Here, children were given pictures describing a situation and a choice of three emotional expressions. Children had to choose the correct emotional expression that corresponded with the situation. Level 1 stories involved questions about scenarios that occurred in *The Transporters* DVD and used characters from the DVD and tested whether children could learn and remember the different emotions seen in scenarios on the DVD. Level 2 stories were a measure of close generalisation and used the same familiar characters from *The Transporters* DVD but with novel scenarios that were not part of the series. Level 3 stories were a measure of more distant generalisation, and involved real human faces (taken from the *Mind Reading* DVD) and new, real life scenarios that the children had no prior experience of from *The Transporters* DVD. Please see Chapter 4 for details of these measures.

Socialisation domain of the Vineland Adaptive Behaviour Scale

To further assess generalisation to everyday life, parents were asked to complete the parent rating scale version of the socialisation domain of the Vineland Adaptive Behaviour Scale (Sparrow et al.; Sparrow et al., 2005). This was to see whether any learning about emotions had generalised to adaptive social skills in everyday life.

Parent evaluation questionnaire

To evaluate how satisfied they were with the DVD's parents in *The Transporters* and the *Jimbo* group were asked to complete an evaluation questionnaire at Time 2. These questionnaires included questions about how much their child enjoyed watching the DVD, whether their child had improved in emotion recognition, whether their child looked at faces more, how easy the DVD was to use, whether they used and enjoyed the quizzes (for *The Transporters* DVD only), whether the intervention period was long enough and their overall satisfaction with the DVD. Each of these statements was rated on a Likert scale about whether the parent strongly agreed, agreed, disagreed or strongly disagreed with the statement. These ratings were converted into scores of 1-4, so that strongly disagree= 1, disagree= 2, agree= 3 and strongly agree= 4.

Predictors of outcome

It was of interest to assess whether child characteristics that have predicted outcomes in previous intervention studies also predicted outcome in this study. These characteristics were age, IQ, verbal IQ and autism symptom severity, hyperactivity and anxiety. These variables alongside a binary variable of whether or not the child had watched *The Transporters* DVD were assessed in a hierarchical stepwise regression analysis to assess whether they predicted change in recognising *Transporters* stimuli and real face stimuli. The outcome measures used in this regression analysis were the scores from *The Transporters* posting tasks plus level 1 stories added together to make a combined *Transporters* stimuli score. Similarly, the scores from posting real human faces plus level 3 stories were added together to make a combined real face stimuli score. A change score for each of these measures was then calculated by subtracting Time 1 scores from Time 2 scores. The change scores for *The Transporters* stimuli and the real face stimuli were used as outcome measures in the regression analysis.

Also of interest was to examine whether the more episodes of *The Transporters* a child watched, the more they improved. A correlation was carried out within the groups of children who watched *The Transporters* DVD (both the ASC + *Transporters* and TD + *Transporters* groups) between number of episodes watched and change scores.

5.2.6 Hypotheses

- Children with ASC who watch *The Transporters* DVD will improve more in measures of emotion recognition than children with ASC who watch *Jimbo* or who receive no intervention.

- Typically developing children will have better emotion recognition scores than children with ASC at Time 1 and Time 2 in all measures.
- Typically developing children will improve in their emotion recognition after watching *The Transporters* DVD.
- Children (TD & ASC) who watch *The Transporters* DVD will improve on emotion recognition measures that use *Transporters* stimuli, and will generalise their learning to the emotion recognition measures that use real human face stimuli.
- Parents will be more satisfied with *The Transporters* DVD than the *Jimbo* DVD and will notice more improvements in their child.
- Watching *The Transporters*, age, IQ, verbal IQ, autism symptom severity, hyperactivity and anxiety will predict outcome.

5.3 Results

Non-parametric tests were used for statistical analyses due to the small sample sizes and because some of the outcome measures were not normally distributed and there was not equality of variance. The results for all outcome measures are summarised in Table 5.3.

Group	Post Transp		Post Real		Level 1		Level 2		Level 3		VABS Soc	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
ASC + No Intervention	11.36 (2.20)	11.72 (1.42)	10.55 (3.39)	12.45 (2.25)	5.36 (1.29)	5.09 (1.81)	5.36 (1.96)	5.27 (1.56)	5.09 (1.04)	6.36 (1.02)	74.69 (9.66)	77.38 (17.04)
ASC + Transporters	11.71 (2.20)	12.71 (1.54)	11.29 (2.43)	12.64 (2.02)	4.57 (1.40)	5.64 (1.60)	5.00 (1.52)	5.29 (1.68)	4.93 (1.77)	5.79 (1.92)	70.16 (8.45)	71.50 (9.33)
ASC + Jimbo	10.79 (2.94)	11.07 (2.46)	10.50 (2.47)	11.86 (3.21)	5.71 (1.73)	5.00 (2.39)	5.57 (1.83)	5.14 (1.61)	5.14 (1.35)	6.14 (1.51)	75.25 (13.64)	79.87 (10.73)
TD + Transporters	11.27 (3.20)	12.47 (1.88)	11.47 (2.48)	12.87 (1.77)	5.73 (1.28)	6.60 (1.35)	5.47 (1.46)	6.07 (1.67)	6.07 (0.88)	6.46 (1.46)	106.19 (13.67)	107.19 (16.10)

Table 5.3. Mean scores and standard deviations (in brackets) for all tasks

5.3.1 Post-box tasks

<u>Transporters stimuli</u>

Results from the post-box tasks showed that there were no significant differences between any of the groups in the number of *Transporters* faces they posted into the correct box at Time 1. At Time 2, a Kruskal-Wallis test showed there was a significant difference between the four groups in posting *Transporters* faces (X^2= 8.54, df= 3, p= 0.036). A further Kruskal-Wallis test including only the three ASC groups showed that the difference between these three groups was approaching significance at Time 2 (X^2= 5.67, df= 2, p= 0.059) but was not significant at Time 1. There were no significant differences between the TD +*Transporters* group and the combined ASC participants at Time 1 or Time 2.

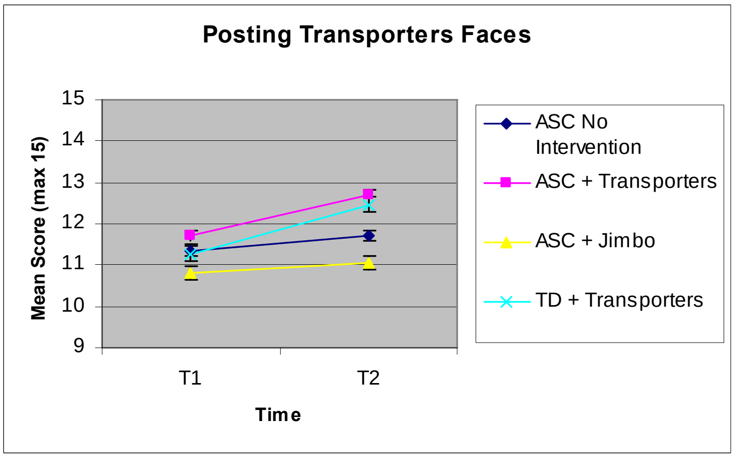

Figure 5.5. Time 1 and 2 scores for posting Transporters faces [bars represent S.E.**]**

Examination of Figure 5.5 suggests that the TD + *Transporters* and the ASC + *Transporters* groups score higher than the other two groups at Time 2. Further examination of group differences using Mann Whitney U tests using a Bonferroni correction showed that these differences were not significant.

Within-group changes were assessed using the Wilcoxon Signed Ranks test and showed that the scores of the TD + *Transporters* group increased significantly between Time 1 and Time 2 (z= -2.18, n-ties= 13, p= 0.029), whereas none of the ASC groups improved significantly between Time 1 and Time 2. Nevertheless, this effect size was small (r= -0.13).

Real face stimuli

Results from posting real human face pictures are shown in Figure 5.6. There were no significant differences between any of the groups at Time 1 or Time 2. There were no significant differences between the TD +*Transporters* group and the combined ASC participants at Time 1 or Time 2.

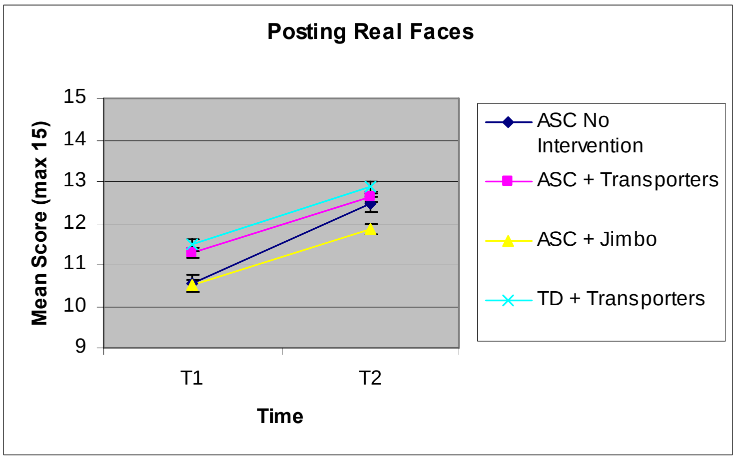

Figure 5.6. Time 1 and 2 scores for posting real faces [bars represent S.E.**]**

Within-group comparisons using the Wilcoxon Signed Ranks Test showed that scores increased significantly between T1 and T2 for the ASC + *Transporters* group (z= -2.51, n-ties= 16, p= 0.012), the ASC + *Jimbo* group (z= -2.12, n-ties= 18, p= 0.034) and the TD + *Transporters* group (z= -3.01, n-ties= 14, p= 0.003). All these effect sizes were small (r= 0.16; r= 0.12 and r= 0.18, respectively).

5.3.2 Stories tasks

As some of the children did not pass the practice story scenario described in section 7.2.5, not all of the children who participated in the study completed the story tasks.

The number of participants in each group who completed the stories is shown in Table 5.4 below.

ASC + *Transporters*	ASC + *Jimbo*	ASC + No intervention	TD + *Transporters*
N= 16	N= 14	N= 11	N= 15

Table 5.4. Number of participants who completed story tasks in each group

<u>Level 1 stories</u>

The Kruskal-Wallis test showed no significant differences between any of the groups at Time 1 or Time 2 in scores on the Level 1 stories (stories that were taken from *The Transporters* DVD). There were no significant differences between any of the ASC groups at Time 1 or Time 2. There were no significant differences between the TD + *Transporters* group and the combined ASC participants at Time 1 but the TD + *Transporters* group scored significantly higher than the combined ASC groups at Time 2 ($U= 174.00$, $z= -2.32$, $p= 0.02$) though this effect size was negligible ($r= 0.03$).

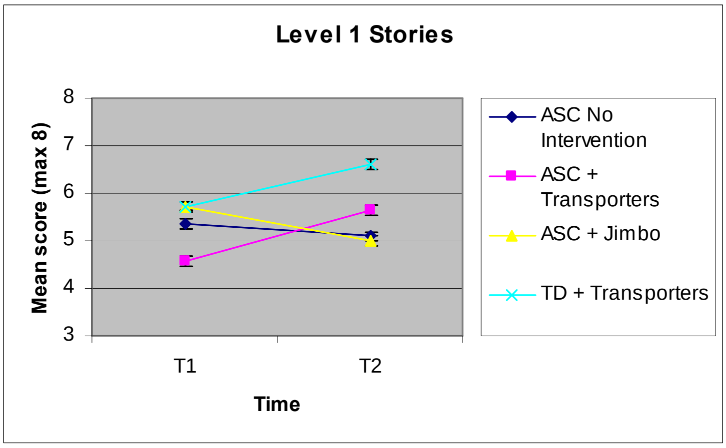

Figure 5.7. Time 1 and 2 scores for Level 1 stories [bars represent S.E.]

Examination of Figure 5.7 suggests that the ASC + *Transporters* and the TD + *Transporters* groups improved in Level 1 stories while the other two groups who did not watch the DVD did not improve. Within-group comparisons using the Wilcoxon

Signed Ranks Test showed that this improvement was only significant for the ASC + *Transporters* group ($z= -2.32$, n-ties= 10, $p= 0.020$) but this effect size was small ($r= 0.17$).

Level 2 stories

The Kruskal-Wallis test showed no significant differences between any of the groups at Time 1 or Time 2 (see Figure 5.8). There were no significant differences between any of the ASC groups at Time 1 or Time 2. There were also no significant differences between the TD +*Transporters* group and the combined ASC participants at Time 1 or Time 2. The Wilcoxon Signed Ranks Test showed no significant changes for any of the groups between Time 1 and Time 2.

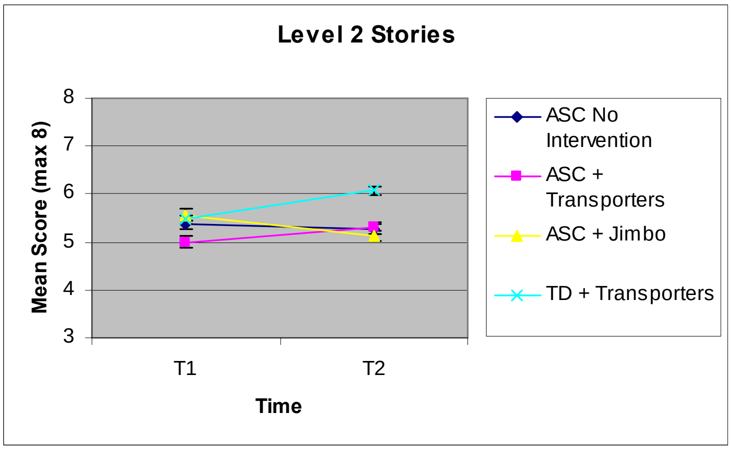

Figure 5.8. Time 1 and 2 scores for Level 2 stories [bars represent S.E.**]**

Level 3 stories

The Kruskal-Wallis test showed no significant differences between any of the groups at time 1 or time 2. There were no differences between any of the ASC groups at Time 1 or Time 2. There was a significant difference between the TD + *Transporters* group and the combined ASC groups at Time 1, ($U= 188$, $z= -2.38$, $p= 0.017$), but not at Time 2 (see Figure 5.9).

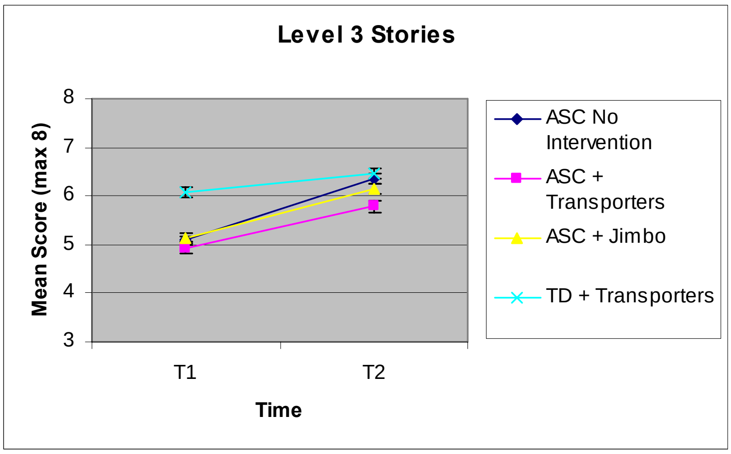

Figure 5.9. Time 1 and 2 scores for Level 3 stories [bars represent S.E.**]**

The Wilcoxon Signed Ranks Test showed that there was a significant improvement in scores between Time 1 and Time 2 for the ASC + *Jimbo* group (z= -2.27, n-ties= 14, p= 0.023) and the ASC + no intervention group (z= -2.23, n-ties= 10, p= 0.023). The effect sizes for both of these changes was small at r= 0.13 for both groups.

5.3.3 Combined scores

Due to the small sample size in the stories tasks, a combined score for tasks using *Transporters* stimuli and tasks using real face stimuli were evaluated. These were calculated as described in section 5.2.5 for predictors of outcome, i.e. *Transporters* score was calculated by adding scores from *The Transporters* post-box task plus scores from Level 1 stories, if this task was completed. The real face score was calculated by adding scores from the real face post-box task plus scores from Level 3 stories. For each of these the maximum total score was 23. Results for the different groups in *Transporters* scores are shown in Figure 5.10.

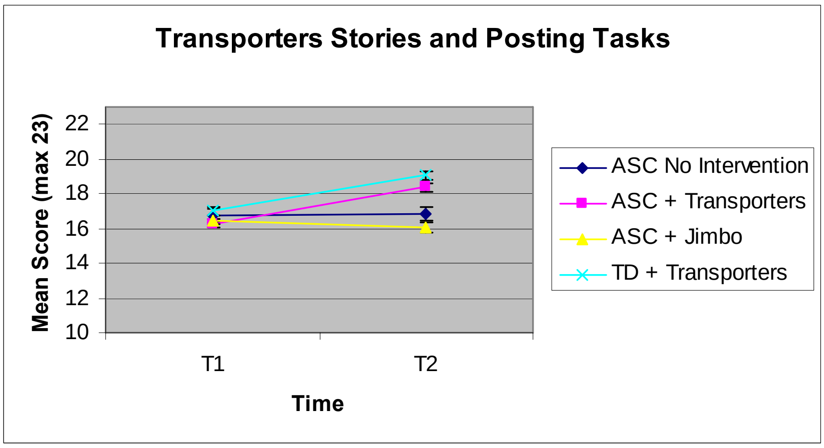

Figure 5.10. Combined *Transporters* scores at Time 1 and Time 2 [bars represent S.E.**]**

Combining these results shows the difference between the four groups more clearly. At Time 1 there are no significant differences between any of the groups. At Time 2 the Kruskal-Wallis test shows that there is a significant difference between the four groups (X2 (3) = 9.05, p= 0.029). Figure 5.17 indicates that this difference is a result of the TD + *Transporters* and the ASC + *Transporters* groups scoring higher than the other two groups at Time 2, however, a further Kruskal-Wallis test showed no significant differences between the three groups with ASC at Time 1 or Time 2. There was a significant difference between the TD + *Transporters* groups and the combined ASC groups at Time 2 (U= 280.00, z= -2.50, p= 0.013). Within-group comparisons using the Wilcoxon Signed Rank test shows that the TD + *Transporters* group improved significantly between Time 1 and Time 2 (z= -2.72, n-ties= 17, p= 0.006) though the effect size was small (r= 0.16). The ASC + *Transporters* group improved to a degree that was approaching significance (z= -1.87, n – ties= 18, p= 0.062).

Results for the combined scores on real face tasks are shown in Figure 5.11. The typically developing group scored significantly higher than the ASC groups combined at Time 1 (U= 319.00, z= -1.976, p= 0.048) but not at Time 2. There were no significant differences between any of the ASC groups at Time 1 or Time 2. Within-group comparisons using the Wilcoxon Signed Ranks test showed that all groups improved significantly between Time 1 and Time 2: ASC + *Transporters* (z= -2.01, n-ties= 18, p= 0.044); ASC + *Jimbo* (z= -2.53, n-ties= 17, p= 0.012); TD + *Transporters* (z= -2.90, n-ties= 16, p= 0.004); ASC + no intervention (z= -1.93, n-ties= 16, p= 0.054).

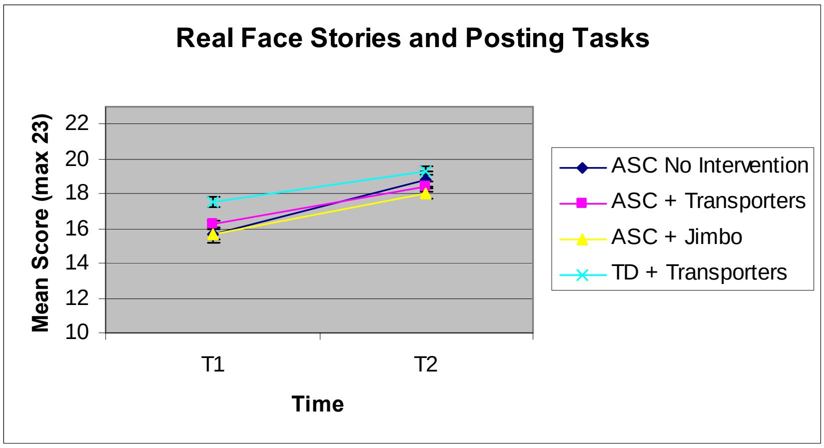

Figure 5.11. Combined real face scores at Time 1 and Time 2 [bars represent S.E.**]**

5.3.4 Socialisation domain of the Vineland Adaptive Behaviour Scale

Results showed no significant differences between any of the groups with ASC at Time 1 or Time 2. There was a significant difference between the ASC groups combined and the TD + *Transporters* group at both Time 1 (U= 14.50, z=-5.79, p<0.001) and Time 2 (U= 58.50, z= -5.12, p <0.001). There were no within group changes in this measure for any of the groups.

5.3.5 Parent evaluation

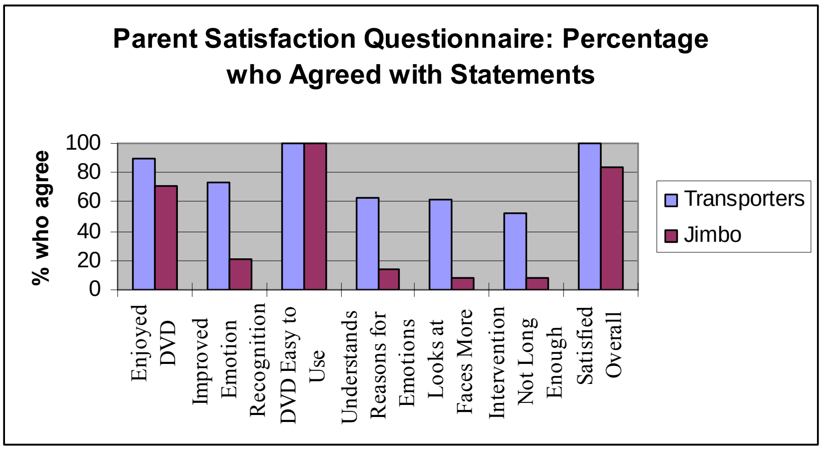

Figure 5.12. Results from parent satisfaction questionnaire

<u>Parent satisfaction with *The Transporters* and *Jimbo*</u>

Figure 5.12 shows the percentage of parents who agreed or strongly agreed with the statements in the DVD evaluation questionnaire. A chi square test was used to assess whether there were any group differences in the scores given on the evaluation questionnaire. Table 5.5 gives the number of parents agreeing and disagreeing with the items in the evaluation questionnaire.

		Enjoyed DVD		DVD easy to use		Improved in emotion recognition		Improved understanding of reasons for emotions		Looks at faces more		4 week intervention is long enough		Overall Satisfaction	
	Total	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Disagree	Agree	Unsatisfied	Satisfied
Transporters	19	2	17	0	19	5	14	7	12	7	12	10	9	0	19
Jimbo	14	4	10	0	14	11	3	12	2	12	2	2	12	3	11
Total	33	6	27	33	33	16	17	19	14	19	14	12	21	3	30

Table 5.5. Number of parents agreeing and disagreeing with evaluation questionnaire items.

A Bonferroni correction was applied to control for multiple comparisons so that a significance level of 0.05/7, or $p < 0.007$ was used. Results showed no significant differences in parent ratings of child enjoyment of the DVDs, how easy the DVDs were to use, or whether the intervention period was long enough. There were also no significant differences in ratings of overall satisfaction with the DVDs.

Significantly more parents in *The Transporters* group than the *Jimbo* group agreed that their child had improved in their ability to recognise emotions after watching the DVD X2(1)= 8.81, p= 0.004. Similarly, significantly more parents in *The Transporters* group than the *Jimbo* group agreed that their child had improved in understanding the reasons for emotions $X^2(1)= 7.88$, p= 0.006. Also, significantly more parents in *The Transporters* group than the *Jimbo* group agreed that their child looks at faces more after watching the DVD $X^2(1)= 7.88$, p= 0.006.

Based on the odds ratio, if their child watched *The Transporters* rather than *Jimbo*, parents were 10.26 times more likely to agree that their child had improved in their understanding of the reasons for emotions, they were 10.26 times more likely to agree that their child had improved in emotion recognition and 10.26 times more likely to agree that their child looked at faces more after watching the DVD.

5.3.6 Predictors of outcome

A hierarchical multiple regression analysis was used to assess characteristics that predicted outcomes for both *Transporters* stimuli and real face stimuli separately. This was done only for participants with ASC. In the first stage, any predictor variable that correlated significantly with the outcome variable at $p < 0.2$ was entered into the model (as recommended by Altman, 1991). Suppressor variables, which were those that correlated highly with the other predictors in the model ($p < 0.01$), but were not correlated significantly with the outcome measures were also included. Table 5.5 on the following page shows a correlation matrix for all predictor variables.

	Age	ELC	RL	GARS AQ	ADHD	Anxiety	Transporters Change	Real Face Change
Age	1							
ELC	-0.073 (p = .595)	1						
RL	-0.163 (p < .236)	0.911** (p < .001)	1					
GARS AQ	-0.142 (p = .321)	-0.216 (p = .128)	-2.63 (p = .062)	1				
ADHD	0.122 (p = .385)	-0.061 (p = .664)	-0.072 (p = .609)	0.273 (p = .057)	1			
Anxiety	0.056 (p =.684)	0.442** (p = .001)	0.328* (p = .015)	0.062 (p = .668)	0.268 (p < .053)	1		
Transporters Change	-0.337* (p= .012)	0.159 (p = .246)	0.237 (p =.081)	0.004 (p = .979)	-0.088 (p = .530)	0.094 (p = .497)	1	
Real Face Change	0.068 (p = .621)	0.309* (p = .022)	0.289* (p =.032)	-0.432** (p = .002)	-0.320* (p = .019)	0.129 (p = .348)	0.037 (p = .755)	1

Table 5.6. Correlation matrix for predictors of outcome

For change in score for *Transporters* stimuli, a stepwise multiple regression analysis was carried out including the predictor variables of age, Mullen early learning composite, receptive language, anxiety and the binary code of whether the child had watched *The Transporters* DVD or not. These variables were entered into the model in a stepwise fashion. The order of entering the variables was of no importance as only the variables that were significant were included in the model. The regression model is shown in Table 5.6 below, and the only variables that predicted change scores for *Transporters* stimuli was age and whether or not the child had watched *The Transporters*.

		B	SE B	β	R^2	Δ R^2	F change	df	sig F change
Step 1									
	Constant	4.657	1.646						
	Age	-0.076	0.029	-0.337	0.114	0.114	6.802	1,53	0.012
Step 2									
	Constant	4.530	1.585						
	Age	-0.083	0.028	-0.367					
	Watched *Transporters*	1.387	0.605	0.287	0.195	0.081	5.256	1,52	0.026

Table 5.7. Hierarchical regression model for predictors of change in *Transporters* stimuli

The younger the child's age, the more he/she improved in their recognition of *Transporters* stimuli. If the participant watched *The Transporters* they also improved more. Together, these variables predicted 19.5 % of the variance.

For change in score for real face stimuli, a stepwise multiple regression analysis was carried out including the predictor variables of GARS AQ, Mullen early learning composite, receptive language, ADHD, and whether the child had watched *The Transporters*. These variables were entered into the model in a stepwise fashion. The order of entering the variables was of no importance as only the variables that were significant were included in the model. The regression model is shown in Table 5.7. The variables that predicted outcome for real face stimuli were receptive language and GARS AQ. Together these predicted 25% of the total variance.

		B	SE B	β	R^2	Δ R^2	F change	df	sig F change
Step 1									
	Constant	-1.063	1.331						
	Receptive Lang	0.067	0.032	0.289	0.084	0.084	4.282	1,47	0.044
Step 2									
	Constant	8.468	3.216						
	Receptive Lang	0.039	0.031	0.166					
	GARS AQ	-0.092	0.029	-0.427	0.251	0.167	10.254	1,46	0.002

Table 5.8. Hierarchical regression model for predictors of change in real face stimuli

Within the group of children who watched *The Transporters* (both TD and those with ASC) it was of interest to see whether the more episodes the child watched, the greater their improvement. A correlation between number of episodes watched and change scores was carried out. There were no significant correlations between number of episodes of *The Transporters* the child watched and their change scores for *Transporters* stimuli, real face stimuli or the Vineland socialisation domain.

5.4 Discussion

The aim of this study was to assess the success of *The Transporters* DVD as a way to teach basic emotion recognition to young children with ASC and very young typically developing children.

It was hypothesised that children with ASC and TD children who watched *The Transporters* DVD would improve more in measures of emotion recognition than children with ASC who watched a comparison DVD called *Jimbo* that was not designed to teach emotion recognition, and children with ASC who received no intervention. It was also hypothesised that children with ASC would score lower and improve less than TD children. These hypotheses were tested by assessing children before and after a 4 week intervention period on several emotion recognition tests at different levels of generalisation. The results from these tests will be described in turn.

5.4.1 Post-box tasks

The two posting tasks were designed with little language requirement and involved posting pictures of faces into the correct post box (*happy*, *sad*, *angry*, *afraid*, *surprise*). There were two levels in this task: the first level used stimuli from *The Transporters* DVD. Improvement in this task between Time 1 and Time 2 would suggest that children could learn the emotional expressions used in the DVD series. The second task was designed to assess generalisation of learning and involved posting pictures of real faces taken from the Ekman stimuli.

<u>Transporters stimuli</u>

It was hypothesised that children with ASC who watched *The Transporters* would improve more than the control groups with ASC who watched a comparison DVD or had no intervention in posting *Transporters* faces. Results supported this hypothesis. There were no differences between the ASC groups at Time 1, but after intervention, at Time 2, the ASC + *Transporters* group scored higher than the other two ASC groups and although this difference approached significance ($p<0.06$), it narrowly missed being significant. It may have been significant with a larger sample size.

When the TD + *Transporters* group were included in the analysis, the difference between the groups at Time 2 became significant. The TD + *Transporters* group improved significantly in their scores between Time 1 and Time 2, after having watched *The Transporters* DVD. None of the ASC groups showed a significant improvement between Time 1 and Time 2. This suggests that the TD group learned more from watching *The Transporters* than the ASC + *Transporters* group.

In summary, typically developing children who watched *The Transporters* improved in their recognition of *Transporters* stimuli. Children with ASC who watched *The Transporters* also improved in their ability to recognise *Transporters* stimuli, but this was not significant. Given the results from Golan et al (Golan et al., in preparation) one might draw the conclusion that *The Transporters* is a useful method for typically developing children at younger ages and for children with ASC at older ages, a pattern that warrants further attention.

Real face (Ekman) stimuli

It was hypothesised that children with ASC and TD children who watched *The Transporters* DVD would improve more than controls in their recognition of emotions on real faces, i.e. it was hypothesised that emotion recognition from *The Transporters* would generalise.

Results did not support this hypothesis. No significant differences between the groups were found before or after the intervention period, suggesting that, at this young age, watching *The Transporters* did not generalise to real life faces in the posting tasks.

Moreover, all groups apart from the ASC + no intervention group improved significantly between Time 1 and Time 2 in posting real faces. This suggests that children receiving some form of intervention improved in their ability to recognise real human faces, whereas those receiving no intervention do not. The fact that children in the *Jimbo* group improved suggests that watching *The Transporters* DVD did not improve recognition of real human faces more than a comparison children's cartoon series. Perhaps being part of an emotion recognition study and being given a DVD to watch makes parents more aware of emotions in daily life and this enables children to learn more about real human expressions. Perhaps the emotional content in ordinary children's cartoons is sufficient to increase emotion recognition skills. Regardless of the reason for the improvement in the *Jimbo* group, it suggests that learning from *The Transporters* DVD does not generalise to real faces.

5.4.2 Stories tasks

The post-box tasks were designed to assess emotion recognition with no context and limited language requirements. To assess understanding of emotions from context, story scenarios were used. Here, children were required to listen to a situation (also shown in a picture) and choose the accompanying face that expressed the appropriate emotion for the situation from a choice of three faces. Some children with poor receptive language could not complete this task, so the sample sizes for these assessments were lower.

There were three different types of stories to assess understanding at three different levels of generalisation. Level 1 stories were scenarios that were shown in *The Transporters* DVD series. This level was designed to assess simple learning of emotions shown in *The Transporters* series. Level 2 stories were designed to assess close generalisation of learning and were novel scenarios that were not included in *The Transporters* but that used *Transporters* characters and *Transporters* faces. Level 3 stories were scenarios that were novel, based in real life, and the faces used were real faces, not faces from *The Transporters*. This level was designed to assess generalisation of learning to real human faces. It was hypothesised that children who watched *The Transporters* would improve more than control groups in their understanding of Level 1, 2 and 3 stories, as was found in previous research evaluating *The Transporters* for 4-8 yr olds. However, this hypothesis was not supported.

For Level 1 stories, results showed that there were no significant differences between any of the groups at Time 1 or Time 2. There were also no significant differences between any of the ASC groups at Time 1 or Time 2. However, within-group analyses showed that the ASC + *Transporters* group improved significantly in their scores between Time 1 and Time 2, though the effect size was small. This suggests that children with ASC who watched *The Transporters* could learn about scenarios seen in the DVD and remember the emotions that the characters felt in the different situations they had seen, supporting hypotheses. Typically developing children who watched *The Transporters* also seemed to improve between Time 1 and Time 2, but this was not significant.

Results from Level 2 stories found no significant differences between any of the groups at Time 1 or Time 2. There were also no significant changes within any of the groups over the course of the intervention period. This suggests that generalising from *The Transporters* DVD to novel scenarios but familiar characters was difficult, even for typically developing children.

This lack of generalisation was also apparent for Level 3 stories, which were novel and used real life faces and scenarios. There were no differences between any of the ASC groups at Time 1 or Time 2. The fact that the TD children and the children with ASC who watched *The Transporters* did not score higher than controls at Time 2 suggests that learning from *The Transporters* did not generalise to emotion recognition from real life contexts. In addition, within-group comparisons showed a significant improvement between Time 1 and Time 2 only in the ASC + *Jimbo* group and the ASC + no intervention group, suggesting that more improvement occurs in emotion recognition from real life contexts if you do not watch *The Transporters* DVD.

This finding was the exact opposite of the hypotheses, and contrasts with previous findings that in older children, learning from *The Transporters* did generalise to recognising emotions in real life scenarios. The reason for this could be that the scenarios used in *The Transporters* DVD relate to vehicles and their adventures. These scenarios might be difficult to relate to every day life. Children who do not watch the DVD but are still part of the study may learn more about real life scenarios just because their parents were more aware of emotions and highlighting emotional situations as a result of taking part in the study. Children who were watching *The Transporters* may have only learned about *Transporters* characters as their parents thought they were getting sufficient intervention.

Another possibility is that children who were watching *The Transporters* may have expected to be asked about *Transporters* characters and *Transporters* scenarios. They may therefore have been confused when they were asked about real life scenarios as it was something unexpected. Another explanation for this finding could be that the Level 3 stories used at Time 2 were easier than the stories used at Time 1. The pilot study suggested that this was not the case, but this study only had a small sample size and was not done with participants with ASC. Perhaps the scenarios used at Time 2 were easier. However, the typically developing children did not improve in their scores between Time 1 and Time 2 suggesting that this might not be the case. If the stories were easier at Time 2 then you would expect typically developing children to improve as well.

Interestingly, the TD + *Transporters* group scored significantly higher than the ASC groups combined at Time 1 level 3 stories but not Time 2 stories. This suggests that typically developing children found it easier to recognise emotions from real life contexts than children with ASC, consistent with previous research that suggests children with ASC find emotion recognition harder than typically developing children (Hobson, 2005). However, the TD + *Transporters* group did not improve significantly in their scores between Time 1 and Time 2, suggesting that watching *The Transporters* did not generalise to improving learning to real life contexts for typically developing children, and this group was not scoring at ceiling level, so there was room for improvement.

Reasons for this could be that the typically developing children in this study were significantly younger than the ASC participants. At an average age of 3 ½ years, these children would only just be reaching the developmental stage in which they begin learning about the reasons for emotions and the contexts of emotions (Denham, 1998), compared to the ASC participants who were a year older on average. It was therefore unlikely that typically developing children would be ready to learn about contextual information pertaining to emotions, as they were too young. The posting task did not require any contextual understanding and so these children were able to learn about faces in *The Transporters* DVD and real life faces. However, the typically developing children were scoring at above chance levels in the story tasks, suggesting that they were able to use contextual information to learn about emotions.

In summary, it seems that watching *The Transporters* did not help improve emotion recognition from real life contexts. Whether this was due to a domain-specific lack of generalisation (i.e. in social-emotional behaviour) or a result of a general deficit in generalisation (e.g. category formation) needs to be tested explicitly. This lack of generalisation also extended to adaptive social skills on the Vineland Adaptive

Behaviour Scale socialisation domain. No significant differences were found between the groups in this measure at Time 1 or Time 2, and there were no significant improvements within groups on this measure. This finding is not surprising given that the intervention specifically targets emotion recognition rather than social skills more generally. Also, the intervention period was only 4 weeks, which is a very short time for any improvement to be seen in adaptive social skills. Moreover, the measure may not have been sensitive enough to pick up on any changes.

5.4.3 Combined *Transporters* and real face scores

Combined scores for emotion recognition tasks using *Transporters* stimuli or real face stimuli were assessed in an attempt to clarify the above findings. The advantage of doing this was an increased sample size, but the disadvantage was a lack of detail. Combining the post-box and stories tasks into one score meant that it was not possible to distinguish results from the tasks that used contextual information from the tasks that did not.

For combined scores, results showed that the typically developing children did not score significantly higher than the ASC participants at Time 1 for *Transporters* stimuli. This was contrary to the hypothesis that TD children find emotion recognition easier than children with ASC. Nevertheless, TD children did score significantly higher than the ASC participants for real face stimuli at Time 1. This suggests that *The Transporters* stimuli were harder for typically developing children to understand, so they were not at their usual advantage over children with ASC in recognising emotions on *Transporters* faces. It is unclear why this might be the case, but it may be due to the outline of the faces of *Transporters* stimuli not being the usual outline of a face (i.e. the faces in *Transporters* stimuli were framed within a vehicle, whereas the real face stimuli were framed within a normal human head). This may have been confusing or distracting. Another possibility is that the faces used in *The Transporters* were not as clear examples of the particular emotions they were supposed to express as the real human face stimuli. Despite all faces used in this study being validated by a panel of adults and children, *The Transporters* stimuli have not been subject to such rigorous validation by previous research as the Ekman stimuli or the *Mind Reading* stimuli. Future research should be carried out to validate *The Transporters* stimuli more rigorously. Research should also be carried out to assess whether *Transporters* stimuli are more difficult to recognise, and if so, what aspects of the stimuli make them so.

Only the children who watched *The Transporters* DVD improved in their recognition of emotions from *Transporters* stimuli. This suggests that both typically developing children and children with ASC can learn equal amounts about emotions expressed on *Transporters* faces. However, for real face stimuli, there were no significant differences between the groups. In fact, all groups improved significantly between Time 1 and Time 2. This suggests that there may have been a practice effect of repeating the same tasks twice for real face stimuli, but not for *Transporters* stimuli. Again, it may be because *The Transporters* stimuli were images of real human faces presented within a vehicle. As this is not something children come across in everyday life, these types of stimuli may have been less easy to learn about and so may not have been open to practice effects.

Alternatively, being part of an emotion recognition study may have caused parents to highlight emotional situations at home more. This would have given children more opportunity to practice emotion recognition from real life faces at home, simply because their parents were more aware of emotions as a result of taking part in the study. Children may have been exposed to more emotions on real life faces during the course of the study and this may explain the significant improvement in scores for all children in real life faces between Time 1 and Time 2. It was noticed informally that several parents of children with ASC were often surprised and concerned by their child’s difficulty with the emotion recognition tasks at Time 1. This may have influenced the parents to highlight emotions to their child in every day life situations.

Only the children who watched *The Transporters* had practice at recognising emotions on *Transporters* faces and results suggest that this familiarity was necessary to learn about these types of faces. Practising emotion recognition on real life faces may not enable children to become familiar with emotions presented on *Transporters* stimuli.

The bottom line of these findings is that children who watched *The Transporters* did learn to recognise emotions on *Transporters* faces but they did not improve more than controls in their recognition of emotions on real faces. This suggests that learning from *The Transporters* did not generalise for typically developing children or children with ASC. Also, emotions presented in *Transporters* faces may be harder to learn about, perhaps because of their unusual nature, or perhaps because they use less valid emotional expressions.

5.4.4 Parent evaluation

It is interesting that despite findings from direct testing that showed little generalisation of learning to real human faces after watching *The Transporters*, parents whose children watched *The Transporters* were more likely to agree that their child had improved in emotion recognition, understanding the reasons for emotions and looked at faces more after having watched *The Transporters* than parents whose child watched *Jimbo*. This could be interpreted in one of two ways. Firstly, it may be that the direct testing materials used did not pick up on the improvements made by children who watched *The Transporters*. Perhaps the artificiality of the test materials did not tap the learning that was seen in daily life by the parents. Secondly, it may be that because the parents in *The Transporters* group were not blind to group allocation, their expectations biased their reports on the satisfaction questionnaire. Future research would benefit from evaluating two types of emotion intervention, so that parents in each group would expect equal improvement and therefore be equally biased.

5.4.5 Predictors of outcome

Predictors of outcome were assessed to evaluate which child characteristics predicted outcome in children with ASC. Outcome measures for this analysis were the change scores of Time 2 – Time 1 for the combined scores for *Transporters* stimuli (posting *Transporters* faces + level 1 stories) and combined scores for real face stimuli (posting real faces + level 3 stories).

Results showed that age and whether or not the child watched *The Transporters* predicted outcome for *Transporters* stimuli: young age and watching *The*

Transporters predicted more improvement. This suggests that watching the DVD helps children recognise *Transporters* stimuli. The finding that the younger you are, the more you improve may be because younger children have had less life experience of emotions and so have more to learn. Alternatively, it may be that the brain is more capable of learning at a younger age. Another explanation could be that watching *The Transporters* is more motivating for younger children so they attend to the DVD more and therefore learn more. Distinguishing between these possibilities is important future research. It also relates to other intervention studies which show age as a predictor of outcome (Harris & Handleman, 2000) and pertains to the recommendation that intervention in ASC should start as early as possible (National-Research-Council, 2001).

For real life faces, age was not a predictor of outcome; neither was watching *The Transporters* DVD. The fact that watching *The Transporters* did not predict outcome for real life face scores reiterates the finding of limited generalisation. Autism symptom severity and receptive language ability did predict outcome for real life faces. Higher receptive language and lower autism symptom severity predicted improvement in real life face scores. This finding is consistent with previous studies showing that receptive language and autism symptom severity predict outcome in psychosocial interventions (Gabriels et al., 2001). It is unclear why age did not predict outcome here, as this has been a significant predictor of outcome in previous intervention studies (Harris & Handleman, 2000). It is also unclear why different child characteristics should predict outcome for *The Transporters* stimuli and the real face stimuli. Future research should investigate this further in a study that compares children's recognition of emotions from *Transporters* stimuli and real face stimuli.

5.4.6 Comparison with previous research

It is interesting to compare these results with previous research evaluating *The Transporters* for older children with ASC, between 4-8yrs old. That study showed that children with ASC who watched *The Transporters* improved significantly more in their recognition of emotions from context at all levels of generalisation (familiar stories and characters used in the DVD, familiar characters from the DVD in novel scenarios, and real human faces in novel scenarios). Moreover, the children with ASC who watched *The Transporters* caught up to the levels of typically developing children who did not watch the DVD but did the tasks twice.

It is possible that this study found generalisation whereas the current study did not because the participants in the current study were younger. However, age correlated negatively with outcome on *Transporters* stimuli, so younger children improved more in their scores. This is relevant to the current recommendations for early intervention, but it does not help explain the difference in findings between the two studies. Also, age did not correlate with change in scores on real human face stimuli, suggesting that it may not be a young age that caused a lack of generalisation in the current study. Nevertheless, the older children in the first study may have been able to use the quizzes on the DVD more than the younger children. The quizzes required considerable attention and language understanding, and were optional in both studies. Children in the current study rarely used the quizzes and parents reported them as being too difficult for their young children. Perhaps in the first study the older children were able to use the quizzes more, and therefore learned more from the DVD and were better able to generalise. Future research should evaluate the active elements of the DVD: perhaps the quizzes are necessary for learning to occur.

It is important to examine the methodological differences between the two studies. The first study was carried out with 4-8yr olds. There were three groups, matched on age and language ability: a group of children with ASC who watched *The Transporters* DVD every weekday for 15 minutes over 4 weeks; a group of children with ASC who received no intervention and a typically developing control group who did not watch the DVD but were tested twice. Children were tested on their definition of emotion words, and on story scenarios similar to those used in this study. There are several key differences in the stimuli used in the story scenarios in both studies. The first study used animated faces that moved, whereas the current study used still pictures of faces. This was because still faces were necessary to assess emotion recognition in the posting task, and because the participants in the current study lived all over England it was not practical to carry a heavy touch-screen around (which would have been necessary to show the animated faces). It may be that because the faces used in *The Transporters* DVD are animated, generalisation of learning to testing situations would be easier if the test stimuli are also animated. Also animated faces are much more ecologically valid. They are more similar to real life faces and so may facilitate generalisation further. A future research project should use animated stimuli to assess the success of *The Transporters* DVD for young children with ASC.

A further difference between the first study and the current study is the number of emotions tested. The first study tested all 15 emotions used in the DVD, whereas the current study only assessed 8 emotions. Based on previous research, emotions for the current study were chosen that were within the understanding of typical 2-5 year olds. The other emotions included in the DVD such as proud, jealous, ashamed were deemed too advanced for 2-5 year olds to learn about. Perhaps if these extra emotions were tested then greater effect sizes would have been found, and greater differences between the groups would have shown up.

5.4.7 Limitations and future directions

There were several limitations to this study. Firstly, the sample sizes were small, particularly for the story scenarios. Perhaps with a larger sample size the effect sizes found in this study would have been greater and group differences would be clearer. The intervention period of 4 weeks may not have been long enough for very young children. A longer and/or more intense intervention period may have shown more significant results. Furthermore, the researchers who carried out the assessments were not blind to group allocation. This may have biased results, and future studies should use assessors who remain blind to group allocation. Parents were also aware of their child's group allocation, which may have biased their reports of effectiveness.

In terms of the stimuli used in the tasks, future studies should assess learning using animated faces rather than still faces to see if this taps the skills learned in the DVD more. Also, it is important to assess generalisation of learning to real life contexts outside of the 'laboratory'. Parents reported that their child improved in their recognition of emotions at home, they looked at faces more, and they understood reasons for emotions more. This may have been a result of parental bias, but it is important for future research to assess emotion recognition in real life contexts, perhaps by measuring the number of emotion words used in a structured play scenario, or by using gaze tracking to measure whether children look more at faces in naturalistic social situations after watching *The Transporters*.

Given the importance of emotion recognition skills in future social competence, it would be of great importance to carry out a long-term follow up of the success of *The Transporters* into later childhood and adolescence. Do children who watch *The Transporters* at a young age show improved emotion recognition at long-term follow up or is any improvement short lived? Do young children who watch *The Transporters* have better social skills in the school playground in later childhood than children who do not watch the DVD? These are all important questions.

Future research should also examine whether using the quizzes on the DVD results in more learning than simply watching it, i.e. finding out the ‘active ingredients’ of the DVD. Another important future study would be a comparison of *The Transporters* with other emotion recognition interventions, particularly those that teach emotions in real life contexts. Also of interest would be to evaluate the success of *The Transporters* in combination with other teaching approaches, such as group discussions about emotions. Such teaching approaches comparing the scenarios in *The Transporters* with scenarios experienced in the daily lives of children may help generalisation.

A further observation relevant to these results and that raises questions for future research is that some children in the ASC + *Transporters* groups loved watching the DVD, while others hated it, and had to be bribed to stay in the room and watch it. This violent reaction to the DVD may be due to its unnatural nature, i.e. in real life trams and buses do not have human faces. Children with ASC who like rule-governed, predictable events may not have liked the unnatural nature of a human face on a vehicle. They may like cartoon faces on cartoons (e.g. in Thomas the Tank Engine) but may not understand real faces on cartoons. This may have prevented them from learning from the DVD. In contrast, other children in the study loved watching the DVD and often became obsessed with it and watched it a lot. It would be of interest to carry out a study to investigate which children like the DVD and which children hate it. Perhaps children with more severe forms of ASC dislike it more, and perhaps children with HFA or AS love the DVD. If a child hates it or loves it, we need to find out what aspects they hate or love and why. If we know this, then we will better placed to ascertain which children are likely to benefit from watching the DVD.

Differences in preference for systematic materials may be a factor in whether or not children like the DVD and learn from it. Future research should measure preferences for systemising, perhaps by developing a children's version of the systemising quotient. Information from such a measure and measures of how much children like vehicles and *The Transporters* DVD itself may help explain individual differences in performance. If children with a strong preference for systemising also rate the systematic elements of the DVD as highly enjoyable, then it may be the systemising nature of the DVD that is preferred. If these children then go on to improve more in emotion recognition than children who do not have a preference for systemising then this might start to imply that a preference for systemising is the reason behind the improvement.

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This then leads to the question of why should systemising help learning in children with ASD? It could be due to the fact systematic materials are more enjoyable and therefore children attend more, and are more motivated to learn. Alternatively, presenting materials in a systematic fashion to children who are good systemisers may make the information more accessible and easier to learn about. Future research should try to distinguish between these possibilities.

One way to help answer the question could be to assess the systemising abilities of children taking part in interventions that employ systematic or non-systematic materials. You could hypothesise that there are individuals who show a preference for systematic materials but are not very good at systemising (let's call these individuals SS) and individuals who do not have a preference for systemising, but are nevertheless good systemisers (let's call these individuals NS). There may also be individuals who do not have a preference for systematic materials and are not good systemisers (let's call these people NN). These individual differences in preference for systematic materials and ability in systemising could be measured and related to outcomes in interventions that uses systematic materials (e.g. *The Transporters)* and or non-systematic materials (e.g. an equivalent DVD that does not use vehicles or predictable movement but does teach emotion recognition). Whether or not systemising is the active element for an intervention might be made a little clearer by this type of research.

Another difficulty with interpreting the results of this study is the lack of females in the research. It may be that gender plays a role in systematic preferences. There were very few girls in this study, and it may be the case that girls with autism like systems and *The Transporters* less than boys and may therefore be less motivated or less able to learn. Females in the typical population are less attracted to systems {Baron-Cohen, 2003 #2627}; however, research has shown that girls with autism do not show the typical preference for female toys and show some masculinisation of toy preference {Knickmeyer, 2008 #3270}. This means that girls with ASC might show an atypical interest in systematic materials and therefore enjoy watching *The Transporters*. Future research should investigate this.

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Despite the limitations of this study, it is encouraging in that it has shown that children with ASC do learn from *The Transporters* DVD, and most of them enjoyed watching it, presumably because of its systematic nature. One limitation of the DVD seems to be its limited generalisation to real life scenarios and future research is needed to evaluate this further.

It is possible that using systemising in real life contexts may be both motivating and enable generalisation. The next study evaluates a social skills intervention that uses the systematic appeal of LEGO® in a naturalistic play context to facilitate learning about social skills for children with ASC.

Chapter 6: Using LEGO® therapy to teach social skills

6.1 Introduction

LEGO® therapy is a social skills approach that is naturalistic, theoretically based, child-friendly, relatively low-cost and easy to implement. It is for school-age children and adolescents with ASC that has the potential to be widely used in both school and clinic settings. It was developed by Dan LeGoff, a clinical psychologist in Philadelphia, following informal observations of children with ASC who enjoyed building LEGO® (LeGoff, 2004). He noted that otherwise uncommunicative and aloof children initiated spontaneous social contact about their LEGO® sets if this set of toys was available in the waiting room of the clinic. Based on this observation, he organised small group therapy sessions for children with ASC and typically developing siblings who worked together on LEGO® projects collaboratively.

The methods used in LEGO® therapy are described fully below. A typical project would be to build a LEGO® set, with the variation of dividing the labour. One child acts as the "engineer", one is the "supplier" and the other is the "builder". The children have to communicate and follow social and behavioural rules conceived by the group to complete the LEGO® build. Each activity requires verbal and non-verbal communication, collaboration, joint problem solving, joint creativity and joint attention to the task. For most members, participating in the group was inherently rewarding and no external rewards were required (LeGoff, 2004). This contrasts with behavioural interventions that typically rely on external rewards for compliance.

LEGO® therapy relates to the empathising-systemising theory of ASC that was described in Chapter 1 (Baron-Cohen, 2002; Baron-Cohen, 2003; Baron-Cohen, 2006). For typically developing individuals, empathising is the psychological mechanism used in understanding social situations, for example sympathising with a person who is upset because their cat just died. Systemising is the psychological mechanism used in understanding rule-governed situations, for example when putting up a shelf strong enough to hold heavy books. Individuals with ASC find highly predictable objects and rule-governed events (i.e. systems) highly attractive. In contrast, they find social situations (i.e. those involving empathising) very challenging. The idea behind LEGO® therapy is to use the attraction of a systematic and predictable activity to motivate learning about empathising skills in a naturalistic setting.

When considering the recommendation to adapt children's natural interests to promote learning in other areas that was discussed in Chapter 3 (Attwood, 1998; Koegel, 1995; Koegel & Koegel, 1995) it is interesting to note that the focus of obsessive interests in ASC are nearly always those that incorporate systems (e.g. maths, computers, taxonomies, spinning objects such as fans, machines). LEGO® itself is a highly structured, predictable and systematic toy. It is therefore likely that children with ASC will be particularly motivated by tasks involving this toy. In fact, after rule-governed games, construction materials (such as LEGO®) have been found to be the next most effective means of facilitating complex social interactions in contrast to dramatic play and functional play (Dewey, Lord, & Magill, 1988). A social skills approach using LEGO® therefore is theoretically based in empathising-systemising theory and follows recommendations that interventions should use children's natural interests to promote learning within a naturalistic setting.

Previous research evaluating the effectiveness of LEGO® therapy has been carried out by LeGoff (2004). He found that after 24 weeks of LEGO® therapy (90 min group session and a 1hr individual session per week) significant improvement in social competence was found in 47 children on the autistic spectrum (LeGoff, 2004). No improvement in social competence was made while these children were on the waiting list for therapy (i.e. receiving no intervention). The strength of this study was in its outcome measures which were both direct observations and parent questionnaires. Children were observed in school play settings and it was found that both the frequency of initiating social contact and the duration of social interactions significantly increased following therapy. This finding suggests that the gains made during therapy did generalise to the school playground, a rare and important finding in this field of research. A further study showed that at 3-year follow up, participants receiving LEGO® therapy over the 3 year period improved significantly more on the Vineland Adaptive Behaviour Scale socialisation domain than controls who had received comparable non-specific educational therapy (LeGoff & Sherman, 2006).

These findings suggest that LEGO®© therapy is a promising intervention to improve social and communicative skills in children with ASC.

Independent replication of results is essential for any intervention evaluation (Schreibman, 2000). It is also of paramount importance in the field of autism intervention to have comparisons of different approaches to evaluate their relative effectiveness. This will enable parents and professionals to make informed decisions about which approach to use with each individual child. The present study was therefore an independent evaluation of the effectiveness of LEGO® therapy in comparison to another specific social skills intervention, the Social Use of Language Programme (SULP; Rinaldi, 2004) and a no intervention control group. SULP is a social-communication skills teaching approach for children with learning difficulties that is widely available in the UK. It is a story-based didactic teaching approach that is not based on systemising and is not a naturalistic approach, yet it uses fun teaching and activity based learning. SULP has yet to be empirically evaluated for use with children with ASC despite being widely used in mainstream and special needs schools in the UK.

It was hypothesised that LEGO® therapy would be a more successful social skills intervention for children with ASC than SULP due to being more motivating as a result of its systematic nature, and because it promotes learning in a naturalistic setting rather than a didactic teaching setting.

6.1.1 What is LEGO® therapy?

<u>Activities used in LEGO® therapy</u>

LEGO® therapy is a collaborative play therapy in which children work together to build LEGO® models. Instead of building LEGO® sets by themselves, children work in pairs or teams of 3. The task of LEGO® building is divided into different roles, such that social interaction is necessary to participate. LEGO® therapy can be held in both individual and group sessions during which natural opportunities are used to practice social communication, social support, social problem-solving and conflict resolution skills. In this thesis, LEGO® therapy was held in after-school group sessions only. Therapy occurred once a week for an hour, in groups of 3-6 children. There were 18 sessions in total over the course of 6 months.

The core of LEGO® therapy is a structured collaborative process. Children are motivated to work together by building LEGO® in pairs or small groups. A typical project may be to build a LEGO® set in groups of three, dividing the task into different roles. One child acts as the 'engineer' (describes the instructions), one is the 'supplier' (finds the correct pieces) and the other is the 'builder' (puts the pieces together). Children play their role for a certain length of time, or a certain number of steps in the instructions and then swap around. This division of labour with a common purpose inherently requires children to practice joint attention, turn taking, sharing, joint problem solving, listening, and general social communication skills. A further way of working together with LEGO® therapy involves 'Freestyle' LEGO® activities in which children design and build a model in pairs, for example, a space rocket. This provides opportunities for children to practice compromise, expressing their ideas clearly and taking other people's perspectives and ideas into account.

LEGO® therapy follows a progression of skill learning. Children start off building quick and simple instruction-based models in pairs or threes with constant adult supervision. Once children can build proficiently in a small group, they move on to more complex, longer term models that take a few sessions to build. Eventually, children are able to build together with minimal adult intervention. At this stage children can be given 'Freestyle' activities to do, as this is a less structured, more challenging way of working together.

<u>LEGO® club rules</u>

During LEGO® therapy children are asked to follow some 'LEGO® Club Rules' described below and are required to remind each other to adhere to the rules.

- Build things together
- If you break it you have to fix it or ask for help to fix it
- If someone else is using it, don't take it, ask first
- Use indoor voices - no yelling

- Keep hands and feet to yourself
- Use polite words
- Clean up and put things back where they came from
- Do not put Lego bricks in your mouth

<u>LEGO® therapist's role</u>

The therapist's role is not to point out specific social problems or rule-breaks or give solutions to social difficulties. Instead they are required to highlight the presence of a problem as and when it occurs. Children then have to identify the problem, and come up with their own solutions (with prompting from the therapist if necessary) which they practice together before continuing with their LEGO® building. For example, 'Johnny' is talking to 'Freddy' but 'Freddy' isn't listening:

Therapist:	"We have a problem here; can you tell me what it is?"
Johnny:	"Freddy isn't listening to me",
Therapist:	"Oh dear, how do you feel when Freddy isn't listening?"
Johnny:	"Really cross"
Therapist:	"Yeah, it might make you cross when someone isn't listening to you. Johnny, can you think of a way to help Freddy listen to you?"
Johnny:	"Say his name first?"
Therapist:	"Wow, that's a great idea! You could say his name to get his attention. Why don't we practice?"…

Solutions that children have come up with are practiced until they can do it, and the therapist can remind children of strategies in the future if similar difficulties arise. In an average session that lasted 1hr, several social issues would arise and the therapist would intervene approximately every 5 minutes. More intervention was required at the start of the study as children were getting used to the nature of building LEGO® in groups.

Rewards and LEGO® club levels

In LEGO® therapy, children are not externally rewarded for their participation. For most members participation in the activity is inherently rewarding. However, there are different levels of skill that can be attained in LEGO® therapy to acknowledge different levels of social participation. LEGO® Helpers are able to find bricks for another child and sort bricks according to shape or colour. LEGO® Builders are able to build models in a group and design freestyle models with adult help. LEGO® Creators are able to build models in groups and design freestyle models in pairs without adult intervention. LEGO® Masters can come up with their own ideas for group building activities, and can help the therapist solve social problems when they arise. Once children demonstrate the skills at a particular level, they are given a certificate which they can take home (see Figure 6.1).

Figure 6.1. Example of a LEGO Builder certificate

6.1.2 What is the Social Use of Language Programme?

The Social Use of Language Programme (Rinaldi) is a direct teaching approach based around stories, modelling, group activities and games. Social and communication skills that are covered include eye contact, listening, turn taking, proxemics and prosody. SULP teaches these skills using a specified framework for learning that begins with comprehension through stories about monster characters that experience a difficulty in one of these areas. Children then evaluate adult models of good and bad skills in that area and then practice the skills themselves and give each other feedback (e.g. thumbs up or marks out of 10). Learning is then extended by practising the target skill in the context of a game. SULP encourages children to understand the relevance of the skills they learn about to help improve generalisation of the skills to other contexts. Carry-over tasks to settings outside the group such as school or home are also given. Each therapy session covers a specific skill, for example eye contact. This skill may be practiced over several sessions before moving on to the next skill in the learning sequence, depending on how quickly the children demonstrate understanding. The skills are covered in the following order: good sitting, eye contact, listening, conversational turn-taking, conversational timing, personal space, speaking speed. There is overlap here with the skills addressed in LEGO® therapy (turn taking, personal space, listening, eye contact, LEGO® rules). The difference between the approaches is in the manner in which the skills are addressed. In LEGO® therapy the skills are taught as and when required and are practiced in a naturalistic setting. In SULP, the skills are taught in a didactic way, in structured activity sequences.

An example of an activity sequence in SULP for eye contact is as follows: comprehension of the importance of eye-contact is taught using a story about ‘Looking Luke’, a monster character who has difficulties with eye-contact (see Figure 6.2). His monster friends help him, and children in the group discuss the problems the monster had. An adult model of poor eye-contact and good eye-contact is then shown by the activity leaders and children are asked a series of questions to help them identify mistakes and correct the use of skills. Children then practice the skill themselves in series of games. For example in a game called ‘magic chair’, children get to sit in the ‘magic chair’ when they make eye contact with the activity leader. They are then rewarded in the chair with a look in a box at an interesting object, e.g. a bubble tube. The next level enables children to practice eye contact as listeners in a communicative context. Parents or teachers are then asked to promote good eye contact at home or school.

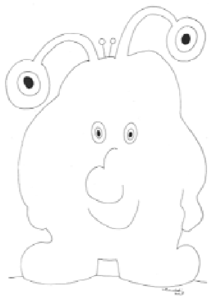

Figure 6.2. Looking Luke: a character to remind children about eye contact.

Rewards in SULP

SULP involves sitting and listening, so children were rewarded with a sticker chart (leading to sweets) for sitting in their chair, listening appropriately, and keeping their hands and feet to themselves. Without these rewards the sessions became difficult to manage.

6.2 Method

6.2.1 Participants

Participants were children with diagnoses of high functioning autism, Asperger Syndrome, autism or an autism spectrum condition between the ages of 6 and 11yrs. Diagnoses were made by a clinical psychologist, psychiatrist or paediatrician and were confirmed using the Autism Diagnostic Interview-Revised {ADI-R; \Lord, 1994 #959} for the children in the LEGO® and SULP groups or the Social Communication Questionnaire {SCQ; \Rutter, 2003 #3051} for the children in the control group (the full ADI-R was not used for children in the control group due to lack of human resources). Three children were excluded from the study as they did not meet diagnostic criteria on the ADI-R (see Figure 6.4).

All participants were recruited through the Autism Research Centre database, the Cambridge Asperger Outreach Clinic, Umbrella Autism (a local autism charity) and local primary schools. The research was approved by Cambridge University Psychology Research Ethics Committee and all parents gave written informed consent. Parents also filled in an initial background questionnaire, to gather information about demographics, education and development.

Children were included in the study if they were between 6 and 11 years old, had an IQ >70 and were able to speak in phrases. In this study, it was assumed that some language ability was a prerequisite for explaining both the rules of LEGO® therapy and to use the materials in SULP. Additionally, inclusion criteria specified that children were currently receiving no other interventions apart from mainstream education, and had no additional diagnoses of childhood psychiatric disorders. Some children in the study were receiving speech and language therapy, occupational therapy or were following a special diet. Most children were receiving some form of educational support, usually 1:1 support from teaching assistants. The number of children in each group receiving additional intervention and educational support is given in Table 6.1.

<u>Participants in the intervention groups</u>

Initially, participants were recruited for the LEGO® and SULP groups only. The study was described to parents as an evaluation of two types of social skills programme (LEGO® therapy and the Social Use of Language Programme). LEGO® and SULP groups were run without a no intervention control group due to concerns about high attrition rates in a no intervention group. The no intervention control group were recruited at a later date. Recruitment for the LEGO® therapy and SULP groups occurred in two phases due to the length of time it took to run therapy groups. Figures 6.3 and 6.4 are consort diagrams for the group make-up for the different recruitment phases. Complete data for 31 children (30 boys, 1 girl) was available for analysis at the end of the study.

<u>No intervention control participants</u>

Participants for the no intervention control group were recruited as part of a study examining parental attitudes to interventions and the development of social skills over six months. Parents were asked if the information collected in this study could be used as a comparison for the LEGO® therapy/ SULP participants, and were told they would be part of a control group for a study evaluating the effectiveness of social skills interventions for children with autism. Parents gave written informed consent for the use of their child's data in this way. Suitable data for 16 children (all boys) was available.

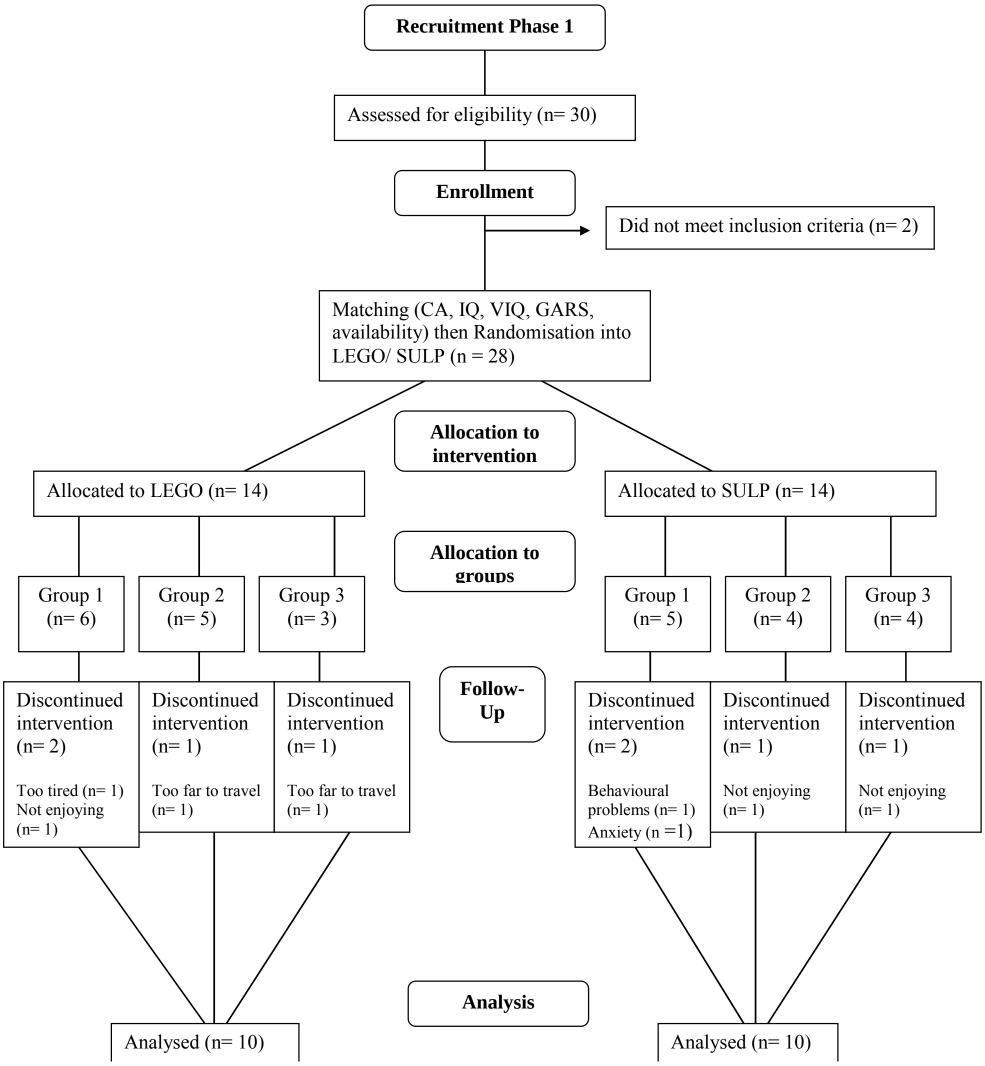

Figure 6.3. Consort diagram for recruitment phase 1

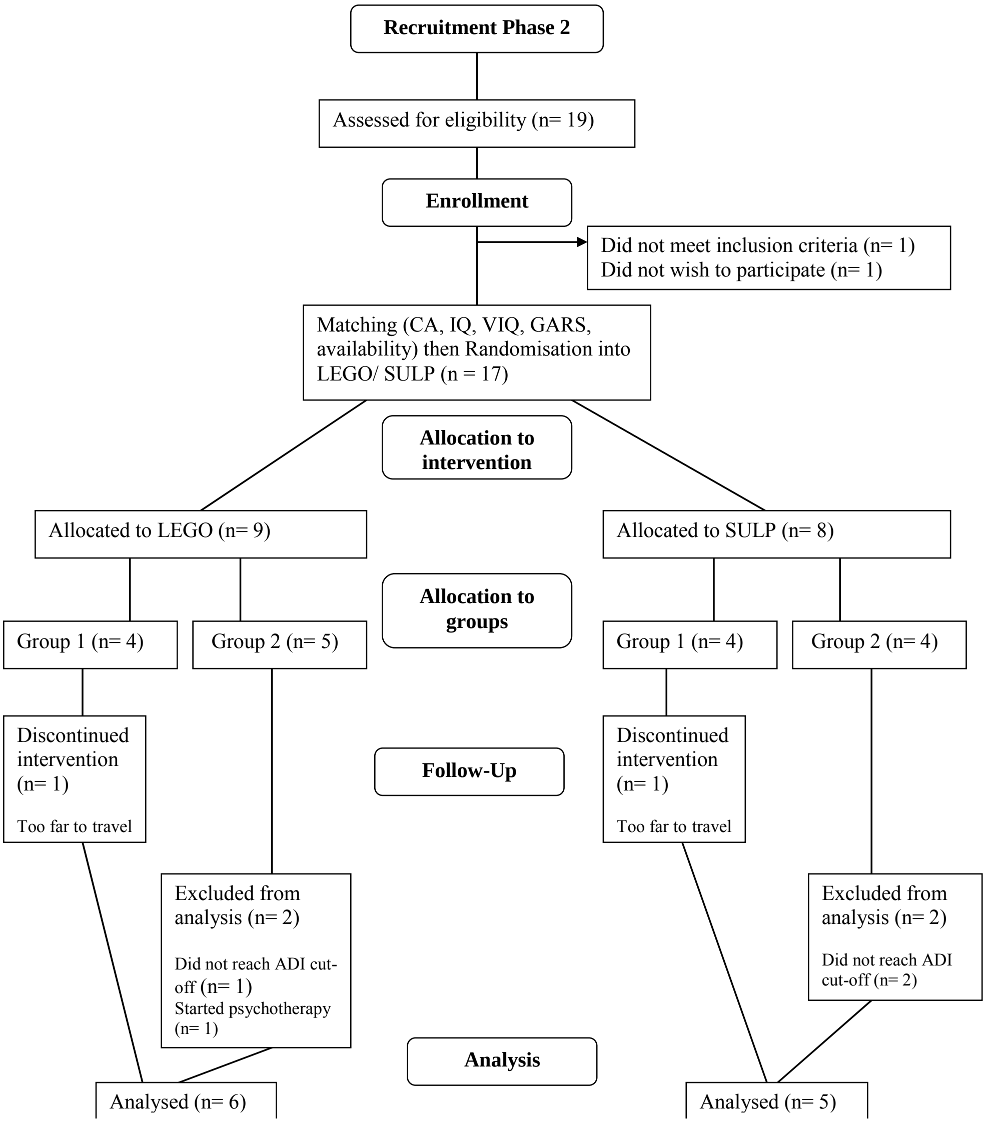

Figure 6.4. Consort diagram for recruitment phase 2

6.2.2 Matching and random assignment

For all groups, an initial assessment session was carried out. In this session IQ was measured using the Wechsler Abbreviated Scales of Intelligence (Wechsler, 1999) and parents completed the following questionnaires to assess autism symptom severity and co-morbid symptoms: the Gilliam Autism Rating Scale (Gilliam, 1995), the Spence Children’s Anxiety Scale (Spence, 2000) and the Conner’s ADHD index, (Conners, 2001). These were measured so that child characteristics that predicted outcome could be evaluated.

The intervention participants were matched into pairs based on availability to attend therapy, chronological age, IQ, autism symptom severity (GARS), and verbal IQ. Groups were run on different days, so availability had to be taken into consideration when matching. One child in each pair was randomly assigned to the LEGO® therapy group, and one to the SULP group. Children allocated to the LEGO® or SULP groups were then allocated a session to attend on a particular day. This was done based on availability and child age, so that children attended therapy with children of a similar age to themselves as far as possible.

The no intervention control participants were matched to the therapy groups on chronological age, full IQ, verbal IQ and autism symptom severity (GARS). The characteristics of the children in all three groups are described in Table 6.1.

		LEGO	SULP	No Intervention
N		16	15	16
Age (months)	mean	99.13	97.33	105.81
	SD	20.14	22.33	16.05
	ANOVA	*F(2,44)=0.82, p=0.45*		
Gender	Male	16	14	16
	Female	0	1	0
Gilliam Autism Rating Scale AQ	mean	81.75	86.27	93.19
	SD	16.39	13.53	18.23
	ANOVA	*F(2,44)=1.45, p=0.25*		
Full IQ	mean	113.93	106.87	108
	SD	16.97	17.15	14.48
	ANOVA	*F(2,43)=0.83, p=0.44*		
Verbal IQ	mean	110.4	100.62	100
	SD	16.24	22.62	15.61
	ANOVA	*F(2,41)=1.03, p=0.37*		
Diagnoses	HFA	5	1	2
	AS	8	8	11
	ASC	2	4	2
	A	1	2	1
Educational support	Part time 1:1 TA	4	4	8
	Full time 1:1 TA	7	4	2
	Inclusion unit	1	3	2
Additional intervention	SALT	3	4	7
	OT	0	0	4
	Medication	0	0	0
	GF/CF diet	1	0	1

Table 6.1. Characteristics of participants [HFA= high functioning autism; AS= Asperger Syndrome; ASC= autism spectrum condition; A= autism; TA= teaching assistant support; SALT= speech and language therapy; OT= occupational therapy; GF/CF= gluten free, casein free]

Deleted:

n
CA (months)
Gender
Full IQ
Verbal IQ
GARS AQ
Diagnosis
Educational Support
Additional Intervention

6.2.3 Running the therapies

Children attended therapy for 1hr per week for 18 weeks after school. In the first phase of the study, groups were run six times per week (3 sessions of each therapy). In the second phase, groups were run four times per week (2 sessions of each therapy). Therapy sessions were run after school by myself with the help of one or two undergraduate volunteers. Each session was individually planned and carefully evaluated. Taking into account the holidays, the total duration of the study was 5½ - 6 months for both phases, during which children received 18 hour long therapy sessions. The control group data was collected over the course of 5½ to 6 months.

<u>Training</u>

To learn how to carry out the different therapies, I attended a week long training course in Philadelphia with Dr. LeGoff to learn the techniques used in LEGO® therapy and attended a two-day SULP training course in the UK. I also used a draft

LEGO® therapy manual produced by Dr. LeGoff and followed the SULP manual (Rinaldi, 2004). After learning the different therapies, I ran a one-day training session for the undergraduate volunteers, which included information about the nature of autism, working with children in general and how to implement the specific therapies. Unfortunately, as I was the only one carrying out the therapies, treatment fidelity could not easily be measured. However, I followed the manuals and planned every therapy session carefully and evaluated them afterwards. This constant referral to the manuals ensured that therapy was implemented correctly.

6.2.4 Outcome measures

Both indirect parent questionnaire measures and direct observation measures were used to evaluate outcome following intervention. All measures were taken immediately before the start of intervention (Time 1) and after 5½ months time (18 therapy sessions; Time 2). In the control group, outcome measures were taken at the start (Time 1) and end (Time 2) of a 5½ - 6 month period.

Direct measures were only taken in the therapy groups and not in the no intervention control group. This was because the no intervention control group was recruited at a later date, and the participants lived away from Cambridge. This meant that travel to schools or travel to an observation centre was difficult. In addition, these children were not part of any group where they met each other: they were strangers. As a result, their interactions with each other in a structured play setting could have been qualitatively different to the interactions of the children in the LEGO® or SULP groups simply because they had not met each other before. For this reason direct observations in a structured play setting did not seem appropriate. All indirect and direct measures used in the study are described below:

<u>Vineland Adaptive Behaviour Scale (Sparrow et al., 1984).</u>

This is a semi-structured parent interview that measures adaptive behaviour in several domains. The ‘Socialisation’ domain, ‘Communication’ domain and the ‘Maladaptive Behaviour’ domain were used as outcome measures in this study. For further details of this measure please see Chapter 4.

In the LEGO® therapy/ SULP groups, Vineland measures at Time 1 in the first recruitment phase of the study were carried out by myself before the children were randomly assigned to therapy. Subsequently I started running the therapy sessions so was aware of the type of therapy the children were receiving. To prevent bias, a research assistant blind to group allocation carried out the interviews at Time 2. The same research assistant carried out interviews at both time points in the second recruitment phase of the study. She continued to be blind to group allocation. A third research assistant, also blind to group allocation, carried out interviews for the control group participants. Inter-rater reliability was calculated by independently coding 20% (6) of the interviews. Intra-class correlations were excellent (0.97; $p < 0.001$).

Gilliam Autism Rating Scale Social Interaction Subscale; GARS SI (Gilliam, 1995).

The Social Interaction subscale of this measure was chosen as an indication of social skills specific to autism. This measure was also used in the original evaluations of LEGO® Therapy (LeGoff, 2004). For details of this measure, please see Chapter 4.

Observation in a structured play setting

Children attended an hour-long structured play setting in an observation room at the start, middle and end of intervention. The observation room was a small playroom with hidden cameras in three corners. Children's interactions were videotaped and later coded for the following play behaviours: adult interaction, unoccupied, independent solitary play, parallel aware play or associative play. This measure is described fully in Chapter 4, but it should be reiterated that the existence of a hi-tech observation room was only discovered half-way through the intervention period for the first recruitment phase of the study. This meant that data for some children was only collected at the middle and end of the intervention period, and not the start. Children who were recruited in the second phase of the study were observed at the start, middle and end of the intervention period.

Observations in the school playground

To provide a measure of skill generalisation in a naturalistic setting, children in the LEGO® therapy and SULP groups were observed in the school playground before and after intervention. Twenty-one children who lived locally and who gave consent were observed in the school playground at break time. There were 10 minutes of suitable data available for each child at both Time 1 and Time 2. The frequency of self-initiated social interactions and the duration of all social interactions were measured to give an overall indication of social functioning. Full descriptions of the observations are given in Chapter 4.

Parent satisfaction and child enjoyment.

Parents of children in the two therapy groups were given an evaluation questionnaire at the end of the study. They were asked to rate their satisfaction on a scale of 1 (unsatisfied) to 10 (very satisfied) and were asked to agree or disagree with the following statements: 'There is a need for more groups like this to be provided'; 'I would recommend groups to other parents'; 'My child made a friend as a result of the groups'; 'I noticed improvements in my child following therapy'. After each statement, parents were asked to give comments and there was space for further comments at the end of the questionnaire. Parents filled in this questionnaire after the final therapy session and posted it back.

In the final therapy session, children were asked to score the groups out of 10 for enjoyment (1= didn't enjoy it; 10= really enjoyed it) by circling a number on a piece of paper. The therapists left the children to fill in the questionnaire by themselves after having explained how to do it.

6.2.5 Child characteristics that might correlate with outcome

Child characteristics that might correlate with intervention outcome were measured and included IQ, verbal IQ, age, autism symptom severity, anxiety and hyperactivity. The measures used to assess these characteristics are described in Chapter 4. These measures were correlated with change scores (i.e. Time 2 – Time 1 scores) for the whole sample for the indirect outcome measures. As direct measures from the school playground were available only for the LEGO®/SULP participants, the no intervention control group were not included in the correlation analysis with this measure. The structured play observation measure was not analysed because the sample size for these data was very small. A full regression analysis was not carried out due to the small sample size in this study.

6.2.6 Hypotheses

- Children receiving LEGO® therapy would improve more than the SULP group in the socialisation and maladaptive behaviour domains of the VABS and the GARS-SI due to the naturalistic and motivating nature of teaching social skills in LEGO® therapy compared to SULP.
- Both intervention groups would improve more than children receiving no intervention on all measures.
- Children in the LEGO® group would increase more in time interacting with peers and in proximity with peers than the SULP group due to the interactive nature of LEGO® therapy.
- Children in the LEGO® therapy group would report higher levels of enjoyment than children in the SULP group due to the systematic nature of the materials used.
- Parents would report higher satisfaction with LEGO® therapy than SULP because their children may find it more enjoyable.
- Children in the LEGO® therapy group would show more generalization of skills to the school playground than children in the SULP group due to the more naturalistic learning approach used in LEGO® therapy.
- Child characteristics of age, IQ, verbal IQ, autism symptom severity, anxiety and hyperactivity would all correlate with outcome.

6.3 Results

Due to the small sample size, non-parametric tests were used for statistical analyses. The results for indirect outcome measures are shown in Table 6.2 and described below.

	Outcome Measure	LEGO		SULP		No-Intervention	
		Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
GARS	Social interaction mean standard score (S.D.)	7.94 (2.70)	7.44 (2.20)	8.60 (2.97)	9.27 (2.66)	8.75 (2.91)	9.75 (3.36)
VABS	Socialisation mean standard score (S.D.)	70.56 (12.13	75.94 (14.86)	63.73 (11.63)	71.33 (12.63)	67.19 (11.51)	69.69 (13.23)
	Communication mean standard score (S.D.)	87.25 (14.89)	91.88 (18.83)	74.13 (18.47)	83.13 (16.34)	82.5 (23.94)	76.06 (17.17)
	Maladaptive behaviour mean raw score (S.D.)	17.75 (9.43)	13.81 (5.23)	19.31 (7.89)	16.69 (5.79)	23.19 (6.15)	22.75 (5.52)

Table 6.2. Summary of results from indirect outcome measures for the three groups

6.3.1 Gilliam Autism Rating Scale-social interaction subscale

Figure 6.5 shows the change in GARS-SI scores at Time 1 and Time 2 for all groups. There was a trend for the LEGO® group to improve on this scale while the other groups did not improve. The Kruskal-Wallis test showed no significant differences between the groups at time 1 ($\chi2$= 0.844, df= 2, p= 0.66) but there was a significant difference between the groups after intervention, at time 2 ($\chi2$= 5.85, df= 2, p= 0.05). The Mann-Whitney U test showed that the LEGO® group scored significantly lower than both the no intervention group, (U= 71.5, z= -2.15, p<0.05) and the SULP group (U= 70.50, z= -1.98, p<0.05) at Time 2, though the effect size of these differences were very small (r= -0.069 for LEGO® vs. no intervention and r= -0.064 for LEGO® vs. SULP). Within-group analyses using the Wilcoxon Signed Ranks test showed that there were no significant increases or decreases in GARS-SI scores for any of the groups. It is interesting to note that the mean GARS-SI score for all participants is below 10, which is the average level of disturbance of social interaction for a child with autism on this measure (Gilliam, 1995). This suggests that the severity of social interaction difficulty of the participants in this study is at an average or below average level for the autistic population.

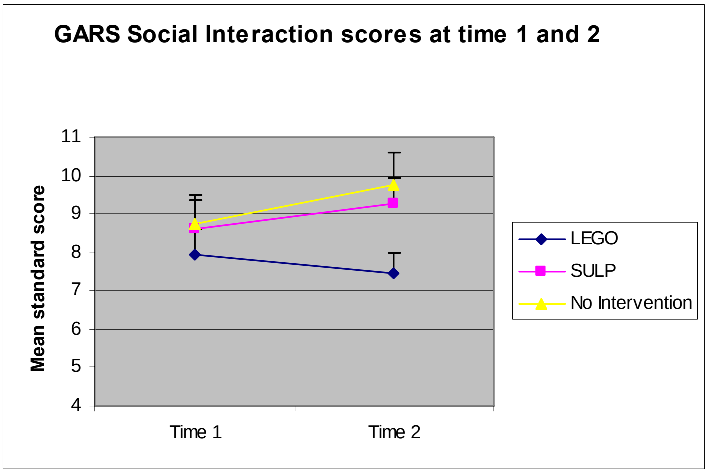

Figure 6.5. GARS Social Interaction Scores [bars represent S.E.]

6.3.2 Vineland Adaptive Behaviour: socialisation domain

Figure 6.6 shows the change in the socialization scale of the VABS. Contrary to hypotheses, there were no significant differences between the groups at Time 1 or Time 2; however, there was a trend for the intervention groups to improve more than the no intervention control group, though social skills remained in the moderately low or low adaptive levels for all participants (Sparrow et al., 1984). Within-group analyses using the Wilcoxon Signed Ranks test showed that the SULP group improved significantly in socialisation ($z = -2.27$, $p < 0.05$, n-ties= 15) whereas the other groups did not, but this was a small effect size ($r = -0.15$).

Figure 6.6. Socialisation domain scores [bars represent S.E.]

6.3.3 Vineland Adaptive Behaviour Scale: communication domain

Figure 6.7 shows the change in the communication scale of the VABS. There were no significant differences between the groups at Time 1 or Time 2; however, there was a trend for the intervention groups to improve while the control group deteriorated slightly. Within-group analyses using the Wilcoxon Signed Ranks test showed that the SULP group improved significantly in communication ($z = -2.77$, $p < 0.01$, n-ties= 14) whereas the other groups did not, though this effect size was small ($r = 0.18$). It can be seen from Figure 6.7 that the LEGO® group mean score was within adequate adaptive levels for the communication domain, whereas the SULP and no intervention groups had a moderately low adaptive level for communication at start and end of intervention (Sparrow et al., 1984).

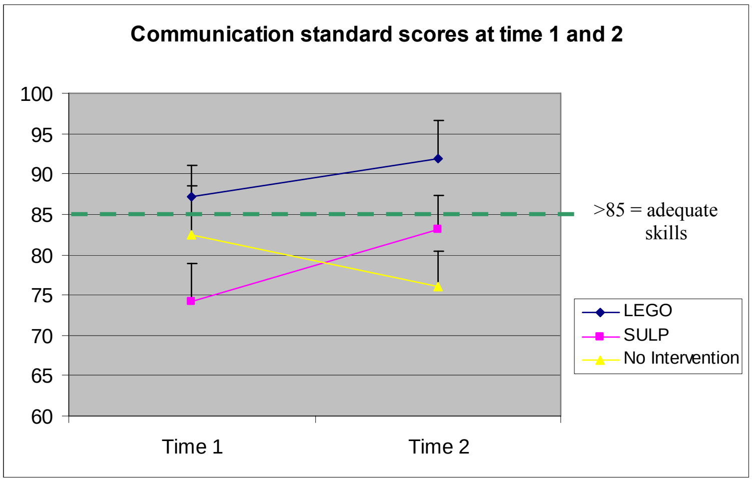

Figure 6.7. Communication domain scores [bars represent S.E.]

6.3.4 Vineland Adaptive Behaviour Scale: maladaptive behaviour domain

Figure 6.8 shows the change in the maladaptive behaviour scale of the VABS. The Kruskal-Wallis test showed no significant differences between the groups at Time 1, though the control group had higher maladaptive behaviour scores at Time 1 and 2 (though this was non-significant). At Time 2, after intervention, there was a significant difference between the three groups ($\chi 2= 14.57$, df= 2, $p= 0.01$). The Mann-Whitney U test showed that at Time 2 the no intervention control group had higher maladaptive behaviour scores than both the LEGO® therapy ($U= 32.5$; $z= -3.61$, $p <0.001$) and SULP groups ($U= 48.0$; $z= -2.46$; $p= 0.01$). Nevertheless, the effect size of these differences were very small ($r= -0.12$ for LEGO® vs. no intervention, and $r= -0.08$ for SULP vs. no intervention). Within-group analyses using the Wilcoxon Signed Ranks test showed that the LEGO® group improved significantly on this measure between Time 1 and Time 2 ($z= -2.16$, $p< 0.05$, n-ties= 15) whereas the other two groups did not, however, this effect size was small ($r= -0.14$). The improvement in the LEGO® group meant that this groups' level of maladaptive behaviour following intervention was approaching intermediate rather than clinically significant levels (Sparrow et al., 1984).

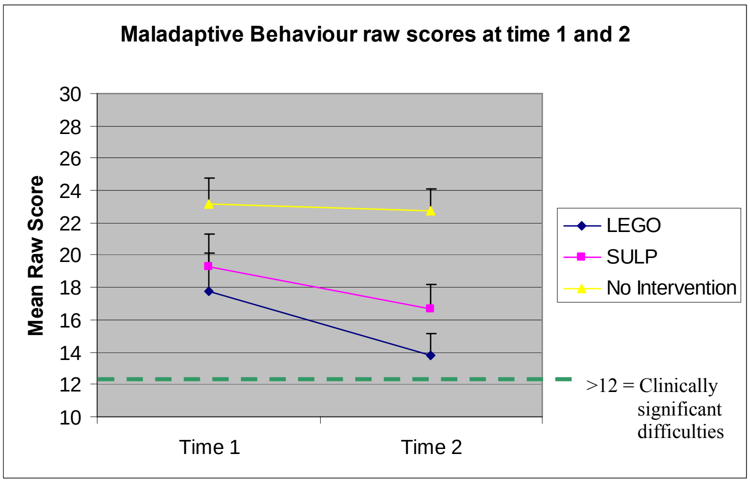

Figure 6.8. Maladaptive behaviour scores [bars represent S.E.]

6.3.5 Structured play observations

The mean percentage of time children in each therapy group spent in each of the play categories is shown in Table 6.3. No significant differences were found between the SULP and LEGO® groups in percentage of time spent interacting with peers or unaware of peers at any time point. There were also no within-group differences on any measures over time.

	LEGO			SULP		
	Time 1	Time 2	Time 3	Time 1	Time 2	Time 3
N	6	12	14	4	11	11
Mean % time spent in proximity with peers (S.D.)	48.50 (9.97)	36.58 (12.38)	42.01 (25.57)	45.23 (17.29)	58.45 (24.37)	47.50 (30.66)
Mean % unoccupied (S.D.)	0.28 (0.69)	0.47 (1.38)	0.057 (0.21)	0	1.03 (3.41)	2.12 (6.76)
Mean % independent solitary play (S.D.)	16.78 (12.35)	26.82 (18.04)	26.52 (24.37)	35.63 (3.78)	25.02 (19.50)	25.24 (15.63)
Mean % parallel aware play (S.D.)	29.45 (11.06)	25.46 (8.58)	31.67 (19.92)	24.37 (4.76)	26.98 (9.28)	25.07 (11.20)
Mean % associative play (S.D.)	45.41 (5.78)	35.19 (24.02)	33.17 (22.06)	22.47 (12.97)	36.36 (19.97)	39.87 (22.07)
Mean % adult interaction (S.D.)	8.05 (4.74)	9.31 (9.77)	6.06 (4.21)	16.05 (13.89)	8.86 (6.90)	7.65 (9.37)

Table 6.3. Social play and proximity direct measures for LEGO® and SULP.

6.3.6 Playground observations

Table 6.4 shows the mean frequency of initiating social interactions and the mean duration of all interactions in the school playground for the LEGO® therapy and SULP groups. There were no significant differences between the LEGO® therapy and SULP groups at Time 1 or Time 2 on frequency or duration of social interactions.

	LEGO		SULP	
	Time 1	Time 2	Time 1	Time 2
Mean freq. of self-initiated social interactions in seconds (S.D.)	9.09 (5.49)	8.81 (7.32)	8.40 (6.34)	7.20 (5.67)
Mean duration of social interactions in seconds (S.D.)	4.77 (2.25)	6.66 (3.54)	4.96 (2.30)	5.80 (2.30)

Table 6.4. School playground direct measures for LEGO® and SULP.

Figure 6.9 shows a trend for the LEGO® group to improve more in the mean duration of social interactions than the SULP group and within-group analyses using the Wilcoxon Signed Rank test showed a significant increase in duration of interactions for the LEGO® group (z= -1.988, p<0.05, n-ties= 10) but not the SULP group, though the magnitude of this change was small (r= -0.095).

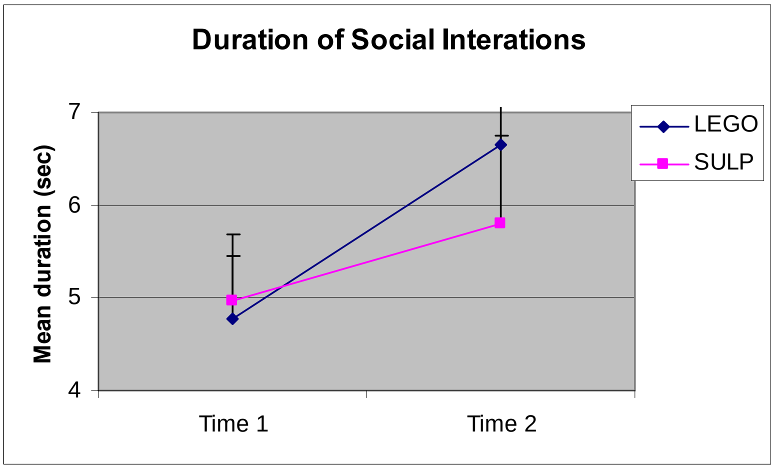

Figure 6.9. Duration of social interactions in the school playground [bars represent S.E.]

6.3.7 Parent satisfaction

There were no significant differences in mean parent satisfaction with the therapy between the two groups. Table 6.5 shows the percentage of parents who agreed with the statements about therapy in the satisfaction questionnaire. One hundred percent of parents in both intervention groups agreed with the statement, 'There is a need for more groups like this to be provided' and a very high percentage would recommend the groups to other parents. A high percentage noticed an improvement in their child's behaviour following intervention. More parents in the LEGO® group than the SULP group agreed that their child had made a friend as a result of the therapy groups.

	LEGO	SULP
There is a need for more groups like this to be provided	100%	100%
I would recommend the groups to other parents	100%	81%
My child made a friend as a result of the groups	67%	33%
I have noticed improvements in my child after therapy	94%	88%

Table 6.5. Percentage of parents agreeing to feedback statements about therapy.

A selection of parents' positive comments about the groups are summarised in Table 6.6 below.

LEGO	SULP
His favourite activity of the week	He usually hates organised activities, but enjoyed coming to this group
He has a club to go to where he really fits in. Usually he is a loner in social situations. A very good experience for him	He has raised self-esteem and confidence- he has more skill in coping with remarks from peers
It's great having some group/club that your child wants to come to and feels no stress about attending. This is a first	He showed a marked increase in his social skills during and after the group
He's become better at playing co-operatively and at conversations of mutual interest (but only when he's in the mood!)	It was a really positive event in the week that he looked forward to
We saw very significant improvement in behaviour at school, general happiness and compliance	He is more articulate, more able to wait to speak rather than talking over people

Table 6.6. A selection of positive feedback from parents about the two therapies.

6.3.8 Child enjoyment of therapy

There were no significant differences in the mean enjoyment scores of children in the LEGO® therapy and SULP groups, though there was a trend for children to give higher scores of enjoyment in the LEGO® group that was approaching significance ($U= 72$, $z=-2.05$, $p=0.06$). Eleven out of 16 children in the LEGO® therapy group gave an enjoyment score of 10/10, whereas only 5 out of 15 children in the SULP group gave 10/10 (see Figure 6.10).

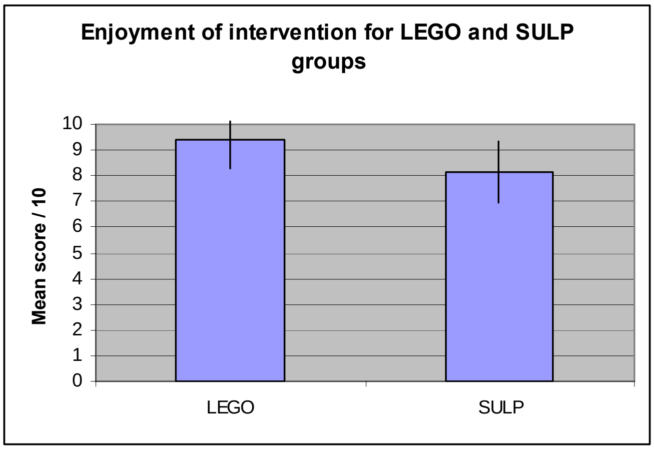

Figure 6.10. Enjoyment of intervention in LEGO® therapy and SULP

6.3.9 Correlations of child characteristics with outcome

Due to the large number of correlations being examined, a Bonferroni correction was used to establish significance levels. Table 6.7 shows a correlation matrix for the whole sample (n= 47) and indirect outcome measures. As there were 10 correlations being made a significance level of 0.05/10, or $p<0.005$, was used. Full IQ and verbal IQ are positively correlated. Autism symptom severity and hyperactivity symptoms are positively correlated. Verbal IQ and change in maladaptive behaviour are negatively correlated (an improvement, or decrease, in maladaptive behaviour will result in a negative change score, so the higher the verbal IQ, the greater the improvement, or decrease, in maladaptive behaviour).

	Age	Full IQ	Verb IQ	GARS AQ	ADHD	Anxiety	Maladaptive Beh Change	Socialisation Change	Communication Change	GARS-SI Change
Age	1									
Full IQ	-0.067 (p = .656)	1								
Verb IQ	-0.106 (p = 0.495)	0.825 * (p < 0.001)	1							
GARS AQ	-0.100 (p = 0.502)	-0.253 (p = 0.090)	-0.152 (p = 0.323)	1						
ADHD	0.060 (p = 0.694)	0.043 (p = 0.780)	0.138 (p = 0.377)	0.426* (p = 0.003)	1					
Anxiety	0.170 (p = 0.263)	0.141 (p = 0.362)	0.138 (p = 0.382)	0.470* (p = 0.001)	0.340 (p = 0.022)	1				
Maladaptive Beh Change	0.079 (p = 0.616)	-0.188 (p = 0.233)	-0.471* (p = 0.002)	-0.083 (p = 0.597)	-0.205 (p = 0.193)	-0.299 (p = 0.057)	1			
Socialisation Change	-0.323 (p = 0.027)	0.086 (p = 0.570)	0.047 (p = 0.764)	-0.174 (p = 0.243)	0.090 (p = 0.554)	-0.141 (p = 0.357)	0.010 (p=0.949)	1		
Communication Change	-0.171 (p = 0.252)	-0.166 (p = 0.272)	-0.097 (p = 0.530)	0.102 (p = 0.495)	0.040 (p = 0.793)	0.034 (p = 0.822)	-0.249 (p=0.108)	0.189 (p=0.203)	1	
GARS-SI Change	0.042 (p = 0.779)	-0.273 (p = 0.067)	-0.218 (p = 0.155)	-0.163 (p = 0.273)	-0.115 (p = 0.446)	-0.220 (p = 0.146)	0.270 (p = 0.080)	-0.150 (p = 0.314)	-0.117 (p = 0.434)	1

Table 6.7. Correlation matrix for child characteristics and indirect outcome measures (correlations marked with * are significant at the p<0.005 level)

Table 6.8 shows the correlation matrix for child characteristics and school playground observation measures for the intervention participants only (n= 21). As there were 8 measures being correlated, a significance level of 0.05/8, or p<0.006, was used. Results showed that full IQ and verbal IQ were positively correlated and that both of these measures correlated negatively with change in number of self-initiated social interactions in the playground. The higher the child's full IQ and verbal IQ, the lower the change in self-initiated social interactions (i.e. children with lower IQ improved more).

	Age	Full IQ	Verb IQ	GARS AQ	ADHD	Anxiety	Change in duration of interactions	Change in no. self-initiated interactions
Age	1							
Full IQ	-0.108 (p = 0.570)	1						
Verb IQ	-0.155 (p = 0.431)	0.842* (p < 0.001)	1					
GARS AQ	-0.105 (p = 0.575)	-0.309 (p = 0.096)	-0.244 (p = 0.210)	1				
ADHD	-0.064 (p = 0.732)	0.047 (p = 0.804)	0.074 (p = 0.707)	0.499* (p = 0.004)	1			
Anxiety	0.254 (p = 0.168)	0.309 (p = 0.097)	0.330 (p = 0.087)	0.444 (p = 0.012)	0.423 (p = 0.018)	1		
Change in duration of interactions	-0.450 (p = 0.041)	-0.068 (p = 0.774)	-0.018 (p = 0.940)	-0.173 (p = 0.453)	-0.420 (p = 0.058)	-0.204 (p = 0.374)	1	
Change in no. self-initiated interactions	0.094 (p = 0.685)	-0.615* (p = 0.004)	-0.607* (p = 0.005)	0.246 (p = 0.283)	-0.037 (p = 0.872)	0.098 (p = 0.673)	0.244 (p = 0.286)	1

Table 6.8. Correlation matrix for child characteristics and direct outcome measures for intervention participants (correlations marked with * are significant at the p < 0.006 level)

6.4 Discussion

The aim of this study was to carry out an independent evaluation of the effectiveness of LEGO® Therapy and the Social Use of Language Programme (SULP) as social skills interventions for 6-11 year olds with HFA/AS.

It was hypothesised that due to the motivating nature of LEGO® therapy as a result of the appeal of using systematic materials, children receiving LEGO® therapy would enjoy it more and would improve on measures of social interaction more than children receiving SULP or no intervention. They would also show more generalisation of learning due to the naturalistic setting of the therapy.

Results did not support the hypothesis that children receiving LEGO® therapy enjoyed it more than children receiving SULP, since this result only approached significance, and enjoyment was high in both therapy groups. More children in the LEGO® group rated their enjoyment of therapy as 10/10 than those in the SULP group so perhaps in a larger sample this non-significant difference may have become significant.

Results also showed that autism-specific social difficulties (measured by the GARS social interaction subscale) reduced following LEGO® therapy, but showed no change in the SULP group or no intervention group. The magnitude of this change was small, but is consistent with previous studies evaluating LEGO® therapy (LeGoff, 2004; LeGoff & Sherman, 2006) and suggests that LEGO® therapy may be more effective than SULP at reducing autism-specific social difficulties such as aloofness, rigidity, and withdrawing from social situations.

Scores on the VABS maladaptive behaviour subscale showed that the LEGO® and SULP groups both had a reduction in maladaptive behaviour following intervention. Scores for the two intervention groups were significantly lower than the no intervention control group at Time 2. While both intervention groups showed a reduction in maladaptive behaviour, this reduction was only significant within the LEGO® therapy group. Taken together, these results suggest that both social skills interventions were better than no intervention for reducing maladaptive behaviour, but that LEGO® therapy might have been slightly more effective than SULP at reducing maladaptive behaviour in children with autism.

Scores on the socialisation domain of the VABS showed a trend for both intervention groups to improve more on socialisation than the no intervention control group. Contrary to the hypothesis that children in the LEGO® group would improve more than the SULP group, results showed a significant increase in socialisation within the SULP group only. However, there were no significant differences between the three groups at Time 2, and the effect size of the change was small.

The SULP group improved significantly on the communication domain of the VABS, while the LEGO® group improved but not significantly and the no intervention group deteriorated slightly (but not significantly). The LEGO® group's communication scores started off in the adequate range of adaptive level, but they still improved slightly between Time 1 and Time 2. However, the SULP and no intervention group started of with a moderately low adaptive level of communication. This makes the scores on this domain rather difficult to interpret, as despite there being no statistically significant differences in communication scores at the start of intervention, the mean scores in the LEGO® group were at an adequate adaptive level while the other two groups were not. This may have an impact on the learning in the different groups, as communication ability is likely to influence treatment outcome. Higher adaptive communication scores in the LEGO® group might mean they learned more from therapy than children with lower adaptive communication scores. Nevertheless, there was a large variation in communication scores and there were no significant differences between the groups in verbal IQ measured on the WASI, which is a more direct measure of communicative skill as it relies on child performance rather than parent report. This suggests that participants started off with similar levels of communicative skill and that the different changes in communication scores on the VABS could have been a result of the different interventions. It was striking to see the contrast between the two intervention groups and the no intervention group on communication scores. Both intervention groups improved, while the no intervention group deteriorated. This implies that some intervention is important for individuals with ASC to improve communication.

Results from the structured play setting showed no differences between the groups in the amount of time spent interacting with other children or in proximity with other children, nor any within-group differences. This suggests that skills may not have generalised to situations other than the therapy sessions. However, it may be simply that the measure was not sensitive enough. Due to difficulties distinguishing between two of the behavioural categories, the number of categories was reduced, making the coding scheme less specific. Perhaps measuring more specific behaviours, such as the frequency of pro-social acts would come up with different results. Another consideration is the fact that the coding scheme did not measure the nature of interactions, but simply coded whether children were interacting or not. It would be of interest to examine whether the interactions children made were qualitatively different before and after intervention, with the hypothesis that children's interactions might be of a superior social quality following intervention. The difficultly with qualitative measures of behaviour in this case would be achieving an objective measure of quality, as this is something that can be very subjective.

In the direct observations of social behaviour in the school playground, the LEGO® therapy group showed a small yet statistically significant increase in the duration of social interactions while the SULP group did not. This suggests some generalisation of skills in the LEGO® group, consistent with hypotheses and previous research; however, this change did not result in significant differences between the two therapy groups after intervention and was very small in magnitude. There was no difference in the number of self-initiated social interactions in the LEGO® or SULP group. Unfortunately, there were no direct observational data available for the no intervention control group. There are also several limitations to this outcome measure. Firstly, the sample size was small (n= 21). Secondly, results may have been subject to bias, as the researcher was not blind to group allocation. Also, the duration of the observations was only 10 minutes, which may not have been sufficient to measure variability in the duration of interactions among participants. Results from this measure should be interpreted with caution, and future studies should carry out longer, blind observations in the playground or other settings.

With all the outcome measures described, there was a large amount of variation between individuals. It was thought to be important to examine the characteristics of children that correlated with outcome. Results showed that verbal IQ correlated negatively with change in maladaptive behaviour, i.e. the higher the IQ, the greater the decrease (improvement) in maladaptive behaviour. This finding is consistent with previous research that shows verbal IQ to predict outcome in other interventions (Ozonoff & Cathcart, 1998). However, verbal IQ and full IQ were negatively correlated with change in number of self-initiated social interactions in the school playground. The higher the IQ, the smaller the improvement. This finding was unexpected and contradictory to previous research and hypotheses in this study. It is a difficult result to explain, as it may be due to a small sample size or an inaccurate measure.

Contrary to hypotheses, neither anxiety nor hyperactivity correlated with outcomes. However, autism symptom severity was positively correlated with hyperactivity symptoms. This finding is consistent with research that shows hyperactivity to be a common symptom amongst individuals with ASC (Frazier et al., 2001; Goldstein & Schwebach, 2004). Future research should evaluate hyperactivity as a predictor of outcome more thoroughly, using more robust ways to assess the influence of different variables on outcome, such as multiple regression models.

Overall, results from this study seem to suggest that LEGO® therapy and SULP are better than no intervention at helping children with autism improve their social, communication and behaviour skills. Results also suggest that LEGO® therapy and SULP may target slightly different types of behaviour. LEGO® therapy seems to target autism-specific social difficulties and maladaptive behaviour, whereas SULP seems to target socialisation and communication more generally. It would be interesting to isolate the specific elements of these interventions that are effective. It would also be of interest to evaluate whether any collaborative play or social communication teaching approach has similar efficacy to LEGO® therapy and SULP. Future research should investigate this.

There were several methodological limitations to this study. First, participants in the no intervention control group were not randomly assigned and there were no direct observational data available for this group. Ideally, all participants would be randomly assigned to the LEGO®, SULP, or no intervention groups and future studies should address this.

Secondly, there were very few girls in the study. It may be that girls do not enjoy LEGO® as much as boys, and might therefore not have responded to this type of intervention. Typically developing boys are better than girls at copying LEGO® models (INSERT McGINNIS REF jack), so it could be hypothesised that girls might enjoy LEGO® therapy less, as they find LEGO® building harder. However, girls with ASD might be better than typically developing girls at copying 3-D models, due to superior systemising or weak central coherence. Future research should investigate this, and if girls do not enjoy LEGO® as much, then perhaps other materials could be adapted to teach social skills that are appealing to girls with autism. It is also likely that preference for materials varies individually.As participants volunteered to take part in the study knowing that it was a LEGO® based therapy, those who did not like LEGO® were unlikely to have volunteered. We therefore do not know how effective the intervention would have been for a population who are indifferent to, or who dislike LEGO®. Future research should aim to include children with a representative sample of interests.

A further limitation to the research was that several of the outcome measures may have been subject to bias. The GARS-SI and VABS were completed by parents who were aware of the type of intervention their child was receiving, so results could have been subject to bias due to parental expectations. However, parents in the no intervention control group were unaware at the time of data collection that their children were part of a no intervention control group, and so were less likely to be biased as a result of not receiving intervention, and parents in the LEGO® therapy and SULP groups were equally satisfied with the therapy they received, suggesting that the scores they gave on parent reports may not have been subject to bias due to different levels of satisfaction. The direct observations in the school playground could have been open to experimenter bias, as she was not blind to group allocation.

An additional problem is the possible lack of sensitivity of the measures used, which may be a cause of the small effect sizes seen. This is especially the case for the structured play observations, where examination of the qualitative nature of interactions may have shown an interesting pattern of results.

A further issue is that the researcher in this study was also the person running both interventions. While this kept the therapist consistent across interventions, it may have added bias because the therapist was aware of the research hypotheses. There were also no treatment fidelity measures taken. Despite this, the researcher was equally well trained in both intervention techniques, and equal effort was put into the preparation of both interventions. Parents were also equally satisfied with the therapy, suggesting that both types of intervention were carried out with equal effort and skill. Undergraduate helpers were used instead of trained professionals, which may have affected the efficacy of the interventions. However, the principal therapist (myself) was adequately qualified to carry out both interventions and guided the undergraduate helpers in each session.

The sample size in this study was small, and the characteristics of children who dropped out of the study were not taken into account so findings need to be replicated and extended. It is also important to follow-up the children after the end of the interventions to see if any gains were maintained over a longer time period.

Despite these methodological limitations of this study, the results for LEGO® therapy and SULP are encouraging. This study independently replicates previous findings that LEGO® therapy is a promising intervention for children with HFA and AS and is the first evaluation of SULP for children with HFA and AS. The next stage should be a large-scale randomised control trial that addresses all the methodological issues mentioned previously and that includes long-term follow-up data. Neither LEGO® therapy or SULP require much financial commitment and can be easily set up by teachers or clinicians. Children who attend mainstream school yet require additional support for social skills might benefit greatly from just a small amount of extra intervention. A manual for SULP is available and SULP training courses happen regularly in the UK. LEGO® therapy is clearly described in LeGoff's original study (LeGoff, 2004) and a draft manual is in progress (LeGoff & Owens, in preparation). Should future large-scale RCTs find these interventions to be effective then there is great potential for using these approaches in classrooms. SULP is already widely used in mainstream primary schools. A pilot trial of setting up LEGO® therapy groups in a school setting is the focus of the next chapter.

Chapter 7: Pilot study of using LEGO® therapy in a school

7.1 Introduction

LEGO® therapy is a social skills approach that is naturalistic, theoretically based, child-friendly, relatively low-cost and easy to implement. It is a novel social skills intervention for school-age children and adolescents with ASC that has the potential to be widely used in school settings. The aim of this pilot study was to assess whether a half-day training course and the draft manual shown in Appendix 1 was sufficient to successfully implement LEGO® therapy groups in a class for children with ASC within a mainstream primary school. Particular attention was given to treatment fidelity, i.e. whether the teachers could successfully set up and carry out LEGO® therapy groups. Child outcomes were also measured to assess the efficacy of the therapy.

7.2 Method

7.2.1 Participants

Participants were children with diagnoses of high functioning autism, Asperger Syndrome, autism or autism spectrum disorder who attended a unit for children with ASC within a mainstream primary school in Darlington. Diagnoses were made by a clinical psychologist, psychiatrist or paediatrician and all children reached cut-off criteria for likely ASC (a score >15) on the Social Communication Questionnaire {SCQ; \Rutter, 2003 #3051}. All children were between 7 and 10 years old and had an IQ >75.

Participants were recruited via the teachers of a primary school in Darlington, who attended a talk about LEGO® therapy at their local National Autistic Society group. The research was approved by Cambridge University Psychology Research Ethics Committee. All parents whose child attended the unit were sent a letter explaining the study which was described as a pilot research project to assess the feasibility of using LEGO® therapy in a school setting. All but one parent gave written informed consent for their child to participate in the study. These parents also filled in an initial background questionnaire, to gather information about demographics, diagnosis, education, additional therapies and development. The characteristics of participants are described in Table 6.1. IQ was measured using the Wechsler Abbreviated Scales of Intelligence (Wechsler, 1999). Parents completed the Gilliam Autism Rating Scale (Gilliam, 1995) and the SCQ (Rutter et al., 2003) prior to the start of the study.

CA (months)	mean	107.4
	S.D.	15.44
Gender	m	7
	f	2
Full IQ	mean	104.78
	S.D.	16.63
Verbal IQ	mean	103.22
	S.D.	18.79
GARS AQ	mean	82.38
	S.D.	20.71
SCQ	mean	23.67
	S.D.	5.95

Table 7.1. Characteristics of participants

For the purpose of this pilot study, strict exclusion criteria were not employed. Some children had additional diagnoses of ADHD, were taking medication, on a special diet, and/or had extra speech therapy. This information is described in Table 6.2.

		N
Diagnosis	A	3
	HFA	0
	AS	1
	ASD	5
Additional diagnosis	ADHD	2
Medication	Floconarzole	1
	Ritalin	1
	Methylpherudate	1
Diet	Gluten/casein free	2
Other therapy	Speech therapy (3 x per month)	3
n		9

Table 7.2. Additional diagnoses, therapies, medication and diet.

7.2.2 Training

A training session was given by myself to 5 teachers and teaching assistants about how to set up and carry out LEGO® therapy. This involved an initial presentation about the theory behind LEGO® therapy and the methods used which lasted about 40 min. This was followed by a practical session in which the teachers role-played activities found in a typical LEGO® session. Training lasted approximately 2 hr 30 min and included plenty of time to discuss questions. Three teaching assistants then went on to run the LEGO® therapy groups in this study.

7.2.3 LEGO® therapy manual

A draft manual written by Dr LeGoff was adapted and expanded by myself for this study. Teachers were given a copy of this manual to read before planning and running LEGO® therapy groups.

7.2.4 Design

The evaluation of the groups was carried out using a within participants baseline design. Assessments were made at the start of the study, prior to a 6 week baseline period in which no intervention was carried out (Time 1; children simply attended normal schooling). Assessments were repeated 6 weeks later, immediately prior to the LEGO® therapy intervention period (Time 2). Assessments were repeated immediately following 6 weeks of LEGO® therapy (Time 3).

7.2.5 Running LEGO® therapy

Following the training, the teachers involved worked out a timetable for running LEGO® therapy groups as part of the school curriculum. This was timetabled into the school day once a week for 60 min. The groups were run by one teaching assistant with the help of two other teaching assistants.

7.2.6 Outcome measures

Outcome measures were completed by parents and teachers and included measures of treatment fidelity, child social skills and a teacher evaluation of setting up LEGO® therapy in a school. Assessments were completed by the child's usual classroom teacher or teaching assistant who did not run the LEGO® therapy groups. While it was asked that parents and classroom teachers would not be aware of whether LEGO® therapy was happening or not, this could not be certain as the children may have talked about their day with their teachers and parents, and teachers may have talked to each other about LEGO® therapy around the school.

<u>Child social skills</u>

Parents were asked to complete the social interaction subscale of the GARS (Gilliam, 1995). Teachers completed the socialisation domain of the Vineland Adaptive Behaviour Scale teacher rating form (Sparrow et al., 2005). These were chosen as measures of autism specific social skills (GARS-SI) and adaptive social functioning in daily life (VABS).

<u>Teacher evaluation of setting up LEGO® therapy</u>

The three teachers who ran the LEGO® therapy groups were asked to fill in a questionnaire about their experiences of setting up and running LEGO® therapy in their school. This included questions about training, the manual, setting up LEGO® therapy, running LEGO® therapy and the success of LEGO® therapy.

7.2.7 Treatment fidelity

To assess whether the teaching assistants running the LEGO® therapy groups were following the correct procedures, every session was videotaped. A checklist of the key activities that should be included in the session, the behaviour of the teaching assistant, and the activities of the children was drawn up based on the manual. This is shown in Appendix 5. The presence or absence of required activities was coded in a binary fashion for each of the 6 sessions at the end of the study. The activities fell into the categories of 'session structure', 'group activities', what the therapist did in the event of a 'rule-break', a 'social difficulty' or when the children displayed 'positive social behaviour'. To help teachers evaluate their own practise, they were given blank planning and evaluation sheets to fill in for each therapy session.

7.3 Results

7.3.1 Treatment fidelity

Figure 7.1 shows the percentage of LEGO® therapy sessions in which the items in the treatment fidelity checklist were adhered to. The table shows the percentage of sessions that were carried out correctly for each of the 3 therapists in terms of session structure, session activities, and therapist behaviour in three circumstances: in the presence of a social difficulty, if a child breaks the rules, and if a child exhibits good social behaviour.

Treatment fidelity item	% adherence over 6 sessions		
	Therapist 1	**Therapist 2**	**Therapist 3**
Session Structure			
Check in	not seen	not seen	not seen
Instruction building	100	100	100
Freestyle	0	16.6	33.3
Kids tidy	100	100	100
Certificates given out	0	0	0
End plenary	not seen	not seen	not seen
Rules displayed	100	100	100
Activities			
Group work	100	100	100
Sit round table	100	100	100
Adult available to help	100	100	100
Children have different roles	100	100	100
Children take turns	100	100	100
Children task focused	100	100	100
Children interacting	100	100	100
Therapist			
Praises good building	100	100	100
Gets kids to help eachother	83.3	100	100
Social Problem			
Highlights presence	100	72.72	57.89
Prompts children for solutions	66.67	54.54	36.84
Give children opportunity to solve	71.4	72.72	31.58
Give suitable alternatives	47.6	40.9	47.37
Ask children to role play solutions	4.7	18.18	0
Practise previous strategies	0	0	00
Rule break			
Highlight presence	n/o	100	n/o
Prompt children to remind each other	n/o	100	n/o
Positive social behaviour			
Praise	100	94.1	85.7

Figure 7.1. Percentage treatment fidelity for all items for each therapist

Session Structure

It can be seen that the overall structure of the therapy sessions were carried out very well. The LEGO® Club rules were always on display, children were building mostly following instructions but with a bit of freestyle building at the end of the sessions, which is how progression in the sessions is specified in the manual. Children also tidied up their own LEGO® bricks at the end of each session. The video recording of the sessions did not encompass the very start or very end of the sessions (probably because the principal therapist was also video recording the groups) so the presence of an initial check-in to the session or an end plenary was not observed. Certificates rewarding different LEGO® Club Levels were also not observed to be given out or recorded on the evaluation sheets.

Session activities

The activities that the children took part in were exactly as specified during training and in the manual. Children were always working in groups, building with instructions, taking turns, were jointly focused on their task and were interacting with each other. This part of LEGO® therapy was adhered to perfectly.

Therapist behaviour

Therapists highlighted and praised the good social behaviour of children over 80% of times it occurred. They also praised good building, and enabled the children to help each other in difficult parts of the build. There were very few instances of breaking the LEGO® club rules throughout all the sessions, and when it did occur, the therapists did the correct thing and prompted the children to correct each other. However, the therapists' behaviour in the presence of other social problems (such as shouting, snatching, arguing, taking over another child's job) was variable. The training and the manual specified that therapists should highlight every social problem or rule break as and when it occurs. They should then ask children to come up with their own solutions to difficulties, giving them prompts and help if required. While therapists highlighted the presence of a social problem when it happened between 50 and 100% of the time, they did not then ask children to come up with their own solutions to the social difficulties or prompt them to come up with alternative behaviours. Instead, the therapists tended to correct children's behaviour with a direct instruction such as, 'Be patient, Luke, and wait for Diane to be ready'. The training and the manual suggested that therapists should help the children work through the problems themselves. Also, the therapists rarely asked the children to role-play and practise alternative positive social strategies following a social difficulty. So while the group activities were correct and carried out excellently, the cognitive element of the therapy in which children are required to think about their own behaviour and come up with alternative strategies was more limited.

7.3.2 Child Social Skills

Due to the small sample size and the fact that some of the data were not normally distributed, non-parametric tests were used. Results are summarised in Table 7.3 below.

		Week 1	Week 6	Week 12
VABS Socialisation Teacher Rating	Mean	79.62	81.38	86.13
	S.D.	7.99	7.22	6.85
GARS-SI Parent Rating	Mean	7.38	7.38	7.38
	S.D.	3.25	2.88	4.07

Table 7.3. Mean VABS socialisation and GARS-SI scores at weeks 1, 6, and 12.

<u>Teacher rating on VABS socialisation domain</u>

Results from a Friedman's ANOVA showed that socialisation scores on the teacher rating scale of the VABS changed significantly over the course of the study ($\chi 2$ (2) = 7.80, p=0.014). Wilcoxon Signed Rank tests were used to follow up this finding. A Bonferroni correction was applied so all effects are reported at a 0.025 level of significance. Results showed that socialisation did not increase significantly between the start and end of the baseline period (z = -0.059, p = 0.953) but that it increased to a level approaching significance between the end of baseline and the end of LEGO®

therapy (z = -2.043, p = 0.031). This improvement following LEGO® therapy but not over the baseline period is illustrated in Figure 7.2 below.

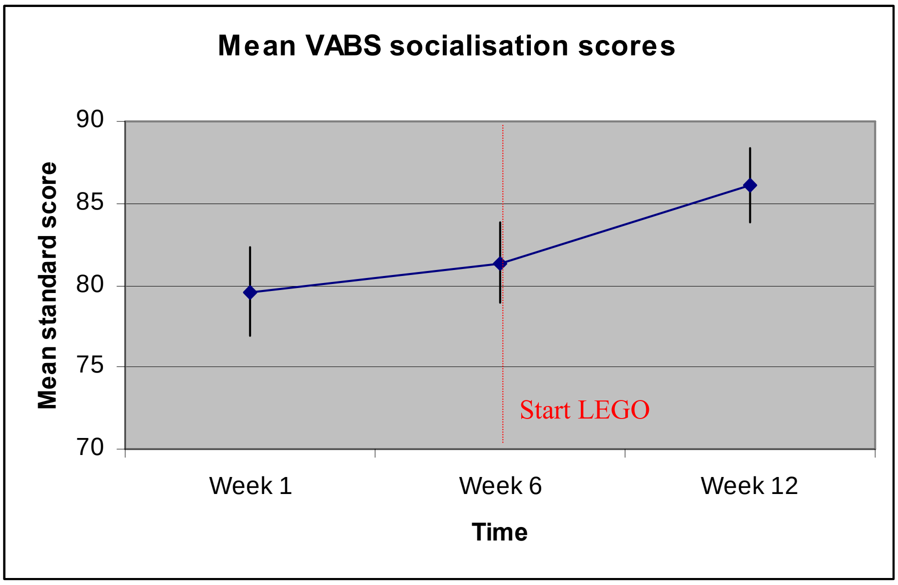

Figure 7.2. Socialisation scores before baseline, after baseline and after LEGO®

<u>Parent evaluation using the GARS-SI</u>

One parent did not complete the GARS-SI questionnaires. Exploratory analyses of the mean scores of the GARS-SI at the start, after baseline, and after LEGO® therapy (see Table 7.3) showed that there were no significant differences in scores across the time points in this measure.

7.3.3 Teacher evaluation of setting up LEGO® therapy

Reports of setting up LEGO® therapy from all three therapists are given in Table 7.4 on the following page.

		Therapist 1	Therapist 2	Therapist 3	Comments
Training	**Easy to understand?**	Yes	Mostly	Yes	
	Sufficient without manual?	Yes	Yes	Yes	Would be useful to see a LEGO therapy session in practise beforehand
Manual	**Easy to follow?**	Yes	Mostly	Yes	
	Had enough information to set up groups?	Yes	No	Yes	Examples of which sets of lego to buy for the hour time slot would be helpful
	Need training as well as manual?	Yes	Yes	Yes	Needed initial training aswell as manual for opportunity to ask questions.
Setting up	**Easy to set up?**	Very easy	Quite easy	Quite easy	
	Financially reasonable?	Don't know	Quite expensive	Don't know	Lego sets are quite expensive to buy
	Easy to timetable?	Don't know	Quite easy	Quite easy	Hard to find a time that did not disrupt core curriculum
Running groups	**Straightforward?**	Quite straightforward	Quite straightforward	Quite straightforward	
	Teaching assistants capable of running therapy?	Yes	Yes	Yes	
	Stressful to run groups?	Not at all stressful	Not at all stressful	Not at all stressful	
	Easy to implement therapy?	Very easy	Quite easy	Quite easy	Needed guidance and support
	Enjoyable for therapists to run?	Most of therapists	All of therapists	Most of therapists	
	Easy to get suitable Lego?	Very easy	Quite easy	Quite easy	
Group success	**Children enjoyed?**	Most of them	Some of them	Most of them	Some pupils found some of the roles difficult. More than a 1hr session may have become stressful
	Children benefited?	Most of them	All of them	Most of them	Better at waiting their turn, describing instructions and interacting with each other. Began to see their own strengths and weaknesses and deal with them. Helped with turn taking, listening and patience
	Would you continue with LEGO?	Yes	Yes	Yes	
	Would you recommend it to other schools?	Yes	Yes	Yes	A very clear tool- practical, enjoyable and hands on.
	How does it compare to other social skills approaches you have used?	Slightly better	Slightly better	Slightly better	Have tried circle time

Table 7.4. Summary of teacher evaluations of running LEGO® therapy in school

7.4 Discussion

The aim of this study was to carry out a pilot study to assess the feasibility of setting up LEGO® therapy groups in a school setting. It was of particular interest to assess whether therapy was carried out according to the manual and to the training, as well as assessing child outcomes.

It was hypothesised that staff would be able to carry out the groups accurately and according to training and the information set out in the manual. While this hypothesis was supported in that the sessions were structured adequately, and the activities the children carried out were perfect, there were key elements of LEGO® therapy that were missing. A minor aspect was the lack of certificates to reward different levels of participation. As groups were only studied for 6 weeks, it was only likely that one or two certificates would be given, however, this was not observed to happen in the group videos.

A more serious problem with therapist behaviour was the fact that children were not given enough opportunity to solve their own social difficulties. A theoretically important aspect of LEGO® therapy is the cognitive element, in which children are made aware of their own behaviour and the effect it has on other children in the group. Children should be made aware of any social difficulties arising during the course of a LEGO® therapy session, and should be asked to discuss the problem and attempt to come up with their own solutions or alternative behaviours. The therapist has a vital role to play here, in making children aware of social difficulties, facilitating discussions and helping children practise positive alternative behaviours. In the sessions observed, therapists tended to correct children's poor social behaviour themselves, rather than introducing a discussion about the problems, and getting the children to come up with their own solutions. Additional training is clearly required to help therapists do this. In running my own LEGO® therapy groups, I noticed that it was difficult to stop myself from correcting poor social behaviour when I saw it. Correcting children's behaviour yourself is an instinct that is quite difficult to suppress. It may be especially difficult for teachers not to automatically correct children's behaviour, as it something they do countless times a day. This is obviously an element of LEGO® therapy that needs thorough and ongoing training. Perhaps therapists could watch videos of themselves in order to discuss different ways of dealing with problem social behaviour.

Despite these difficulties, I felt that the LEGO® therapy sessions were run very well, with appropriate activities, an adequate staff to child ratio, and a real enthusiasm. Results from child outcomes support the fact that the therapy was carried out quite well. Children improved more on teacher ratings of social skills following 6 weeks of LEGO® therapy than following 6 weeks of normal schooling baseline. This result was approaching significance. Perhaps with additional therapist training in the cognitive aspects of LEGO® therapy and/or a longer or more intensive intervention period, this pattern would reach statistical significance. This same pattern was not observed in parent ratings of social skills using the Gilliam Autism Rating Scale. Perhaps this measure is not sensitive enough, or perhaps skills learned in school did not generalise to home. Another alternative explanation could be that the teacher ratings of social skills were subject to bias, as the teachers may have been aware of whether or not children were receiving LEGO® therapy. While the teachers carrying out the evaluations were different to the teachers doing the therapy, they may not have been blind to the fact that children had started LEGO® therapy as teachers and children may have talked about it in school.

Teacher reports of setting up and running LEGO® therapy were generally positive. They found the training easy to understand, the manual easy to follow and the groups quite easy to set up. The difficulties they reported were to do with timetabling the groups. This is something that schools will need to think about carefully on an individual basis should they wish to set up LEGO® therapy in their schools. Also, LEGO® sets were quite expensive for the schools to buy. Useful feedback was given about training, in that it would have been useful to see a LEGO® therapy session in practise as part of the training. Also, they felt that training was needed as well as the manual, suggesting that if LEGO® therapy is to be made available to other schools and other professionals, training sessions as well as a manual need to be provided. In terms of running the groups, teachers reported groups to be quite straightforward, enjoyable, not stressful and quite easy to implement. Most of the children enjoyed therapy, though some found the roles difficult. Anecdotally, the teachers reported the pupils to be better at turn-taking, interacting, patience and recognising their own strengths and weaknesses following LEGO® therapy. All of the teachers would carry on using LEGO® therapy in their school and all of them would recommend the approach to other schools. These evaluations are very encouraging. Should further research find that LEGO® therapy to be effective in more rigorous evaluations, it certainly seems appropriate and desirable for use in a school setting.

There were several methodological limitations to the design of this study. As previously mentioned, the teachers filling out the child evaluations may not have been blind to treatment status. The sample size of 9 children was very small which makes it difficult to draw conclusions about the results. Also, the study used a baseline design, where a multiple baseline design would have been preferable. In a multiple baseline study, children start intervention at different times so it can be seen whether any changes in outcome measures were a result of intervention or due to extraneous variables that had not been measured. Due to practical reasons, the school was not able to carry out a multiple baseline study (it was too difficult to timetable) and the finding that children improved in the second half of the study may have had nothing to do with the addition of LEGO® therapy- it may have been due to other variables present at school. For example, children may have improved more during the second half of the school term because they had got used to the school routine by this stage. Perhaps doing the Christmas play enabled children to interact with each other more during the second half of term, and so helped them improve their social skills. There are all sorts of hypotheses one could make about why children improved in the second half of the study which have no bearing on the addition of LEGO® therapy to the school curriculum.

Despite these methodological problems, this study was simply a pilot study to ascertain whether LEGO® therapy was suitable to use in a school setting. It set out to evaluate how much training teachers would need and how well teachers and teaching assistants could set up and run LEGO® therapy groups. To this end, the study was a success. It has highlighted the fact that LEGO® can be incorporated into the school curriculum to help motivate children to interact with each other and to practise social skills. It has also shown that further training and ongoing support is needed for teachers to overcome their natural instinct to correct children's behaviour, rather than introducing discussions and enabling children to try and solve their own social difficulties. It demonstrated that teachers enjoyed running LEGO® therapy, found it easy to implement and would recommend the approach to other schools.

This study suggests that it would be worthwhile to set up a larger scale, randomized control trial of the use of LEGO® therapy in school settings. Research questions that need to be addressed include: a) What aspects of the intervention are effective? b) Is the cognitive element of LEGO® therapy necessary? c) How long does therapy need to last to have an effect? d) How does LEGO® therapy compare to other collaborative play interventions? e) What extra training is required? f) Is LEGO® therapy more suitable for some children than others?

If subsequent well-planned, rigorous research can answer these questions, then parents and professionals in the future will be able to judge whether LEGO® therapy could help improve the social skills of an individual child.

Chapter 8: General Discussion

The aim of this thesis was to evaluate how successful it was to use systemising to motivate children on the autistic spectrum to improve their social competence. The empathising-systemising (E-S) theory suggests that individuals with ASC have impaired empathising ability but preserved or superior systemising ability (Baron-Cohen, 2002). The potential to harness the attraction of systems to promote empathy in those on the autistic spectrum has previously been demonstrated in research evaluating a systematic guide to emotions for older children and adults called *Mind Reading* (Golan, 2006; Golan & Baron-Cohen, 2006). This thesis set out to be an extension of that work, to see whether systemising could promote empathising and social competence more generally in younger children with ASC.

The research presented is unusual in the field of social skills intervention for ASC in that it had theoretical grounding in the E-S theory. The literature on interventions to promote social competence in ASC largely consists of approaches that are not theoretically based. It is also unusual as it involved controlled studies evaluating and comparing different approaches. The research is also important because it links research with practice. Within social skills interventions for ASC, there is a disparity between the interventions that are being used in community settings and the interventions that are being assessed in academic research. Interventions that are easy to use and widely available are those that are commonly employed in schools, regardless of a lack of evidence for their effectiveness. Interventions that are researched in academic institutions tend to be more complex and time consuming to deliver, and manuals and training describing the approaches are often difficult to access. The current thesis goes some way to addressing this disparity as it has empirically evaluated two new interventions (LEGO® therapy and *The Transporters* DVD) that are easy to use in school and clinic settings. A draft manual has been developed for LEGO® therapy and *The Transporters* DVD will be commercially available in summer 2008. This thesis has also provided the first empirical evaluation of SULP, an approach that is already in use in many schools across the UK.

8.1 Overview of findings

Two different interventions that were based in E-S theory were examined in this thesis. The first intervention, *The Transporters* DVD was an approach that is based on a developmental model for early intervention. In this model, pivotal skills that are central to the development of social competence are targeted in very young children, with the idea that these will help in the development of social competence later (see Chapter 2 for a review of these skills). *The Transporters* DVD is a children's cartoon series designed to teach emotion recognition, one of the pivotal skills central to the development of social competence. In *The Transporters*, vehicles with images of real human faces grafted onto the front are used to teach about facial expressions of emotion, thus presenting emotional information (facial expressions) in a systematic framework (vehicles with predictable patterns of movement). Along with cogs, wheels and cables, the systematic appeal of the vehicles aims to enhance attention to emotional information, thus increasing opportunities to learn about facial expressions of emotion. Previous research showed that in 4-8yr olds with HFA and AS, emotion recognition improved significantly and up to typically developing levels after using *The Transporters* for 15 min per day over 4 weeks (Golan et al., in preparation). Based on the idea that pivotal skills related to social competence such as emotion recognition should be taught at a young age, and the current emphasis on early intervention in ASC (Le Couter, 2003; National-Research-Council, 2001), it was thought to be interesting to evaluate whether *The Transporters* was also effective for younger children with HFA and AS.

The study presented in this thesis evaluated the success of *The Transporters* in 2-5yr olds with ASC in a randomised control trial. Results from direct measures of emotion recognition showed that children with ASC who watched *The Transporters* DVD improved more than controls (who watched a comparison children's cartoon or received no intervention) in their recognition of emotions shown in familiar stimuli used in the DVD. They did not improve more than controls in their recognition of unfamiliar, real human face stimuli. This was the case for the tasks that did not require any contextual understanding (posting faces into the correct post box) and the tasks that did (choosing an appropriate emotion for a character within a story scenario).

Moreover, typically developing children who also watched *The Transporters* improved in their recognition of emotions from *Transporters* stimuli, but learning did not generalise to real human face stimuli. There were also no improvements for any groups in the Vineland Adaptive Behaviour Scale socialisation domain, a measure of adaptive social skills in every day life. Despite this lack of generalisation on these measures, significantly more parents whose children watched *The Transporters* reported their child looked at faces more and improved in their emotion recognition and understanding of the causes of emotions after intervention. The majority of the parents also reported their children enjoyed watching the DVD.

The second intervention to be evaluated was LEGO® therapy, a systematic approach to teaching social skills to older children with ASC. Here, children played with LEGO® in a collaborative fashion, each child taking it in turns to play the role of engineer (who reads the instructions), supplier (who finds the bricks) or builder (who puts the model together). Other tasks involved pairs of children building a model of their own joint design. LEGO® is a systematic and predictable toy, and therefore appeals to children with ASC. Using LEGO® in a way that children have to collaborate to build models enables social skills to be practiced in a fun setting. In addition to the systematic nature of LEGO® therapy there is a cognitive component to the teaching. Whenever a social difficulty arises, the therapist highlights the presence of a general problem to the whole group of children. The children are required to identify the social problem and think about what solutions there could be, and then practice the solution. Doing this helps children to understand the impact their behaviour has on others, and to learn alternative behaviours that are more socially acceptable. LEGO® therapy also teaches social skills in a naturalistic play session, something that has been recommended as a way to improve generalisation of learning (Attwood, 1998). Previous research with 6-16 yr olds who used LEGO® therapy once a week for 24 weeks found more improvement in social skills during LEGO® therapy than on the waiting list for intervention (LeGoff, 2004). Over 3 years it also resulted in more improvements in social skills than eclectic mental health provision (LeGoff & Sherman, 2006).

The study presented in this thesis was an independent evaluation of LEGO® therapy in comparison to a non-systematic social skills intervention called the Social Use of

Language Programme (Rinaldi) and no intervention. This was a matched controlled study with 6-11 yr olds with high functioning ASC who received LEGO® therapy, SULP or no intervention for 1hr per week over 18 weeks. Results showed that children receiving LEGO® therapy reduced their autism specific social difficulties (as measured on the Gilliam Autism Rating Scale social interaction scale) more than children receiving SULP or no intervention. This finding was consistent with findings from the previously mentioned LEGO® therapy evaluations (LeGoff, 2004). Children receiving LEGO® therapy also showed a significant reduction in maladaptive behaviour over the course of intervention, which neither of the comparison groups did. This was a new finding, as maladaptive behaviour had not previously been assessed as an outcome measure following LEGO® therapy. Both the LEGO® therapy and the SULP groups improved in their socialisation as measured on the Vineland Adaptive Behaviour Scale, whilst the no intervention group did not change. Only the SULP group improved significantly in communication. However, none of these improvements were seen in a structured play setting in which social play and proximity were measured. There was some evidence of generalisation to the school playground in the duration of social interactions in the LEGO® therapy group only. Children in this group showed a statistically significant increase in duration of social interactions in the school playground over the course of intervention. This suggests that LEGO® therapy may have helped generalisation of learning more than SULP. Parents receiving both interventions were very satisfied with the approach, and children in both groups enjoyed the therapy. More children receiving LEGO® therapy rated it with maximum enjoyment scores than children receiving SULP, suggesting that this approach may have been more enjoyable for the children.

The final study presented in this thesis was a pilot baseline design study evaluating the feasibility of using LEGO® therapy in a school setting. Results showed that children made more improvements in the socialisation domain of the Vineland Adaptive Behaviour Scale after 6 weeks of LEGO® therapy than after a 6 week baseline period. Teachers also found LEGO® therapy relatively easy to implement in school, and treatment fidelity measures demonstrated that teachers could carry out the therapy successfully, though in future, extra training should be provided to practice the cognitive elements of the intervention.

A secondary aim of this thesis was to examine child characteristics that may influence intervention outcomes. Previous research has shown that age of intervention onset, IQ, verbal IQ and severity of autistic symptoms predict outcome (see Chapters 1 and 3). It was of interest to evaluate whether these characteristics also predicted outcome in the interventions in this thesis. It was hypothesised that young age, high IQ, high verbal IQ and fewer autistic symptoms would predict good outcome. In addition, anxiety and hyperactivity were examined as predictors of outcome, as these have been shown to be common co-morbid symptoms in children with ASC (Ming et al., 2008). Having such additional symptoms might impact on a child's ability to learn. It was hypothesised that regardless of intervention type, children with higher levels of anxiety and hyperactivity would show poorer outcomes following intervention. In the LEGO® therapy study, verbal IQ was positively correlated with change in maladaptive behaviour and full IQ and verbal IQ were negatively correlated with change in self-initiated social interaction in the playground. In *The Transporters* study, young age and watching *The Transporters* predicted positive outcome for learning about *Transporters* stimuli. Lower autism symptom severity and higher verbal IQ predicted positive outcome in learning about real face stimuli. These findings are consistent with previous research that show age and IQ to predict outcome (Harris & Handleman, 2000). These findings warrant follow-up in a study with a much larger sample size to evaluate which child characteristics influence outcome in which types of intervention for which target behaviours. This information will be extremely useful for parents and professionals when choosing appropriate intervention approaches for an individual child.

8.2 Discussion of findings

8.2.1 Systematic materials are enjoyable

The finding that children enjoyed the interventions in all studies is an important one. LEGO® therapy was extremely popular with children and parents, and the fact that some children said it was their favourite activity of the week is fantastic. Usually, social skills interventions are not motivating for children with ASC who are not naturally drawn to social situations, so having a social skills group that is also extremely fun is likely to increase motivation to attend over the long term. Also, the majority of children who watched *The Transporters* DVD really enjoyed it. This is expected to increase the likelihood of them continuing to watch it and therefore increase their exposure to emotional learning opportunities. So it seems that using systematic materials is motivating for children with ASC. Nevertheless, there were some children who did not like LEGO®, and some children reacted negatively to *The Transporters*. Perhaps these children would be attracted to interventions that use other types of systems, for example computers or rule-based card games. There certainly seems to be a large opportunity to develop or adapt other intervention approaches to include systematic materials. For example, Yugio cards where different characters have different special features and interact with each other in rule based battles could be adapted to include emotional expressions and social interaction lessons. LEGO® Ltd are currently developing an online interactive 'LEGO® world' in which children can play a LEGO® character and interact live with other children's LEGO® characters to build models in cyberspace and collect 'inspiration dust'. This type of rule-based but nevertheless real-life interaction could be adapted to teach social skills. Recently, a fun, interactive and systematic computer game called 'Astropolis' has been developed to carry out psychological tests (such as the go-no go task, or tests of coherent motion) with individuals with ASC (Belmonte, 2008). This demonstrates that the idea of using ASC friendly, enjoyable materials is useful and increasing in prevalence. Developing more such materials for intervention and assessment will be an interesting avenue for future research. However, further evidence is still needed to evaluate whether individuals with ASC are superior at systemising and to find out whether systematic materials are more motivating, or whether it is just anecdotal evidence that suggests this. It may be that on a more simple level, interventions should be based on what motivates children on an individual basis (Attwood, 1998). Research could be carried out to look at children's ratings of enjoyment of different types of intervention. Also, the number of children that drop out of interventions due to a lack of enjoyment could be used as a measure of enjoyment. Perhaps there would be fewer drop-outs from interventions that use systematic materials. In the studies presented in this thesis, there were very few girls, and it remains to be seen whether girls with ASC enjoy the LEGO® and vehicles as much as they boys. It may be that there are other systems that are more appealing to females on the autism spectrum, for example, knitting or animals that might be adapted to teach social skills. Moreover, research has found that boys are better than girls at copying 3-D LEGO® models

(INSERT McGInnis & Morley from Jac). Maybe the lack of girls in the LEGO® therapy study was due to the fact that it is harder for them to build, and maybe therefore less enjoyable. Research should have been carried out to measure the individual differences in how appealing the materials were to the children in these studies. This could then have been related to outcome.

8.2.2 Does using systemising promote emotion recognition and social skills?

Previous research and recommendations have suggested that the natural interests of the child should be used as a basis for intervention (Attwood, 1998; Koegel & Koegel, 1995). As systems have a strong appeal to those with ASC (Baron-Cohen, 2002), the interventions in this thesis were based on systematic materials. The main question here is whether the improvements seen in children taking part in the systematic interventions were a result of the systematic nature of the intervention or a result of other factors. The results from this thesis are unable to answer this question. It certainly seems that systematic materials are fun: children enjoyed the interventions, which may have increased motivation to learn. However, we do not know in the case of *The Transporters* whether presenting emotional information in a non-systematic fashion would cause the same improvements in emotion recognition. The fact that children in the control groups who watched *Jimbo* or received no intervention improved in their recognition of real human face stimuli suggests that simply being part of any emotion recognition intervention, or practising tasks twice, causes improvements, regardless of systematic materials. Future research is necessary to compare *The Transporters* to non-systematic interventions that target emotion recognition. It may be the case that the emotion information itself needs to be systemised, i.e. presented in a rule-based way, rather than in the context of real-life stories. *The Transporters*, unlike *Mind Reading* (which showed more success), only used systemising as an appealing way to frame the stories, rather than the emotions themselves being presented in systemisable categories. However, emotions in real life contexts do not follow predictable patterns, so there is a limit to the extent to which they can be presented systematically.

In the case of LEGO® therapy, more improvements in autism specific social competence and maladaptive behaviour were seen in children receiving this systematic approach in comparison those receiving the non-systematic SULP approach. Children receiving SULP did improve in measures of adaptive socialisation and communication, but not on the autism specific social skills measure. This suggests that the systematic approach used in LEGO® therapy did help improve the social deficits relevant to ASC (such as aloofness, rigidity, withdrawal from social situations, eye contact) whereas the non systematic approach in SULP did not. However, at present it is not clear whether it was the systemising per se that caused the improvements. Future research is necessary to elucidate what aspects of the interventions used are the active elements.

Possible ways to operationalise and test the empathising-systemising model need to be found. We need to find out whether systemising is motivating, whether presenting information systematically makes it more understandable to individuals with autism, and whether this differs in typically developing individuals and across genders. A simple experiment could be done that presents information (e.g. a list of emotion definitions) either systematically (e.g. in categories of similar types of feeling) or non-systematically (in no particular order). Each of these emotions could then be presented either on carriages of trains, on a track going around in a predictable path (i.e. high systematic appeal), or randomly floating across a computer screen in no particular direction (i.e. no systematic appeal). We could then compare how many definitions were learned in the different contexts and elucidate to a certain extent whether it is systematic appeal, or systematic organisation of information that is important.

8.2.3 Does using systemising promote generalisation?

It was hypothesised that systemising would promote generalisation of learning due to the motivating nature of the materials. Being more motivated and more attentive to learning opportunities due to the intrinsic appeal of intervention materials may reduce the need for artificial reinforcement of behaviours. Artificial reinforcers can impede generalisation to the natural environment, so it was hypothesised that using systematic materials in interventions may improve generalisation. However, while using systemising may increase attention to emotional information and may increase enjoyment of social skills therapy, the results from this thesis suggest that using systemising does not seem to increase the generalisation of learning to other contexts.

Simply put, enjoyment does not necessarily lead to generalisation. This is not surprising, as generalisation is a pervasive difficulty in ASC and is likely to be a result of differences in cognitive processing, not simply due to inattention and a lack of motivation to learn about social information.

Children who received LEGO® therapy were the only group who showed some generalisation of learning to real life settings (duration of social interactions in the school playground). This suggests that the approach used in LEGO® therapy helped generalisation more than the approach used in SULP. However, it may not be the systemising used in LEGO® therapy that is the important difference between the two interventions. The fact that children (even the typically developing children) watching *The Transporters* showed no generalisation of learning suggests that something more than systemising may be needed. It may be that the naturalistic element of LEGO® therapy is what is important. Learning in naturalistic settings has been found to help generalisation in previous studies (Delprato, 2001; Kohler et al., 1997). The reason for this could be that individuals with ASC who are strong systemisers and who find making links between different settings very difficult are best off learning about important skills within the contexts that they would usually occur. LEGO® therapy happens in a very naturalistic play setting, where children interact with each other as they would do in every day life. Social difficulties that arise during the natural course of events are discussed and dealt with. In contrast, SULP requires making links between stories about the social difficulties of monster characters and real life social interactions. *The Transporters* DVD teaches about emotions in vehicles, something which may not be easily related to everyday life. Perhaps the motivating nature of systemising alongside learning within naturalistic settings is the best way forward.

Another reason for more generalisation within the LEGO® therapy group could be the cognitive element of the intervention. Children were required to actively assess their own and others' social interactions and to identify social difficulties and try to come up with solutions. This may have made the information more memorable. Other studies using cognitive approaches for children with HFA and AS have shown that self-monitoring and self-management strategies are effective at improving appropriate social interactions and children are capable of self-reflection (see Chapter 3). Neither SULP nor *The Transporters* have a large cognitive component to the intervention, and future research should examine the addition of this element to see if it increases generalisation.

8.2.4 What might help promote generalisation?

Clearly, systemising is not the whole answer to the pervasive generalisation difficulties in ASC. Learning within naturalistic contexts or adding a cognitive element to intervention may help, but further research is needed to understand how. It might be useful to examine the aetiology of generalisation difficulties in ASC to see whether these give us any ideas about how to help improve generalisation.

Generalisation requires the creation of rules or categories that apply to several situations that can be flexibly applied to new situations. Without this ability to make conceptual groupings and to use them to make inferences about new information, each new situation appears completely unique and the environment becomes extremely complex. The cognitive theories of autism provide several explanations as to why this process is impaired in ASC. The Weak Central Coherence theory suggests that difficulties with generalisation of information across experiences is due to a lack of ‘central coherence’, i.e. due to an increased attention to details and an inability to perceive the bigger picture or context (Frith & Happe, 1994). In this case, teaching in settings that are closest to those in everyday life may help, as learning occurs in the context in which it will be used, requiring less generalisation skill. However, the ultimate aim would be to teach a flexible understanding of social interactions, rather than rote learning of rules for situations that are likely to occur in daily life. The executive function theory suggests that generalisation difficulties arise due to a lack of cognitive flexibility, i.e. an insistence on routine and sameness (Hill, 2004). This theory also suggests that an inability to inhibit socially irrelevant details may interrupt the ability to learn general rules. Perhaps teaching children how to process social information, by adding a cognitive element to intervention might help, as might teaching in a structured but varied way and removing distracting stimuli from the teaching environment. Teaching executive function skills has been shown to help improve theory of mind in the short term (Ozonoff & Miller, 1995) and future interventions should see if an element of executive function in an intervention helps promote generalisation.

Other ideas suggest that a difficulty with forming categories that requires the integration of information across experiences is at the root of the generalisation problem in ASC (Klinger & Dawson, 2001). Individuals with ASC may be able to create rule-based categories, but may have more difficulty creating prototype-based categories. Rule-based categories are those that can be defined by a list of rules, for example, all objects with four equal sides joined by 90^{o} angles belong to the category of squares. Prototypes tend to be an average of all previously experienced category members and cannot be defined easily by a list of rules, for example Border collie, Jack Russell and Poodle all belong to the prototype of 'Dog'. If individuals with ASC have difficulties with creating prototypes, then they may rely on using rule-based categories. Social situations cannot be easily defined in terms of a list of rules, so such a strategy would result in difficulties with generalising social information. Perhaps teaching category formation might help children with ASC to generalise social learning. For example, children could be asked to put examples of lots of different happy facial expressions taken from different sources (*The Transporters, Mind Reading,* magazines, Smiley symbols) onto a collage. In conjunction with other teaching methods this may help generalisation and the formation of categories for emotions.

A further hypothesis for the generalisation difficulties in ASC has been put forward by Plaisted, who suggests that individuals with ASC show a reduced processing of similarities between stimuli and enhanced discrimination and attention to the differences between stimuli (Plaisted, 2001). This will affect generalisation and transfer of knowledge from one situation to another. Perhaps this should be an added component to interventions. For example, in social skills teaching, different relationships and behaviour between people could be compared, highlighting the similarities as well as the differences (e.g. show a picture of two friends playing, compared to a picture of a child interacting with an adult; or compare a picture of two people in a relationship with two people who are friends).

Future intervention studies should examine these possibilities to help improve generalisation in ASC. If they are successful, not only will they help improve outcomes for children with ASC, but they will also provide evidence about the aetiology of generalisation problems (if we add an element of teaching similarities between social situations and generalisation is improved, this will be evidence to support Plaisted's theory of enhanced discrimination and reduced generalisation).

8.3 Methodological Challenges

When I started out, I was concerned at the lack of rigorous methodology amongst autism intervention research. After 3½ years struggling with methodological challenges, I now have a better understanding of the difficulties in conducting such research. Carrying out an intervention study requires a considerable amount of planning, human resources and staying power (Lord et al., 2005). Setting out as a PhD student, deciding to run interventions myself, recruiting and organising families and recruiting volunteers to carry out blind assessments was slightly naïve; however, I have acquired experience that I probably could not have done any other way. The research presented has also for the most part followed recommendations of how to evaluate psychosocial interventions for ASC (Smith et al., 2007). Nevertheless, there are several methodological issues with the studies presented in this thesis which, if starting all over again, might have been conducted differently.

Firstly, the randomised control trial (RCT) is the gold standard approach for intervention research (Lord et al., 2005; Smith et al., 2007). I set out to do an RCT for the LEGO® therapy and SULP study, but failed to include a no intervention control group due to concerns about attrition amongst families who were randomly allocated to no intervention. Adding a post-hoc no intervention control group who were matched to the other children may not have been the best way of assessing whether either LEGO® or SULP were better than no intervention. Future studies could address the problem of attrition by randomly assigning participants to those who receive interventions straight away and those who get put on a waiting list, and receive no intervention for a period of time. This was done in *The Transporters* study: those allocated to the no intervention group were given the DVD after the 4 week research period.

Problems with no intervention control groups highlight an important ethical issue. To fully examine the effectiveness of different interventions, we need to carry out longitudinal studies comparing the effectiveness of different approaches over time. Clearly it is unacceptable to randomly allocate needy children to a no intervention group over a long period of time. Perhaps no intervention groups should be replaced in longitudinal studies with comparison interventions. If two different approaches show different outcomes, then this will be extremely useful information in itself.

A further difficulty arises in isolating interventions that are effective because children with ASC rarely receive no therapy. Due to a lack of consistent evidence in favour of one approach over another parents try several approaches, thus any gains cannot be attributed to a single intervention. Large enough numbers of people need to be evaluated so that additional therapies can be controlled for statistically. Alternatively, studies using baseline designs can be used, in which different interventions are added over time and change in outcome measures after intervention compared to baseline can be assessed.

The lack of long-term follow-up is a further limitation to the studies in this thesis. It would be interesting and valuable to follow-up children who receive emotion recognition intervention at a young age to see if gains are seen in later childhood and even adulthood. This would have a bearing on the importance of pivotal skills in the development of social competence. Also it would be important to compare the long term outcomes of children receiving LEGO® therapy or SULP. However, a project like this requires long term funding and a lot of motivation from parents and children participating in the study. Large scale, multi-site studies that are well funded over the long-term are necessary to compare different interventions over the lifespan.

Another difficulty encountered in this thesis was with outcome measures. Using the Vineland Adaptive Behaviour Scale enabled adaptive functioning in socialisation to be assessed, but this is a parent interview that may have been open to bias as parents were not blind to the intervention their child was receiving. It may also not be sensitive enough to the changes that may have occurred over the course of intervention. The Gilliam Autism Rating Scale was useful as a measure of autism specific social difficulties, but again may have been open to bias and may not have been very sensitive. Direct measures were used with the hope that these would pick up on more subtle elements of social and emotional behaviour, however, these were not well validated, and problems arose with a lack of human resources to carry out blind assessments. Also, in *The Transporters* study, the use of still face stimuli instead of animated ones may have been the cause of a lack of generalisation being found. Animated faces are much more ecologically valid, and the type of face children will come across in everyday life. They were the types of stimuli used in the DVD, but still face stimuli were used in assessments. Future research should examine whether using stimuli of the same modality in intervention and assessments improves the ability to measure any generalisation that might occur. Type of stimulus, along with the age of participants, was one of the key differences between the study presented in this thesis and previous research evaluating *The Transporters* for older children with ASC. This study showed excellent results and generalisation to real faces in animated stimuli. Future research is urgently needed to create and validate appropriate outcome measures for social competence that are sensitive to change in the targets of intervention, are easy to use, and clinically relevant.

One of the main criticisms of research into interventions for ASC is small sample sizes (Lord et al., 2005). Though the sample sizes in the studies in this thesis were larger than many intervention studies they were still small. A good amount of effort was put into recruiting participants; however, it was still difficult to get enough families to take part. This could be due to the large commitment required from families to take part in a long-term intervention project. In the LEGO®/SULP study, families had to come to the Autism Research Centre every week for 5-6 months, often bringing siblings and rearranging family commitments to do so. This large commitment is likely to put people off taking part in research projects, particularly as family life with a child with ASC is often difficult. In *The Transporters* parents were required to show the DVD to their child every day for a month in addition to allowing their child to be assessed for up to 2h30 at the start and end of the study. Some parents may not have been able to commit to this, and some children may not have been able to cope with long assessment sessions. Recruitment strategies may also not have been suitable for parents. It was surprising to me that out of 798 people who asked for research information, only 73 decided to take part (see Figure 5.3 in Chapter 5). This suggests that either something went badly wrong with the letter describing the research study or the commitment required to take part was too large. To comply with ethical regulations every detail of the studies has to be described in recruitment letters.

While I agree with this, it was interesting to hear that one mother suggested I simplify the letters in future, as they contained too much information and were overwhelming. This may have put families off participating.

8.4 Limitations and future directions

There are several other factors that limit our ability to generalise findings from this thesis to children with ASC in general. Firstly, the group of participants were those with HFA and AS who had average or above average IQ. While this population was of particular interest for the interventions studied due to their suitability for use within mainstream schools, we cannot generalise the findings to children with lower functioning autism. Due to the language requirements of all of the interventions in this thesis, I do not think that they would be suitable for non-verbal children with ASC, however, future research should examine whether the approaches could be adapted for children with lower intellectual capacity.

The participants in this thesis had heterogeneous diagnoses of ASC. Some children had diagnoses of AS, others HFA, others autism. Some children had a non-specific diagnosis of ‘autism spectrum disorder’. It is possible that children with different diagnoses respond differently to the interventions, for example, it could be hypothesised that children with AS might do better than those with a diagnosis of autism due to their superior language skills and therefore better understanding of the verbal aspects of the interventions. Future research should have larger samples, within which diagnosis can be investigated as a variable that may predict outcome.

Another important area for future research would be to evaluate at what age the interventions are most successful. For example, previous research found *The Transporters* to be highly successful for 4-8 yr olds with ASC, whereas the current thesis found a lack of generalisation using the same DVD in 2-5 yr olds. Despite this, and consistent with previous research (Harris & Handleman, 2000), younger age predicted positive outcome in the study in this thesis. Alongside the findings that different child characteristics predict different outcomes in different interventions, it seems important that future research be carried out to evaluate fully which child characteristics are associated with which outcomes in different interventions.

It is not just the child characteristics that are likely to be important. Therapist skill may also be a contributing factor in outcome (Smith, Buch, & Gamby, 2000). As I was the therapist for both the LEGO® and SULP interventions, therapist skill was not really assessed in the first LEGO® study. In the school study, there were three different therapists, and from the treatment fidelity measures it could be seen that some were doing a better job than others. If interventions are to be successful and evaluated in multi-site research, then standardised training needs to be implemented and future research should evaluate this. No therapists are required to use *The Transporters* DVD, but it is likely that different parents take different levels of interest in the DVD and may promote emotion recognition in the home to greater or lesser extents (Luiselli et al., 2000). Future research needs to assess whether different levels of parent participation result in different outcomes for the child.

A further variable that should be examined in future studies is the length and intensity of intervention. It is thought that the more intense interventions result in the best outcomes (Lovaas, 1987), but research suggests that very intense interventions of up to 40hr per week are not necessarily more effective (Gabriels et al., 2001; Luiselli et al., 2000) and such approaches are usually used with lower functioning children with ASC. The interventions described in this thesis were all very low intensity. Further research should examine whether better outcomes would occur if the interventions were used for more hours per week. Also, perhaps better outcomes would occur if the interventions were used for a longer period of time, particularly *The Transporters* DVD, which was only used for 4 weeks. It is likely that more improvements might be seen should children watch the DVD for longer.

A promising way forward in intervention research in ASC would be to carry out interdisciplinary studies that try to integrate brain structure, genetics, neuroscience, cognition, behaviour and intervention. Bringing together these different levels of explanation is the next step in fully understanding autistic behaviour. Having an improved understanding of the aetiology of ASC is likely to help with the development of effective interventions. As can be seen in Chapter 1, there is still a long way to go before we have a sound understanding of the causes of ASC; however, it is nevertheless important to base interventions on current theoretical understanding of the condition. If a theoretically based intervention proves successful, not only can it inform us of how to help individuals with ASC, but it can also provide evidence about the aetiology of the condition. Previous short-term interventions have been based on theory of mind and executive function difficulties, and have shown limited success. The studies presented in this thesis are some of the first to base interventions in the E-S theory of the condition. Results have demonstrated that including an element of systemising is enjoyable for children with ASC, but that systemising does not help generalisation. Further evaluation is necessary to examine whether systemising per se is the active component of intervention, particularly with regards LEGO® therapy. If subsequent studies find that systemising does help social competence, then that will provide evidence that E-S theory does indeed characterise the cognitive profile of ASC. Future research is needed to examine the E-S theory more rigorously, and perhaps this will help inform intervention practice. Intervention research should carry on along this path of basing practice in theory, as and when new evidence of the aetiology of ASC emerges.

An inter-disciplinary approach could also be applied to the evaluation of interventions. One interesting avenue could be carrying out neuroimaging studies of the social brain network of children with ASC before and after participating in an intervention. For example, the brain regions involved in emotion recognition or face processing could be examined before and after using *The Transporters* DVD, to see if outcomes can be measured in terms of change in brain activation. Similarly, areas of the social brain network such as the amygdala could be examined before and after social skills intervention. Gaze tracking studies should also be used to examine outcomes from intervention: do children with ASC look more at the eye region of the face following emotion recognition training? Do they spend more time looking at socially relevant aspects of scenes following social skills training? All of these questions can be answered in future multidisciplinary research.

8.5 Clinical impressions

It became very clear throughout the course of the LEGO®/SULP study that parents were extremely grateful for any type of intervention for their child. All of the children in this study were in a mainstream school or in an inclusion unit within the mainstream. Parents felt that their child often did not get the support they required, and were very pleased to have an after school social skills group that their child could attend. It seems that inclusion in the mainstream is not working for several children with ASC without special provision to deal with social skills. LEGO® therapy was easily incorporated into a school setting with success in the pilot study in this thesis, and future studies should carry out larger scale evaluations to confirm this. SULP is already used in schools, and research should be carried out for both LEGO® therapy and SULP to compare their efficacy when delivered in school settings in comparison to clinic settings. Future research should investigate other options that could either be included as after school social skills groups specific to ASC. Other educational strategies aside from inclusion should also be researched.

Alongside the fact that their child was enjoying attending the social skills groups, parents also enjoyed their time with other parents in the waiting area. Further important research should be done to evaluate parent stress and outcomes for the rest of the family following interventions. Studies have shown that greater levels of family stress are associated with having a child with ASC compared to a child diagnosed with mental retardation (Konstantareas, Homatidis, & Plowright, 1992). Adequate social support and active coping styles are related to positive family functioning (Bristol, 1987). It seems likely that having some time each week to talk to other parents with similar children to your own could have large benefits for family function, and parental self-esteem and coping. Feedback from families and teachers who used *The Transporters* showed that the DVD was a useful resource in schools and at home. It could be regarded as one part of a social skills training programme, and can easily be incorporated into lesson plans and daily home life. Research evaluating its effectiveness alongside other approaches is warranted.

8.6 Overall conclusion

This thesis has started out on the road to evaluating interventions that have the potential to be widely used in school and clinic settings. They are easy to implement, fun to use and show some success in improving social competence in children with ASC. Considering that many interventions with ASC require very specialist training or huge amounts of commitment, the fact that all of the interventions in this study are easy to use and do not require lots of time is something in their favour. In schools in the UK, interventions that are easily used are widely used, despite a lack of research evidence. The fact that the three approaches here can be (and in the case of SULP, are) widely used and now have had some research evaluating their effectiveness is a really positive step. Nevertheless, there is still a considerable way to go in the field of autism intervention research (see Figure 8.1 for a few possible future directions). Developing and evaluating more approaches along the lines of LEGO® therapy and *The Transporters* is vital, if high functioning children with ASC are to receive the specialist support they deserve.

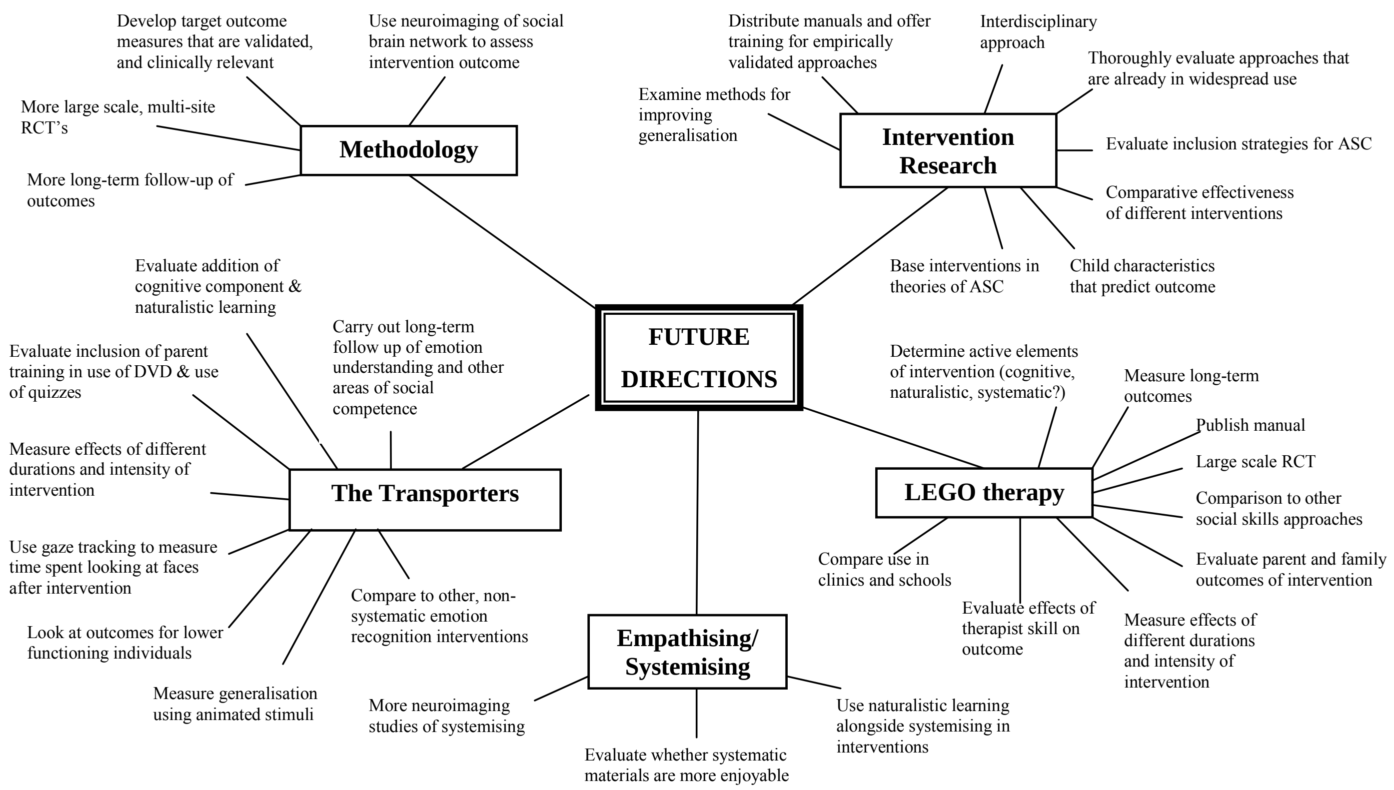

Figure 8.1. Ideas for future directions in intervention research for ASC

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Appendix 1: LEGO® therapy manual

LEGO® THERAPY

A MANUAL FOR THE IMPLEMENTATION OF LEGO®-BASED SOCIAL DEVELOPMENT THERAPY FOR CHILDREN WITH AUTISM SPECTRUM DISORDERS.

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2007

Introduction

LEGO® Therapy is a social development programme that evolved over time as a consequence of ongoing attempts to provide effective social development therapy for children with autism spectrum disorders. The strategies used in LEGO® Therapy reflect both Dr LeGoff's input, as a scientist-practitioner, study from Miss Owens' doctoral thesis, and the influence of an inspiring and persuasive group of children.

The impetus for developing LEGO® Therapy was provided, first, by the scarcity of school-based social skills development programs with demonstrated effectiveness that were suitable for children with autism spectrum disorders. The second major reason for the development of this approach was the fact that therapy approaches in use at the time often seemed difficult, irrelevant, and un-engaging for the children. In other words, for most educational, behavioral and mental health specialists working with children with social development deficits, the existing therapies were neither effective, nor fun. It is often noted that children with autism spectrum disorders tend to be disinterested in social learning opportunities, and have little intrinsic motivation to improve their social functioning (e.g. Attwood, 1999; Klin & Volkmar, 2000), but there have been very few published studies which provide clear evidence of effective interventions designed to overcome these deficits. A third impetus for this approach was the fact that although many children with autism spectrum disorders can learn to respond appropriately to social skills exercises in the therapy setting, and can demonstrate social behaviors when prompted by adults or peers in some settings, the generalization of these skills to new settings and to everyday life is often unsuccessful. There is a persistent absence of self-initiation of social interaction, especially with peers, including a failure to develop age-appropriate peer relationships. The children appeared to be able to learn from social and play drills and exercises, and when prompted could demonstrate the correct behavior in the classroom, but they were not initiating contact or play in the playground, and they were not making friends.

Although there have been a number of published guidelines for social skills interventions for children with autism (Mesibov, 1984, 1992; Gray & Garand, 1993; Gray, 1994; Gray, 2000; Frea, 1995; Quill, 1995), few of these provide much empirical evidence of effectiveness (Swaggart, Gagnon, Bock, Earles, Quinn, Myles & Simpson, 1995, and Ozonoff and Miller, 1995). In addition, despite the work of a few clinical researchers describing different diagnostic groups and clinical features (Schopler & Mesibov, 1992, 1986; Baron-Cohen, 1995), there has been little empirical data regarding which therapy approaches might be more or less effective for which problems. The extant treatment literature indicates that psychoeducational interventions should be tailored to the needs and strengths of the individual child and family (e.g. Albanese, et al, 1995; Schopler, 1987; Harris & Weiss, 1998), but there is still scant data available to guide these treatment decisions. Recently, there has been a significant expansion of autism treatment literature (e.g. Weiss & Harris, 2001; Quill, 2000; Koegel & Koegel, 1995). Unfortunately, there remains very little empirical data available on outcome efficacy for improving social skills, and even less on variables affecting outcome. A comprehensive discussion of the recent treatment outcome literature is beyond the scope of this manual and the reader is referred to the following texts:. Klin & Volkmar, 2000; AACAP, 1999; Schopler, Mesibov & Kunce, 1998, part IV; Harris & Handleman, 1997. The gold standard for evaluating interventions of any kind is the large scale randomized control trial (RCT). As yet, no large scale RCT has been carried out to evaluate the effectiveness of Lego ® Therapy fully. However, some very informative small-scale controlled studies have shown that LEGO® Therapy is effective for improving social competence in children with autism spectrum disorders.

Recommendations state that prior to any RCT being carried out a comprehensive manual must be published to ensure that any intervention being evaluated can be faithfully replicated. This manual presents a comprehensive description of LEGO® Therapy and its components, such that professionals can set up their own therapy groups and researchers can carry out the necessary RCTs to evaluate its true effectiveness. The clinical approach used in LEGO® Therapy and outcome data from research are presented with three purposes in mind: First, to describe a therapy approach which appears to be interesting and engaging to the participants; second, to provide data on which to assess the therapeutic effectiveness of this approach in improving social competence in different types of children with autism spectrum disorders; and third, to stimulate some thought about the nature of social competence, its component skills, and the effective strategies for enhancing it.

The Development of LEGO® Therapy

The use of LEGO® as a therapy medium is based on the idea of 'constructive application' (Attwood, 1998, p. 96): that is, using the child's natural interests to motivate learning and behavior change. Attwood described children with Asperger Syndrome as deficient in the need to please their teachers and parents (and therapists), ignoring the usual social pressures to conform to peer groups, imitate peers, cooperate with them, or compete with them. Consequently, many of the techniques recommended for social skill building which utilized peer instruction and peer modeling, have had little impact, or worse, result in robotic attempts at imitation. Even on a one-to-one basis it is often difficult to sustain motivation to persist with learning tasks that they do not find inherently interesting. Although use of external rewards can improve compliance, these gains are usually short-lived, and intrinsic motivation for learning is rarely achieved (Greenspan & Wieder, 1998; R.L. Koegel, L.K. Koegel, Frea & Smith, 1995). At the same time, these children often develop singular, obsessive interests and habits, and appear to have limitless reserves of focused energy and drive when engaged in these activities. It has therefore been recommended that children's stereotyped interests and/ or behaviors be used to promote the learning of social, communication and play skills (Attwood, 1998, Greenspan & Wieder 1998). This can be done by shaping activities and behaviors to promote interaction (Greenspan & Wieder, 1998) and by using a child's choice of stimulus to improve their motivation to participate in social interactions or as natural reinforcers for positive social interactions (Koegel and Koegel ,1995) Most published studies of social skill interventions have also emphasized the importance of peer modeling, peer interaction, and opportunities to practice social competence with peers (cf. Harris & Handleman, 1997; Koegel, L.K., 1995).
The idea of using LEGO® as a therapy tool in a structured and comprehensive way arose from an inadvertent observation. Two of Dr LeGoff's clients, both eight years

old and diagnosed with Asperger's Disorder, were found excitedly playing and talking together in the waiting room. They had coincidentally brought LEGO® creations to the clinic that day, and as one was leaving and the other was arriving, they discovered each other. These two boys had previously shown little or no interest in each other, and had low motivation for social interaction in general. After a discussion with their parents, we agreed to try to work with the two of them together using LEGO® as a medium for them to communicate and to motivate them to continue the relationship. Initially it was just the two of them. They brought LEGO® constructions to share, or built LEGO® sets were provided. They were clearly motivated to complete new LEGO® sets (the reader may have seen or experienced this phenomenon directly) and cooperated fully with social skill building strategies (such as sharing, turn-taking, making eye-contact, following social rules, using greetings and names) as long as they were permitted to build LEGO® sets. A key strategy for sustaining interaction involved dividing the task of set building so that they had joint and interactive jobs to do: one was given the LEGO® pieces to put together, and the other the visual instructions. The "engineer," was required to give verbal descriptions of the pieces needed and directions for assembling them, while the "builder" followed his directions, collected and put the pieces together. There was much checking back and forth between the plan and the creation. Roles were then switched so they both had a chance to be both "engineer," and "builder." Much of this was done through nonverbal communication and required considerable emphasis on joint attention, eye contact, and "mind-reading" in general (cf. Baron-Cohen, 1999). We also did joint "free-style" building, in which the two of them had to agree upon a project, the design and materials, and the final shape and color of the creation. This required considerable problem solving and some conflict-resolution. Rules to follow were provided, but they were generally left to muddle through on their own as much as possible. Eventually, the two of them developed a relationship independent of the therapy, and started meeting for "play dates," outside of the joint therapy sessions.

Individual therapy continued alongside the joint sessions, allowing for reviews, practicing and rehearsing skills and problem-solving strategies so that we could implement these in the next joint session. Individual sessions were also centered around LEGO® building, which we used as an interactive medium for working on turn-taking, perspective-taking, eye-watching, joint-attention, and question-asking. During the joint session, one or the other could be cued about something practiced in individual therapy, such as following gaze, asking social questions, making apologies, or initiating play. The back-and-forth between individual and joint sessions added considerably to the effectiveness of the therapy overall. If something came up in the joint session, for example an unresolved dispute, an inappropriate or annoying behavior, or a frustrating situation that led to a melt-down, we would revisit that in individual therapy and work on the underlying skill.

Group Therapy: The LEGO® Club

Soon after beginning LEGO®-based sessions with the initial two clients, the LEGO® collection began to grow, and others began to express an interest in using them. The children with autism spectrum disorders seemed to naturally gravitate towards LEGO®, and ignored the other toys and activities that were also provided in the playroom (the puppets, paints, sand-tray, dolls, board games, Playdoh, etc. eventually went into the closet). Somewhat surprisingly, the first two LEGO® enthusiasts were happy to have others join them. The LEGO® creations and paraphernalia, LEGO® posters, pictures of the children and their favorite LEGO® creations, postcards from LEGO-Land© trips, and LEGO® magazines and catalogues, soon filled a large playroom. Eventually, there were seven children in the group. Work with the larger group utilized the same strategies that had been developed with the first two members: collaborative work, division of labor, sharing, turn-taking, cued eye-contact and gaze-following, emphasis on verbal and nonverbal communication, and taking advantage of natural opportunities for practicing social support (tearful meltdowns were a common occurrence), social problem-solving and conflict resolution.

Once the decision was made to increase the size of the group (which we called LEGO® Club), there was a need for increased structure, and a consistent set of rules (cf. Kunce & Mesibov, 1998). LEGO®-based therapy strategies also evolved, such as LEGO® building contests in which members worked in pairs.

For the first time for most of them, they identified with a peer group, and began to be motivated by social approval and social status within that group. In order to become a better LEGO® builder, which was associated with increased status with their peers, they needed to learn from them, cooperate with them, solve disputes, and be helpful. Initially we used a formal "LEGO® Points" system, in which points were awarded for behavioral, social and LEGO®-related achievements which could be traded in for LEGO® prizes (small sets, LEGO® people, etc.). The points became inherently valuable after a while, and were not associated with any primary reward, other than social approval. Group members continued to follow social and behavioral rules, practiced "mind-reading," solved social conflicts, and exhibited pro-social behavior long after the points became merely a verbal "feather in the cap."

The LEGO® Club was instantly popular with parents, in part because their children were highly motivated to participate in the therapy. The parents formed a LEGO®-Club support group in the waiting area. They discussed their children, their IEPs, the impact on their other children and extended families, the strategies they were using at home, etc. Some also began to get together socially outside of the group sessions (c.f. Albanese, et al, 1995; Marcus, et al, 1997). At the suggestion of a parent, non-autistic siblings were included in the younger groups as role models and "helpers." They were well-suited as helpers, as they were familiar with the problems of their sibling, and required little prompting to provide redirection for stereotyped behaviors, or distraction from oncoming tantrums.

Over time, various social skills strategies were tried. Some were successful, and some were not. Successful and unsuccessful strategies are described on p 32. Eventually, there were nine LEGO® social skills groups altogether, with members ranging from pre-school to high-school and even college. Some of the original group members were still participating after seven years. Although the style of interaction in the group changed over time, becoming more verbal, and the types of LEGO® changed (more sophisticated, complex, electronic sets and computer software games), the group membership remained very consistent.

Implementing LEGO® Therapy

General Principles

***What* is LEGO® therapy?**

LEGO® therapy is a collaborative play therapy in which children work together to build LEGO® models. Instead of building LEGO® sets by themselves, children work in pairs or teams of 3. The task of LEGO® building is divided into different roles, such that social interaction is necessary to participate. By doing this, children practice key skills of collaboration, joint attention, fair division of labor, sharing, turn-taking, eye-contact, gaze-following, verbal communication and nonverbal communication. LEGO® therapy can be held in both individual and group sessions during which natural opportunities are used to practice social communication, social support, social problem-solving and conflict resolution skills.

Who is LEGO® Therapy for?

LEGO® Therapy was initially developed for children with autism spectrum disorders. However, it may also be helpful for children with other social communication difficulties and anxiety disorders (especially social phobia), depression, or adjustment difficulties manifesting as depression or anxiety. Experience suggests that LEGO® therapy may not be appropriate for children with behavior disorders, such as ADHD, ODD, or other externalizing disorders, who also have social skill problems.

What qualifications do you need to run LEGO® Therapy groups?

LEGO® therapy should be run by individuals who have a sound understanding of children with autism spectrum disorders and experience of working with children. Clinical psychologists, educational psychologists, teachers and learning support assistants are all capable of running LEGO® therapy groups. Alongside the main adult supervisor, additional support staff may be needed. Typically, two adults are needed to help in a group of six children. The methods used in LEGO® therapy are clearly outlined in this manual, and should be implemented by dedicated individuals who are experienced in working with children with autism spectrum disorders.

T*he main principles of LEGO® therapy*

The use of LEGO® as a means of facilitating social, behavioral and cognitive development is an intervention approach which developed as a result of applying the following basic principles:

LEGO® therapy is a skill-building approach. This assumes that problematic social behavior and deficits in the development of age appropriate peer relationships result from underlying neurobiologically-based deficits in social development. As children improve in their social and adaptive functioning, self-regulation, and problem-solving,

behavioral and social deficits are replaced by more adaptive behaviors in all relevant settings.
LEGO® therapy capitalizes on the inherently rewarding and motivating aspects of constructive play. The intervention thereby avoids the necessity for using secondary positive reinforcement in order to elicit and sustain appropriate behavior in almost all cases.

The core of the therapeutic intervention is a collaborative process, with inherent inter-dependence, creating a necessity for joint attention, shared goals, social communication, and mutual purpose.

LEGO®-based interventions emphasize social identity development. In creating a sense of common purpose and a shared interest in the LEGO® play system, children who otherwise are typically socially isolated, feel that they are part of a group of peers with whom they identify. As one of the first participants expressed, after meeting another child who was a LEGO® fan: "That kid is from my planet."

LEGO® therapy has four progressive levels of intervention. Each level builds on the skills learned in the previous levels. These levels are described in the next section.

LEGO® therapy levels of intervention

<u>Level One – Individual Therapy.</u>

Pivotal Skills

Many younger children, and those with cognitive and/or visual-motor deficits, may need help with learning the basic skills of LEGO® building. For this reason, the leader may wish to start with individual basic skill acquisition. Core or "pivotal" skills (c.f. Koegel & Koegel, 1995) necessary for higher level activities include the following:

- Sitting in a chair at a table, without attempting to escape;
- Responding to verbal and nonverbal prompts, including pointing and gaze direction;
- Imitation of actions with LEGO® materials;
- Not engaging in aggressive or destructive behaviors;
- Compliance with group activities and routines;
- Cooperation with peers;
- Verbal and nonverbal communication with peers;
- Sorting LEGO® pieces by color, size, shape and function;
- Associating LEGO® pieces with verbal labels (receptive labeling);
- Verbally describing pieces (expressive labeling);
- Following simple set directions, with adult assistance;
- Following simple set directions with peer assistance;
- Independent assembly of small LEGO® sets.

Although many of these skills are prerequisites for group participation (e.g. sitting still, not engaging in aggressive behavior), others are skills which can be acquired in individual as well as group activities. The leader should collaborate with others, including home-based therapists, teachers, behavior analysts, speech-language therapists, occupational therapists, in working on these goals. Often it is helpful to have periodic team meetings to introduce other team members to the use of LEGO® as a medium, and to discuss goals and strategies.

Children working on pivotal or Level One skills can be included in groups with peers of similar levels, although these groups usually require 1:1 or 1:2 adult-to-participant ratios of supervision. In these groups, typically, the group is led by a senior leader, with additional support provided by qualified aides, students, trainees, etc., similar to levels of instruction and supervision necessary in a classroom setting. These groups should contain a balance of activities focused on three areas:

- Building fine motor, visual-motor and other basic skills
- Behavioral self-control and compliance
- Social and communication skills.

Therapeutic Activities for Building Pivotal Skills.

<u>Preference assessment.</u>

Determine the child's preferred LEGO® activities by first allowing the child to freely explore the LEGO® therapy room (this can be done during an initial interview), and noting the items with which they are engaged. If they do not engage with the materials, or show no particular preferences, you may ask the parents about preferred play activities, sensory experiences, or color and texture preferences. Follow up these suggestions by presenting the child with a limited number of options (two or three at a time), within visual sight and arms' reach. Note which items are reached for consistently; especially if they go on to manipulate the items. Attempt to take the items from the child and place just outside of their reach, but within sight. Note whether they request or otherwise indicate interest, by reaching, pointing, or vocalizing while looking at the item.

Typically, children will show a preference for at least one or two small display items, or for a particular container of freestyle pieces. Attempt to find at least two or three activities or items which consistently result in reaching or other signs of interest. Some children gravitate towards the LEGO® literature (catalogues and magazines). These can become preferred items on their own, or the child may indicate some items from the catalogue which are desired, either by nonverbal cues (staying on one page, pointing, etc.), or by verbal request. It may be useful to have parents or the Club acquire these items. It is also advised that duplicates of LEGO® catalogues and magazines be available, as these tend to have a shorter life than the building materials, especially well-loved favorites.

Initiating structured activities.

In subsequent sessions, the pivotal skills can be built using the preferred items, both as materials, and as rewards for compliance, sitting, communication, etc.

Small Set Building. If the child has shown a consistent interest in a small set, the set can become the focus of initial sessions, by having the child construct the set from disassembled parts, using the directions, with adult support. The instructions may need to be modified, including enlarging them, laminating them, or by creating more detailed directions with additional sub-steps (this is difficult and time-consuming, and should be necessary only with severely delayed children). It is often helpful to have duplicates of favorite small sets so that the finished set can be used as reward for initiating set construction, or for doing pre-construction activities, e.g. sitting at the table, putting pieces into the tray, sorting the pieces, looking at the instructions.

If child has chosen a small set that is beyond their building skills at the initial stage, and will not accept a smaller set, early instruction may begin with a partially completed set, with only the final few steps left unassembled. This can be highly motivating, and leads to early mastery experiences which are inherently rewarding.

Appropriate sitting and compliance with the task should be rewarded with access to the preferred set item. As the child is able to show consistent compliance for access to the completed set, the set can be progressively disassembled, with parts of the set used provided as reinforcement. Consistent with reinforcement principles of discrete trial instruction (c.f. Leaf & McEachin, 2000), the duration of sitting, and number of compliant responses necessary for receiving an additional part or piece of the set, can be increased over time. Keep in mind that the set may eventually lose interest for the child, and other sets may be substituted. Keeping track of items with which the child initiates play when they first enter the room, can help with keeping a set of desired items, which can be rotated as needed.

Pre-building Skills.

In order to prepare a child for collaborative building in groups, they need to develop basic motor and cognitive skills, including piece sorting, piece assembly, matching and imitating. This can be done with freestyle pieces easily, and children can be rewarded for completing the activities with access to a preferred set or pieces of the set. Activities should include:

- sorting by color, shape and size (e.g. “Put the red ones in here, the blue ones here,”;
- matching three-dimensional pieces (i.e. “Find another one like this,”);
- matching two-dimensional images (from instructions) with actual pieces (“We need one like this, look in the picture,”);
- piece assembly (i.e. “Put this one on top, press hard,”);
- imitation (i.e. “Can you make yours look like mine?”);
- turn-taking (i.e. “Ok, you do the next one,”); and
- simple collaborative building (i.e. “What should we build? What next? Show me,”).

Building Skills.

Collaborative set-building can be initiated once the child shows independent abilities to identify pieces, sort and select pieces based on the instructions, and basic imitation. Medium level sets (50 – 150 pieces) can be introduced. The LEGO® age guidelines provided on sets can be very useful in determining the next level for a given child. Parents should be encouraged to attempt sets at home which are at the next level of difficulty above the one most recently mastered. Often, at this level, the child will need adult prompting and help, especially with parts that are more difficult to assemble (e.g. wheels, smaller parts). Once they are able to consistently collaborate with an adult and stay focused on task appropriately, without having to use external reinforcement each step (i.e. rewards can be delayed to final completion), the child is ready for collaborative building with a peer.

Level Two – Collaborative Building with One Peer.

Level Two activities involve collaborative building with one peer, and often require close adult supervision. It is often helpful, especially initially, to have a typically developing or at least more advanced peer-mentor as a helper. In this regard, we have often found useful to match a child who is working on prosocial and helping behaviors with a learner (i.e. a LEGO® Creator or LEGO® Master with a LEGO® Builder or Helper- see section on behaviour management and rewards). Although peer mentoring continues at all levels of the LEGO® Club groups, at times such as this, it is more explicitly the focus of the intervention.

Collaborative Set Building.

With pairs, it is often helpful to start off with sets which are within reach of the child who is being helped. As the pair demonstrates reciprocal building (e.g. they able to complete a small set independently, with minimal adult intervention), the level of complexity of sets can be increased. The helping child may need to be given additional support and rewards for being patient and supportive at this stage, with access to preferred sets, magazines, etc, or by earning new sets or desired pieces. Typically, helpers have difficulty allowing the less skilled builder to fully participate, and will tend to take over the task completely. For this reason, the adult should strictly regulate the activity by assigning specific tasks as follows:

The child just starting level two will be the Parts supplier. Their job is to find the correct LEGO® pieces and give them to the child who they are working with.

The more advanced member of the pair will be the Builder. Their job is to put the pieces together according to the instructions.

The Parts supplier should be encouraged and prompted primarily by the builder, not the adult supervisor. For example, the builder should prompt the parts supplier when they have finished one step and need the next piece.

The Builder should be instructed to follow a hierarchy of requests or prompts. The Builder will ask for specific parts needed to complete the set by verbally describing the pieces, first (e.g. 'Please can I have a black 2 by 2 brick?'). Second, if the Parts supplier gives the wrong piece or doesn't respond, the Builder should point to the item in the instructions, again giving the verbal label. Finally, if the Parts supplier has not yet given the correct piece, the Builder should point to the actual piece, and again verbally label it. The Builder should not take pieces from the Parts supplier, or take the Parts supplier's hand to guide a response. Only when there is a clear failure of verbal and nonverbal requests, the adult should give direct assistance by pointing or hand-over-hand prompting. The adult should also repeat the verbal prompt, and if necessary, the place the piece in the Parts Supplier's hand, and then prompt him or her to give the piece to the Builder.

This process of collaborative building with a peer is at the core of the LEGO® Therapy process, and should be learned and perfected as a central skill-building strategy. All higher level LEGO® Therapy activities are dependent on mastery of this initial collaborative task.

Once a Parts supplier has shown some mastery of this task, i.e. the child spontaneously gives parts and needs fewer non-verbal prompts, then turn-taking should be introduced. In this situation, the set is either divided according to number of steps (e.g. one child is builder for the first 20 of 40 steps and the second child is builder for the final 20 steps), or by functional design characteristics of the set (e.g. building different parts, or sections of a set). On larger sets, with pairs collaborating, it may be necessary to switch more than once during the completion (e.g. switching every ten steps). Alternatively, turn-taking can be determined by time, e.g. swap roles every 10 minutes.

Collaborative Freestyle.

Once a child is able to sustain consistent turn-taking and collaboration with a peer on set-building, they can be introduced to paired freestyle building. Freestyle building is designing and building your own creations from non set specific LEGO® pieces, rather than following printed instructions to build a particular model. The adult can help steer the pair towards possible projects, which have good potential for success (see table 2 for examples of freestyle activities).

Freestyle building involves an increased demand for communication, sharing of ideas, joint attention collaboration. The pair should initially be led by the more advanced child. Their role is now the Engineer, and they are in charge of designing the freestyle creation. The less skilled child, who is working at level two combines the roles of Parts supplier and Builder.

The emphasis in freestyle building should be on both effective communication, and collaboration. Problem-solving, compromise, and turn-taking may need to be encouraged, modeled and supported by the adult. If there is little success initially (e.g. the Engineer just takes over and the Builder winds up watching or making suggestions which are ignored) the adult should take a more active role. In this situation, the adult should join in a subservient role (Parts supplier or Assistant builder) not as Engineer.

Once the pair has demonstrated some proficiency at independently designing and completing freestyle creations, the less experienced child is ready to take over the role of Engineer. Again, the adult may need to be more involved initially, and again, should assist rather than direct the project. Typically, at this stage, the LEGO® Helper will be given a mock diploma, recognizing their achievement of the LEGO® Club status of LEGO Builder, and is eligible for inclusion in larger group setting with age/developmental peers.

<u>Level Three – Collaborative Building with Two Peers.</u>

Set Building.

Group set-building within LEGO® Club groups usually involves small subgroups. With some of the larger projects undertaken by the older groups, there are often five or six participants working on a project, but with younger groups (age 12 and under), there are usually no more than three participants working on a given project.

In the dyads and triads, the members are assigned different building tasks:
The Engineer describes which parts are required and where to put them according to the instructions. Bricks can be described according to their colour, shape and size. For example:

 Blue, 1 x 1 brick  Black, corner brick

 Red, 1 x 2 brick  See-thru yellow nose cone

 Yellow, 2 x 2 brick  White round brick

A good place to look to find appropriate names for bricks that are quite complicated in shape is the LEGO® Factory website, on the pick-a-brick pages (factory.**lego**.com/pab/).

Once the Engineer has described the bricks, the Parts Supplier searches through the bricks to find the piece that the Engineer has specified and passes the pieces one at a time to the Builder. Typically, all the bricks are tipped out onto a tray rather than out onto a table so that pieces are less likely to fall onto the floor and get lost. The Parts Supplier may have additional tasks during building, such as cleaning parts for re-assembly for restoration projects, or sorting parts for pre-assembly on larger projects. The Parts Supplier may also be assigned some pre-assembly, when there are a large number of simple units needed (e.g. pre-assembling wheels, axles and tires).

The Builder is given the pieces by the Parts Supplier and constructs the LEGO® set according to the printed instructions and directions from the Engineer.

Children then take it in turns to play each of the different roles (e.g. swap every 10 steps of the instructions). Here is a useful opportunity to practice turn taking in a fair way. It is useful to ask children to generate fair strategies to decide who gets to be builder first (usually everyone wants this job). If they cannot come up with their own idea, then you can prompt them to do 'eenie meenie mynie moh' or 'scissors, paper, stone' or another appropriate and fair strategy.

With most groups of five or more participants, there are at least two adults in the room to facilitate and supervise. As noted above with single peer collaborations, it is important not to take a leading role in the set building, and defer most conflicts or problems to the members themselves. Children often seek out the adults for help, but should be redirected to the other children in the group as appropriate resources. In some situations (e.g. a critical missing LEGO® piece), the entire group may be solicited to provide help. "Search parties," are common during groups in which larger projects are underway.
In younger groups (8 and under) there are more dyads than triads, and there is a need for closer adult supervision. Off-task behavior is more frequent, and is tolerated, as long as the participants can return to the group, often with peer-mediated prompting, "Hey, I still need your help!" Set building can be very technical and demands considerable attention and close interpersonal contact. Younger group members can rarely tolerate this for more than about 20 minutes at a time. Although some older group members can spend a full hour or 90 minutes building sets, the younger ones will need to have breaks during which they can play with the sets or do some relaxed freestyle building. One way of organizing a 1hr session would be to have 20 – 30 mins set building, then 10 minutes break (e.g. for a drink outside the LEGO® space) and then another 20 minutes freestyle building, and 10 minutes clear –up.

Freestyle Building.

In a larger group, it is difficult to maintain close supervision during freestyle building. There is a greater need for movement around the materials, and typically there is more noise and off-task behavior as well. When one participant has an idea for a freestyle design, he or she is encouraged to share the idea with the group, and other group members are recruited to help. This typically results in two or three small groups working with the Engineer who had the idea, and two Builders/Suppliers, who assist. The duration of interaction during freestyle building tends to be shorter, as diverging interests draw group members in different directions. Participants are often cued or prompted to recruit helpers, especially when they seek advice or assistance from the adults.

E.g. Phillip: "Hey Dr. Dan, I need another black wheel like this one."
Dr. Dan: "I know we have one somewhere, not sure. Who's helping you?"
Phillip: "No one. I'm building this by myself."
Dr. Dan: "Can't do that Phil, buddy. You'll need help. Find a helper."
Phillip: "Hey who wants to help me find this wheel? Curt? Help me."

Freestyle building in small groups can often take the form of competitions. For example, two triads may be challenged to create the best space ship, monster truck, fire station, etc. The group members and the group leaders later judge the results. Or there may be some objective assessment procedure, such as a race, completion of a stunt or trick, or a "drop test," (LEGO® creations are tested for engineering quality by being dropped from a certain height – the creation that loses the fewest pieces wins).

Level Four – Social Communication.

Individual Therapy.

Although some participants attend only paired and/or group sessions, many also attend individual therapy, both initially to build pivotal skills, but also later to address specific behavioral or communication challenges. This is often a good opportunity to learn and rehearse communication strategies which can then be practiced with peers in the group sessions. Straightforward skills such as appropriate greetings (learning other participants' names using photos, nonverbal communication such as a high-five in place of handshake, making and sustaining eye contact) can be practiced in individual sessions.

Other more complex issues can also be worked on, including active listening and expressing empathy, social problem-solving and conflict resolution, assertiveness, etc. For these skills, it is important to utilize examples and situations which occurred in the group context, so that there are no hypothetical situations, which tend not to be effective in eliciting the appropriate behavior in natural settings. During individual sessions, participants are asked to review events which occurred during groups, sometimes with videotaped evidence to help. Following this, the participant is encouraged to role-play alternative responses or to practice skills.

E.g. Dr. Dan: "Tony, remember when Burt came to group last week? He was late."

Tony: "Yeah, he was late."

Dr. Dan: "What was he doing when he came in?"

Tony: "He was being late."

Dr. Dan: "Yes, but what else?"

Tony: [Laughing] "He was crying."

Dr. Dan: "Right, he was upset about being late. It bothered him. What did you do when you saw him?"

Tony: "I teased him … Oh, I said 'Cry baby, did you poop your diaper?'"

Dr. Dan: "Yeah. Then what happened?"

Tony: "Burt threw the train, and broke it. He ran out there, and he was knocking things in the waiting room!"

Dr. Dan: "Do you think you made him more upset?"

Tony: "Yeah, I think so. I shouldn't have teased him."

Dr. Dan: "Ok. So what could you have said to him instead of teasing?"

Tony: "I should have said it's ok, don't worry."

Dr. Dan: "How about this, I'll pretend to be Burt, and you practice saying

something that will help me feel better?" ...

During sessions, the participants are prompted unobtrusively to engage in a rehearsed communication skill. Depending on the results, we may do some practice in the group, with other participants helping, and at times, role-playing.

'Check-in'

Participant role-playing occurs more in older groups, especially during the first part of the session, which in 12 years and older groups, is dedicated to social communication skills, during a fifteen minute period called "Check in." During 'check-in' the members are restricted from LEGO® projects for the first fifteen or twenty minutes, and are instructed to present to the group any significant or emotional event that occurred in the past week since the last group session.
Participants are required to listen, and not interrupt the presenter, and each takes a turn, giving a brief description of the event (about two or three minutes). When the participant has finished, the other group members are encouraged to respond. Expressions of empathy and support are encouraged and praised, while problem-solving suggestions are supported, but not as enthusiastically. Group members who express hostility, or who offer inappropriate suggestions, are either ignored, or gently chastised. Role reversal during role play of real scenarios are sometimes used to enhance empathy, both receptive (understanding another's emotions and experience) and expressively (responding in a way that helps the other feel heard and understood).

Following check-in, the group begins a discussion about what they plan to do for the remainder of the session – i.e. choosing a LEGO® project. There is often a strong pressure on group members to convince other group members to join them, but there are often quick alliances and agreements for reciprocal exchanges, as the time for the group is dwindling during any debating. Once there is a consensus regarding a project, the group members are asked to take roles, or projects, and responsibilities are assigned.

Structure of a LEGO® Therapy Group Session

Group sessions usually last between 75 and 90 minutes. The first and last 10 -15 minutes usually involve parent contact. Group sessions, out of necessity, tend to be more structured and uniform than individual sessions.

In general, the format in a group session moves from a higher degree of structure and control by the leader(s), to more self-directed and less structured activity towards the end. The first part of the session sets the tone for the rest of the time so it is important to have a strong presence and a clear agenda at the outset. Following the usual chaos of bringing members in from the waiting room and talking briefly with parents there should be a clear set of options, or an established procedure in order to get the group engaged in a productive and semi-structured activity. Allowing free-play at the beginning of a session, as opposed to the end, essentially guarantees that the rest of the group time will be spent in semi-chaotic individual activities.

Once the group has been called to order after entering the room, the sequence follows more or less the following format:

Initial greeting

Here, children say hi to other group members, requiring name-learning, age-appropriate greetings, eye contact, and transition into the room. There is often a clothing issue: either the members take off clothing (jackets, sweaters, hats, etc) and/or shoes (and socks), and throw them down in the room somewhere, or they may go to the work areas still wearing heavy outdoor clothing, and even backpacks, or personal music devices. In any case, this is a busy coaching time, for the interpersonal greeting, name-learning, and the clothing issues.

Group review and discussion

Here, the leader and children discuss what activities will be the focus for the session. This can be as simple as an announcement by the leader, e.g. "Hey guys, that new set we ordered came in, who wants to build it?" Or, it can involve a lengthy and potentially heated discussion about the group activity. This is especially problematic for members who have rigid, repetitive activities and behaviors, and may have difficulty not engaging in a ritual during the session. It is best to address this as a group issue, and to engage in some bartering.

Role and task assignment

This is usually based on the task or tasks agreed upon by the group members. Have the group discuss what needs to be done in order to meet their activity goals for the day, including dividing up the time among tasks. This is an especially important feature of sharing the available time among disparate points of view. Help the group members to work out compromise solutions

Group-based semi-structured activities

This is the core of the group session, and during which the group members are actively engaged in an activity. During this time, the group leader may need to be very active with members, or less so, depending on the skills and developmental level of the group. It also depends on the novelty of the task. For newer, less familiar tasks, there is a need for much more input from the leader. Younger group members or inexperienced builders also tend to require more input. If the group activity is chosen appropriately, the leader can focus more on the social and communication coaching, and less on helping get the project done on time.

It is best to try to limit the group to an achievable number and complexity of tasks at the beginning. This can take some experience in order to know how long a given building task may take. For set-building a rule-of-thumb formula for gauging time requirements is:

$$\frac{\text{Number of LEGO® pieces involved}}{\text{Developmental age of group members (years)}} = \text{Time (minutes)}$$

For example, a group of children with the building skills of average ten year olds can put together a LEGO® set with 600 pieces in 60 minutes. Keep in mind that that is an un-interrupted and intensive 60 minutes. Alternatively, a group of children with developmental age four years would accomplish the same task in about 150 minutes.

<u>Less structured, creative time</u>

Following the main structured activity, there is often some time remaining, and this is a good time to allow a relaxation of structure and allow the members to pursue their own interests and projects. As much as possible, during this time, it is useful to try to link members up in pairs to work on joint projects, or link together members who may be engaging in play activities with similar themes.

<u>Clean-up time</u>

Start giving clean up time warnings about five to ten minutes ahead of time, depending on how involved and complex the ongoing projects are, and the extent of mess in the room. Give at least two or three warnings before announcing clean up time. Following the first warning, make sure no new projects are started, and no new play themes or LEGO® sets are taken down from the shelf, etc. “Don’t start anything new, it’s almost clean up time, you have three minutes to finish up what you’re doing.” Announce clean up time at roughly fifteen minutes prior to the group ending – don’t be flexible about this, or the group leader will spend an inordinate amount of time ordering and cleaning the materials. Be sure to indicate that all materials have to be replaced from where they came, and all members should help each other put materials back, not just the ones they were personally using. This is a good team-building exercise. Remind them that any pieces left on the floor will go into the vacuum cleaner. We have routinely offered “LEGO® points,” to younger members for gathering up stray LEGO®’s under tables etc.

<u>Farewell and parent review</u>

Once the room is put back in order and everything is off the floor, cue group members to give age appropriate farewells, including use of members’ names. While group members are rotating through their farewells, I usually head out to the waiting room to give a brief feedback to parents about the group session, progress, problems, concerns, etc. There are inevitably a second set of farewells in the waiting room, and often a continuation of this process out the door. At times, parents may be late in getting their child following a group. This elicits a wide range of reactions from the members, few of which are positive. A couple of times parents have neglected to return to pick up their child following a group. It is a good idea to remind parents ahead of time that this is not acceptable, and that they need to be on time to get their child after the group. Of course, this is not a problem for school-based or other groups in which parent transportation is not an issue.

Effective and Ineffective Procedures in LEGO® Therapy

Various procedures and group make-up have been tried in the development of LEGO® therapy. Some have been successful, some less so. Effective and ineffective procedures are outlined in the table below:

Effective Strategies	Ineffective Strategies
Siblings attending groups as Helpers (though they must attend regularly)	It is less effective to have individuals attend the group who don't also have individual therapy
Including therapeutic aides, graduate students or other helpers (but not parents)	LEGO® Club members inviting guests to the group. This was ineffective because the guests were more interested in the LEGO® collection than their hosts, and had little motivation to follow the group rules
Allowing group members free play time to be creative and do role-based fantasy play with the figures and sets, rather than just building as this leads to increased spontaneous interaction among group members.	Allowing parents to sit in to observe the group was a mistake in almost all cases -- the children acted much differently with a parent in the room
Encouraging female group members to join- this is especially helpful in older groups in which adolescent developmental issues are discussed	Having snacks in the LEGO® room was a disaster (LEGO®'s are very hard to clean) -- the waiting room became the designated snacking area
Having a 10-15min 'check-in' time in which members are asked to give a verbal account of personal experiences, or to share views on a current topic.	Including children with behavior disorders, such as ADHD, ODD, or other externalizing disorders, who also had social skill problems, was not productive
Group members making joint decisions about things that affect the group, e.g. choosing new LEGO®, activities for the day, promotions of members	
Assigning mentors for newer group members, and encouraging pro-social helping and teaching	
Encouraging families to develop a support and activity network outside of LEGO® therapy.	
Including children with anxiety disorders (especially social phobia), depression, or adjustment difficulties manifesting as depression or anxiety, in the group. Many of them continue to attend as my "helpers," long after their presenting problems were resolved	

Behavior Management and Rewards

LEGO® Club Rules

Parents, as well as teachers and other therapists who are not familiar with this treatment approach often ask about discipline or behavior control procedures. It turns out that problem behavior is quite rare using this approach, especially when the participants are highly motivated, and have been properly prepared during the initial interview.

A key to LEGO® Therapy is establishing self-regulation, and using peer-mediated corrective feedback. These skills are aided by the use of posted rules, the LEGO® Club rules. During the initial interview, potential participants are told, "If you want to come to the LEGO® Club, you have to be able to follow the rules." For non-verbal or pre-verbal children, this message is usually conveyed by correcting their behavior during individual therapy sessions. Children without verbal communication skills are not included in groups until they are proficient at the required skill set, which includes behavioral compliance. The LEGO® Rules were developed by the original participants in the first LEGO®-based social skills groups, and reflect the consensus regarding a necessary and sufficient set of rules for peer-mediated regulation of the group process:

LEGO Club Rules

If you break it, you have to fix it.
If you can't fix it, ask for help.
If someone else is using it, don't take it, ask first.
No yelling. Use indoor voices.
No climbing or jumping on furniture.
No teasing, name-calling or bad words.
No hitting or wrestling – keeps hands and feet to yourself.
Clean up – put things back where they came from.

The rules are printed in large print so they can be easily read, and are posted on the poster board in the LEGO® therapy room. Whenever a new member is introduced to a group, one or more of the group members are asked to review the rules with the new member, and we often then have a group discussion about how each of the members has occasionally needed to be corrected about a rule violation.

An important aspect of having the rules is implementing them consistently, and without negativity. The leader should typically not offer direct feedback regarding inappropriate behavior. Instead, whenever possible, the leader will request the other children in the group to remind each other about the rules. Using indirect and ambiguous terms enhances the participants' abilities to identify inappropriate behaviors in others, and in themselves. For example, when a child climbs onto a chair to retrieve something from a high shelf:

E.g. Dr. Dan: "Hey guys, is someone in here breaking a rule?"
David: "Uh, yeah, Peter is hogging the big truck wheels."
Dr. Dan: "Anything else?"
Peter: "Yes! Sam is climbing on furniture. Get down Sam, that's rule number 5."
Dr. Dan: "Good point, Peter. Sam?"
Sam: "Sorry, Dr. Dan, I just wanted to get R2D2 for my X-wing."
Dr. Dan: "Well, what should you do?"
Sam: "I couldn't reach it without getting up …"
Dr. Dan: "LEGO® Club, what should Sam do?"
Group (together): "He should ask for help!"

<u>LEGO® Points</u>

A formal "LEGO® Points" system can be used, in which points are awarded for behavioral, social and LEGO®-related achievements (e.g. complying with rules, building models with another child). These points can be collected and traded in for LEGO® prizes (small sets, LEGO® people, etc.). Prizes can be useful initially, but after a while, points tend to become inherently valuable, and not associated with any tangible reward. Instead, children seek the social approval of earning points. For this reason, points are an option of LEGO® therapy.

<u>Use of Time-Out.</u>

In rare circumstances, a participant may either refuse to comply with a rule, or may persist with an inappropriate or interfering behavior. Often these situations occur at the beginning or towards the end of the session – during transitions – or following a peer conflict situation. As much as possible, all negative behaviors are addressed by having peers intervene, and encourage appropriate alternative behaviors. Usually just reminding others of the rules is enough. If the behavior does persist, the leader should ask the group members, or a specific group member (usually an experienced group member) how we should address the situation. Only after receiving consensus from other group members should the leader indicate the need for a time-out.

Time-out consists of being asked to stop their current activity, leave all LEGO®'s, and sit in the time-out chair. There are no LEGO®'s nearby, and the group members are not to interact with a participant in time-out, for about a minute or so. Then, when the participant appears calm and/or eager to re-join the group, the other participants are asked to discuss the situation with the participant in time out. Usually, a senior group member will simply ask the participant if he or she understands why they are in time-out, and what they will do differently in similar circumstances in the future. Other group members learn this process by watching senior group members, and as they gain more experience in groups, may be asked to do the same.

“Rules of Cool”.

Unlike the proscriptive LEGO® Club rules, the Rules of Cool, are implicit, prescriptive rules which are not overtly written or otherwise indicated. These implicit rules are actually defined by the group members as part of an ongoing discussion which takes part during sessions informally. The topic is introduced to members in situations in which there may be socially inappropriate or stigmatizing behaviors evident, but which do not necessarily violate one of the LEGO® Club rules. Positive or pro-social behaviors exhibited by group members should be noted and pointed out by the therapists or instructors: e.g. “Hey, Matt, thanks for sharing with Nick. That was cool. Wasn’t that cool guys?” Also encourage other group members to comment on other’s behaviors, both positive and negative, e.g. “Hey, John, did you see Sean just grab that out of David’s hand? Was that cool? What should he have done – tell him.”

The LEGO® Club Level System.

Similar to many aspects of the LEGO® approach, the level system evolved over time, and was utilized as a strategy to support social development based on direct clinical evidence. The LEGO® Club levels are in place to reward children and to motivate children to improve. There are five LEGO® Club levels that are outlined below. Once the skills for a particular level are demonstrated, children are given a LEGO® Club certificate or diploma (which many group members have kept and cherished for years). Rather than the group leader awarding a certificate, it is the peers in the rest of the group that review whether or not a child’s project meets the specific criteria for a given level.
In general, there is a clear and persistent interest by group members in attaining higher levels within the system, and this often leads to improved motivation, task persistence and willingness to undertake difficult tasks.

LEGO® Levels:

1. LEGO Helper

Participants are considered to be at the Helper level when they first join a group. At this level, they are encouraged to “help out” the group activities by pre-sorting pieces when set building (e.g. all the grey pieces together), sorting freestyle pieces, checking sets for integrity against directions when completed, ordering and cleaning the LEGO® room. This level serves different functions for children depending on their skills: For children who are not yet proficient at set building, or do not have the ability to sustain attention on a task long enough, this allows for participation, and provides the context for peer approval and appreciation of input; For children with higher skills, these activities motivate them to demonstrate their proficiency at higher level skills in order to move up, including gaining peer approval and building peer alliances.

2. LEGO Builder

Once a LEGO Helper has demonstrated that they can construct LEGO sets of a moderate size (100 pieces and above), and can take the role of builder in a group set-building activity, the group members will be asked if the participant warrants graduating up to LEGO Builder status. If the group agrees, the participant is then awarded a diploma, which is signed by the therapist(s) and all other group members.

3. LEGO Creator

The challenge for a LEGO Builder who wants to move up to being a LEGO Creator is to construct a Free-style creation. This has to be an original idea, with a certain degree of complexity and gestalt integrity that makes it appealing to the other members. The other group members again make a group decision regarding the creation, and if they are agreed, the participant is given a second diploma.

4. LEGO Master

The challenge at this level is to lead a group project. The participant must have either initiated the purchase of a large LEGO® set (over 300 pieces) for which they then coordinate the construction, or the presentation to the group of a desirable group Free-style project (e.g. build a complex building, a small town, an airport, or a zoo, or construct a series of creations such as a set of vehicles, robots or other craft). The important point here is that the group members are assigned tasks and roles by the leader, and he effectively directs the project, enlisting support and input from other members, resulting in a project that all group members are agreed was challenging and worthwhile.

5. LEGO Genius

This level was actually created to appease a few LEGO® Masters who requested a new challenge against which to pitch their LEGO® leadership skills. The criteria for achievement at this level include: writing a movie script or story which they present to the group (they can choose a reader for this). The script must be critiqued by other members and edited as necessary. The final script is then analyzed in terms of how the project can be translated into a LEGO®-based stop-action animated short film. This is a new development in LEGO® Club and the details of LEGO® stop-action film making are beyond the scope of this manual, but may be covered in more detail later. The LEGO® Master must lead the group in the project, including assigning building tasks for the set and characters, assigning action, voice and sound-effects roles, controlling or assigning control of the camera and computer (a digital video camera and lap-top with editing software are used), and then directing the film itself. The project can take numerous sessions to complete, and requires considerable leadership skill in order to get all members to sustain focus on the task for the required length of time. The resulting animated short film is then edited by the producing member, and is shown to the group, and other groups, and the group members and participant discuss whether the work qualifies as worthy of the LEGO Genius diploma. This level has been attained by only four members to date. They have ranged in age from nine to twelve, and all four had different developmental levels and diagnoses.

Setting up your own LEGO® therapy groups

There are three ways to set up and implement LEGO® therapy:

Permanent LEGO® Room. This requires setting up a designated LEGO® therapy room where all the materials are to be kept and where all therapy sessions take place;
Temporary Set-up. This approach utilizes a specific site, but the materials are not permanently installed or displayed so that they can be moved or stored separately;
Portable Materials. This involves using a portable set of materials which are transported to different sites (e.g. schools, community settings, libraries, etc.).

Note that these different approaches are not mutually exclusive, and we have used all three depending on the circumstances. There are advantages and disadvantages to each approach, and the decision regarding which would be most appropriate depends on a number of factors that are discussed in table 1 on page 45 .

<u>The Permanent LEGO® Room.</u>

The first site-specific and permanent LEGO® Room was not so much a result of planning, as of natural evolution. Initially, LEGO® materials were available in a play therapy room which also included a range of other materials. Over time, however, the participants themselves chose to focus on LEGO®-based activities, and the other materials were either co-opted into use with LEGO® (e.g. using painting materials to create backdrops for LEGO® scenes; using the sand-tray and water-table to create specialized settings for LEGO® creations) or simply pushed out of the way. Once the term "LEGO® Club," was applied to the room, there was no going back.

An exclusive, dedicated LEGO® space gives the participants a strong sense of group identification, and a more immediate response to the possibility of becoming a "member" of LEGO® Club. Motivation to participate in group activities, and to follow behavioral and social rules, are important factors in effective social skills interventions. Most of the children who have participated in LEGO® Club groups appear to be both relieved that the group activities are so clearly prescribed, as well as excited ("All we do is build LEGO®'s? I can do that!).

Physical Layout.
A key aspect of creating a successful LEGO® room is the physical layout. The room should be visually stimulating and inviting, without being overwhelming. In order to achieve this, it is important to provide a balance of complexity with visual order (a characteristic of LEGO® materials themselves). The room must be set up in such a way so that the materials are evident and accessible, without being overwhelming. Use of display shelves and tables, with orderly displays of both freestyle creations and LEGO® sets (arranged by theme, preferably), is encouraged, and these should not be overly cluttered, and well-secured (we had one incident involving a large, unsecured shelving unit loaded with LEGO® and a visiting two year old which kept the group

busy sorting and rebuilding sets for weeks). Freestyle display areas should be physically separate from set displays. The display areas should be around the outside of the room, with the center of the room reserved for the LEGO® building surfaces and materials. As much as possible, keep the structure and design of the room consistent and predictable, but with enough spare surface or display area for growth and new projects.

Very complex display sets should be stored out of reach of younger participants. This inevitably results in attempts to climb shelves, and this tendency should be addressed pro-actively (see "rules"). Simpler, "hands-on" sets can be displayed on lower shelves. It is acceptable, and expected, that these sets will be manipulated, and dismantled frequently. The shelves should be sturdy enough to withstand frequent contact, and be free from dangerous edges and materials: wood or plastic shelves tend to work best. Keep in mind that the shelves will need to be deep enough to accommodate larger sets.

The use of a limited number of primary colors in both wall colors and furniture tends to emphasize the LEGO®-specific quality of the space, and decreases over-stimulation. Our current LEGO® room is painted in large blocks of LEGO® colors – the colors of LEGO® bricks were easily duplicated at the hardware store. The lighting needs to be adequate for careful examination of the materials and directions, but also soft enough to reduce glare (typically, fluorescent lighting with frosted diffusion panels).

There should be two visibly separate centers in the room: one for set-building and one for freestyle creating. The set building area should have only those materials related to ongoing set projects. Overlapping freestyle and set-building tends to lead to degradation of the sets, i.e. unauthorized borrowing. See LEGO® Club rules. The set building area should be large enough to accommodate the full group, with close arrangement of seating. The best set up for this we've found is the standard teacher's jelly-bean shaped instruction table. During set-building, it is best to try to keep the participants seated, and not on top of each other, as this tends to decrease compliance with tasks and increases conflicts.

The freestyle building area should be the most accessible in the room, and there should be easily accessible bins of materials. The projects tend to be more collaborative, with less order, and remaining seated is not always necessary or appropriate. Participants tend to roam around the project, to get access to materials, and the leader will be challenged by the many opportunities for corrective feedback regarding nonverbal communication. The freestyle display area should also be elevated, with a lower shelf for younger member creations, and a higher shelf for more ambitious projects. Never underestimate the importance of a personal creation, nor the memory span of its creator.

In one corner of the room, place a large armchair. This chair is often used by adults when they visit the room, but is designated within group sessions as "The time-out chair." This chair is used only in unusual circumstances, such as persistent or flagrant rule violation, interpersonal aggressive behavior, tantrums, or for persistent over-arousal ("The sillies"). Use of time-out is discussed below under "Interventions."

Establishing the Structure.
The LEGO® Room should always be in good order and with evident attention to detail. The impact of a visually disorganized room is immediately apparent on the behavior of the participants. In a well-organized room, the participants are likely to be more inhibited in their initial approach, but they are also more likely to take the responsibility of maintaining the room more seriously. Before a new member or visitor is allowed to work with or examine the materials, they should be given an orientation to the room, and the rules.

Emphasize the group cohesiveness and identity by restricting access to non-members, such as siblings and parents. In some instances, siblings are included as members (see "Methods: Group Therapy"), but generally, they are allowed into the room briefly only when invited by participants. Although this can create sibling conflicts, the harm is usually outweighed by the benefits of peer-group identification.

The rules for the group should be prominently displayed. There should be at least one large and accessible cork or other display board. This should contain the rules, as well as photos, drawings, etc., which group members use to display. It is also used for rehearsing group members' names, and for visual cuing regarding social rehearsal during individual therapy sessions.

Keep to the schedule of the group carefully. Do not allow participants into the room before the group time, and have the group members leave on time. Both of these require considerable attention and planning as there tends to be a strong pressure to enter and stay in the LEGO® Room – this is less of a problem with temporary or portable materials. Beginning and ending the group on time helps with implementing social rules (greetings and salutations, learning names, etc.), as well as allaying anxieties. Inevitably, participants arrive early or late. Both situations can be opportunities for peer-mediated coping, and some coaching of parents about waiting-room behavior can help considerably.

Temporary Set-Up.

The multipurpose site tends not to be as effective in creating a motivation to participate, or in encouraging group identity and cohesion, but it can be an effective alternative to a permanent site. The emphasis on structure and routine is even more important, as well as the use of support materials, such as photographs, LEGO® literature, and display boards. As much as possible, set up the room using the guidelines above, and try to keep the same furniture arrangement from session to session. Close arrangement of seating is necessary to encourage close interaction during set-building, while more open arrangements or standing up around a table, can be useful during freestyle building and creative play. Emphasize the social unit by noticing when members are absent, and the importance of roles within the group. The following specific recommendations may be helpful:

- Use of portable or temporary support materials (poster boards with photographs of members and favorite projects);
- Presence of LEGO® publications, posters, etc.;
- An emphasis on consistent attendance, and routine within the sessions;

- Creation of group structure and social roles (e.g. election of LEGO® Club officers; hierarchy of LEGO® helpers, builders, creators, etc.);
- Use of the same location, even if it is a multipurpose site;
- When possible, use multi-session projects (i.e. large sets or other projects requiring multiple sessions for completion).

Portable Materials.

Although it might seem that creating a structure and group cohesion would be especially difficult when visiting a site with portable materials, this is not always the case. Part of the benefit of going to a school or other site, is that it emphasizes the uniqueness of the group and its members relative to the rest of the population. This can sometimes create problems of its own, as non-members or parents at the site may request participation. This problem has been resolved at times by having others participate as helpers (reverse inclusion), but there may be difficulties arising from confidentiality, consent, etc., especially in mental health settings.

One of the drawbacks of portable LEGO® Clubs is often inadequate or inappropriate space allocation (we've conducted LEGO® groups in storage rooms many times), or lack of an enclosed space altogether (e.g. middle of a library). Working with school or other facility administrators in advance to find or set up an appropriate space is well worth the time and effort. This should include a discussion of possible storage space, and use of selected school materials (e.g. display boards, tables and chairs, shelving). Schools and other facilities often have assigned rooms for speech-language or occupational therapy, and these are excellent possible sites, when available.

The other potential stumbling block in this situation is uninformed site staff. The intrusion of other staff into the group can be disruptive both to the ongoing process as well as to the less obvious group identification issues. Preparing site staff with a quick briefing and establishing procedures with them prior to starting group or individual sessions is important. Although most school or facility staff recognize the "confidential," nature of individual therapy, they may not see this in the context of a "play group."

When considering which set-up system to follow, it might be helpful to consider the factors outlined in table 1 on the following pages.

1. Who the group is for.	In some instances, the group participants may not have the option of traveling to a designated site, as in hospitalized children or otherwise non-ambulatory children. There may also be a mix of participants for whom the materials would need to be changed or moved. For example, an assigned space may be shared between participants across a wide age range. Consequently, some LEGO® materials would present a risk for younger children (as well as a risk to the materials), while older participants may not identify with and appreciate the presence of early childhood materials.
2. How many people and how many groups.	As the number of participants increases, there is a greater demand for physical structure in the set up of the therapy space, and that limits the feasibility of portable interventions. Also, with higher numbers of groups, the requirement for more varied LEGO® materials, and support materials (shelves, storage containers, table-top space), usually requires a designated room.
3. Geographical location.	When the group participants are close to each other but far from the leader, it is often easier to have the therapist bring materials to the group setting. This is often the case when group members are all students at one school or residents in a program, which may be some distance from the leader's home-base.
4. Availability of space.	In many instances, the leader may not have access to an appropriate space which can be set up as a permanent "LEGO® Room." In this case, although a single room might be used on a regular basis for therapy sessions, the materials may need to be stored or removed from the space. This is usually the situation in public school settings.
5. The Time-Space Continuum.	One of the chronic difficulties involved in using the LEGO® Room approach, is room availability. This is especially critical when the site is in a clinic or office where children are typically coming on an out-patient basis and are not available during normal business hours because of school. There are a limited number of hours in the day during which children can feasibly be seen after school. Both for the sake of efficacy and the mental health of the leader, running groups later in the evening is not recommended. Running simultaneous groups can maximize resources, although this usually requires that at least one of the groups be a temporary one. See Sharing, below.
6. Sharing.	For schools, clinics and other institutions, it is cost-effective to have multiple leaders share a set of LEGO® materials. This can be achieved with any of the set-up options, and different set-ups can be combined; e.g. a subset of materials can be removed from a permanent room for use in another site. This allows for simultaneous groups, which we have previously done, with good results, especially in terms of resource allocation. Portable set-ups are easily shared, but are not effective for simultaneous use. Having a central storage area which can be accessed by multiple leaders is a good option, although with this approach, the integrity of the materials tends to decline due to "diffusion of responsibility," effects.

7. Scheduling.	Finding a meeting time which accommodates the schedules of parents, participants, and siblings, including travel to and from the group or individual sessions, has been a significant problem. A number of LEGO® Club groups have stopped meeting entirely as a result of inconsistent attendance due primarily to scheduling conflicts. This seems especially to be a factor for older participants who are more likely to have additional after-school activities and commitments. This headache is obviated by having groups on-site at a school or hospital, and parents especially are often very appreciative of this option.
8. Choice and Flexibility.	The permanent LEGO® Room has the advantage of having more materials and a broader range of activities than can be accommodated in a temporary or portable set-up. This allows for important group decision-making opportunities, and gives more of a sense of ownership and self-direction to the group members. Although more than one activity can be accommodated by either temporary or portable materials, this is much more limited.
9. Group Identity and Cohesion.	Part of the effectiveness of this approach is based on creating a sense of group cohesion and identity. For many participants, the LEGO® Club is the first social activity with which they actively identify, and in which they enthusiastically participate. Most of the children who benefit from this therapy do not easily identify with others, and have deficits in empathy. Consequently, creating a physical setting which supports and facilitates group cohesion and social belonging can be a necessary component. The absence of group identification in some children was highlighted by one of my participants who never responded to general instructions given to the group; e.g. "Okay, everybody, it's time to clean-up." When asked why he was not helping to clean up, he responded, "You said everybody, not me!" In this regard, the permanent LEGO® Room has distinct advantages, and temporary or portable approaches need to compensate for this shortcoming in other ways (see recommendations below).
10. Third-party payer issues.	Although the costs of participation in this form of intervention are often covered by school districts, either directly or through contracted services, many of the participants in the U.S. have utilized private health insurance to cover individual and group therapy sessions. Due to the nature of third party payer contracts, services are required to be provided at a designated site. Although this does not preclude one from having a temporary use of space, it does preclude travel to another site, unless, in some instances, the site is a hospital or residential mental health clinic.
11. Integrity of Materials.	Anyone who has ever attempted to transport a LEGO® creation in a moving vehicle will agree that portability has its limitations. This becomes a factor especially with larger, more complex projects which require multiple sessions to complete. Nothing is more disappointing to a group of participants than a set-back resulting from travel damage. If at all possible, the materials should be safely stored on-site. The LEGO® pieces themselves are very resilient for the most part (there are a few minor exceptions), but the support materials (magazines and catalogues, display materials, etc.) are not.

	Again, on-site storage is a good option.
12. Graft.	Although it has always been a pleasant surprise to us that there is usually very little in the way of informal "borrowing," there are some factors that seem to increase the risk of this: First, newcomers or visitors to the room or site seem to be much more tempted than regular group members; Second, the degree of visible organization and structure of the room helps, likely because the missing elements would be immediately apparent (at least to those familiar with the room or set-up) – portable or temporary materials are at a much higher risk than those in a fixed setting; Third, group size and adult to participant ratio is a factor. With a ratio of less than 1:3 or 1:4, the graft risk increases significantly. With 1:5 or more, somewhat depending on participant characteristics, the leader will likely need to institute graft-reduction techniques (see recommendations below).
13. Displays.	One of the more important features of the LEGO® Club experience is the pride in creativity and skill inherent in displaying sets and creations. This seems to be universal, regardless of the level of skill or complexity involved. The sharing of creations with parents and siblings, as well as the more individualistic self-efficacy, are both enhanced by having more or less permanent reminders. Both parents and participants have expressed considerable benefit from the mutual activity of showing and being shown the LEGO® projects. Although the display component can be accommodated to some degree in temporary set-ups using photographs (preferably digital, so that the images can be displayed immediately), there is a loss of immediacy and the degree of excitement involved in "look what I just made!" There is also a lingering pride associated with: "Yeah, I remember making that." Perhaps most importantly, the admiration of one's peers seems to be especially valuable in building self-confidence and self-efficacy, "Did you make that? Wow!"

Specific Materials and Arrangements

Choosing Materials: sets with instructions.

The choice of materials is a key issue in implementing LEGO®-based interventions, for obvious reasons. Unlike many other approaches, however, the process of choosing the materials is an integral part of the therapy itself. Participant selection of LEGO® materials can be a part of both individual and group therapy sessions, and should be both structured and facilitated by the therapist.

When you are starting off, it is useful to have some LEGO® sets already, and some ideas of LEGO® sets that have been popular are listed in the table below. Bear in mind that a part of LEGO® therapy is that the children choose models themselves and discuss as a group which models to get. However, as this is not always possible when setting up a group, some ideas for popular sets are given in the table below. You should talk to children individually to find out what sort of LEGO® they enjoy and find motivating. You can do this by showing children LEGO® magazines or LEGO® catalogues, or by looking at the LEGO® website (www.lego.com). All LEGO® models have an age range and the number of pieces specified. In general, the fewer the pieces, the cheaper the model and the faster they are to build.

Lego Model	Age Range	Number of pieces
Mini astro-fighter	6-12	57
Police car 7236	5+	59
Mini construction 4915	6-12	68
Fire helicopter 7238	5 +	75
Ambulance 7890	5-12	118
Digger 7248	5+	127
Fireboat 7906	5-12	187
Cool cars 7245	6-12	206
Passenger plane 7893	5-12	401
Mobile crane 7249	6+	524
Police station 7237	5+	597
Ferrari 8145	10-16	1327

When children are choosing LEGO® models, bear in mind that LEGO® comes in several different themes that might be popular with children. In the table below is a list of the themes available at the time of writing this manual. In addition, for older, more experienced builders, there is LEGO® technic and LEGO® Mindstorms. There is also a LEGO® factory online that is free to use, where you can custom design your own model and get the bricks to build it.

Bionicle	City	Harry Potter	Belville (girls)	Exoforce	Sports
Castle	Aqua Raiders	Batman	Racers	Trains	Thomas
Mars Mission	Star Wars	Sponge Bob	Vikings	Ferrari	Bob-the-Builder

In individual therapy, access to specific new LEGO® sets or building materials can be made contingent on targeted behavioral goals. The goals can be agreed upon and monitored by the participants themselves, or by report from either parents or teachers. Integration of individual and group sessions is also often achieved by having participants practice a persuasive argument with the therapist, and then introduce this proposal to the group for consideration. Social communication can be coached and prompted in both individual and group therapy. The success of this technique often rests on the level of motivation for acquisition of the new set, etc. There is little risk that the participant will neglect to initiate communication if it is clear that his initiating group discussion and consensus is a prerequisite for getting the coveted new LEGO®.

It is best to establish a specific budget with both individuals and groups. This often creates a press among members to have more of the Club funds utilized for their particular interest, and the resulting conflict can be very fruitful for coaching social problem-solving, sharing, turn-taking and reciprocity. Effective social communication can be enhanced by individual coaching, as well as by prompting during group sessions. Encourage group members to express reluctance or lack of interest for another's ideas openly, and assertively, but appropriately. Although the process can be frustrating for those with communication deficits, their motivation will be high. Turn-taking in presenting conflicting points of view, with rebuttals, and counter-arguments, can significantly improve social communication, and this tends to be generalized. Language functioning has been shown to account for some of the variance in overall treatment outcome, however, and concomitant speech-language therapy is important.

Choosing materials: freestyle LEGO®

Freestyle LEGO® materials can be acquired either directly from LEGO® or acquired informally as the remnants of defunct sets, donated shoeboxes full of abandoned bits, or in large bins or sets which have multiple possible uses. As much as possible, the freestyle materials should be kept organized in plastic, see-through bins. A large supply of freestyle materials is needed in order to facilitate the wide range of interests, and the tendency for group members to reify freestyle creations. Although members can be encouraged to "recycle," freestyle pieces, certain ground-breaking masterpieces tend to take on particular importance for all concerned. A large supply of freestyle materials can be acquired by donations, although these often require extensive sorting and cleaning, which is time-consuming. LEGO® Educational Division also offers a large range at reduced cost to educational and non-profit organizations.

Maintaining Materials.

In order to get a group started, the leader will need to have a core set of materials that will facilitate both set-building and freestyle activities. Sets are readily available at retail outlets or through on-line sources (http://shop.lego.com), and the best information regarding available products are the LEGO® website, and catalogues. Display sets are often useful in getting group members interested in participating. A critical factor in the long range success of a LEGO® Club is retaining set directions. Keep set directions in a safe, separate location which can be accessed but not easily trampled or rummaged. A large drawer, or box placed on a shelf will do.

LEGO® sets on display rarely survive more than a few days without significant alteration, if not complete disassembly. The consistent application of Rule #1 – "If you break it, you have to fix it," – is a necessary though not sufficient rule for sustaining an orderly and effective set of materials. In addition to resorting to Rule #2 – "If you can't fix it, ask for help," – there may also be some special clean-up sessions, and restoration projects. When a set is restored, it is often necessary to disassemble it completely first in order to follow the direction sequence. This is a good opportunity to replace or repair parts, and to clean the parts. LEGO® pieces tend to collect dust (in part because of all the handling), and this can make the sets look old and neglected before their time (we have some LEGO® sets that are 15 years old or older, and still look like new, and are treated by the participants as new, because the plastic is bright, and not dusty). Dusting is best done with a clean toothbrush, or similar non-abrasive plastic brush.

Another key factor in maintaining LEGO® in good condition is the strict adherence to the NO TEETH rule. Never let members attempt to separate parts with their teeth. Aside from the obvious hygiene issue and risk of damaged teeth (especially among six and seven year olds), it permanently damages the material, as few other things will. Some older white LEGO® pieces will yellow with age, but most colored bricks retain their new look for decades.

Whenever a set structure is damaged or temporarily modified, all the set pieces should be collected and placed in a tray (we use colorful cafeteria trays as well as plastic see-through tubs). We also use trays during initial set construction. It facilitates searching for parts, while reducing (not eliminating) the number of pieces on the floor. During clean up at the end of each session; be sure to do a thorough floor search (many small LEGO® pieces have been saved from the vacuum cleaner this way).

The maintenance of the materials in presentable order often falls on the older participants, as the younger ones tend to have less focus and skill, as well as poorer impulse control. Although this often results in the older members creating a mock fuss about having to fix disassembled sets, there is also a tendency for group members to bond with each other over this issue, and to create a heightened sense of group cohesion.

Assessment Procedures

A key component of any intervention is thorough assessment. The assessment process allows the leader to determine both areas of need and strength, as well as to establish objective baseline data for assessing progress in future. The assessment process has two elements: 1. The initial assessment; and 2. progress assessment. Although there will be considerable variability across leaders and individual participants, the following general guidelines have been established as core features of LEGO®-based therapies through both clinical experience and research.

Initial Assessment.

Initial Interview.

The assessment process should begin with an introductory interview of the participant and family, typically one hour. This interview is designed to both provide information regarding the methodology and procedures to participants and parents, and to collect information about the participant that will help with further assessment and treatment planning. If the leader will be using a permanent LEGO® Room site, then the interview should be conducted in that room and the interview will begin with an orientation to the room. If the site is a temporary one (multipurpose room), then the LEGO® materials should be present. Otherwise, if the participant will be attending a portable site, the interview can be conducted at the site, or at the leader's clinic or office. In any case, it is helpful for information-sharing, as well as for establishing rapport, to have LEGO® materials available at the initial interview.

The interview should be conducted in a relatively informal and unstructured manner. References to the mental health aspects of LEGO® intervention should be minimized (e.g. therapy, interventions, diagnoses, social skills, etc.), with an emphasis on the activities, requirements for participation, and the social nature of the group.

Important information to be shared with participants and parents at the initial interview, which is typically one hour, includes the following:

- Consent/assent procedures and confidentiality issues.
- Audiovisual recording, and consent procedures, if any.
- Frequency, duration and location of group and individual therapy sessions.
- Opportunities for family involvement.
- Group and individual therapy modalities.
- Costs or third-party payer arrangements.
- Attendance expectations and cancellation procedures.
- LEGO® Club Rules.
- LEGO® therapy methodology.
- Brief review of outcome studies and efficacy of methodology.
- Expected benefits and methods for assessing outcome.
- LEGO® Club level system (i.e. Helper, Builder, Creator, and Genius).
- Termination planning, i.e. "Graduation."

- Alternative and/or additional interventions that may be beneficial.

Most of this information is conveyed directly to parents during the interview. It is also helpful to have written information, in the form of a brochure or single-page description, which may be shared with parents and educators either at the initial interview or beforehand. Many parents find this helpful as there is often too much information to absorb in one interview. The participant should be directly involved in the discussion of the LEGO® Club Rules, and asked if they understand and can comply with the rules as a condition of participation.

During the interview, usually while parents are providing information about their child, the participant is offered two LEGO® activities which will provide direct information regarding the participant's skills and behaviors. The interviewer will be required to do both the interview and informal observation simultaneously, unless there are two individuals conducting the interview.

i. Building a small set. In a LEGO® Room setting, it may be difficult to get the participant to focus on building as they are often distracted by exploring the displayed sets and creations. Allow them to explore for a few minutes, and then say, "I need your help. Do you think you can put this together for me?" The interviewer should provide a small set, ranging from 20-30 pieces to up to roughly 100 pieces, depending on the age and developmental level of the child. For most participants, a small to medium-sized vehicle with a wind-up motor, or a small airplane, are good choices as they are highly motivating, and there are many small and large versions of these available. The set should be completely disassembled, presented on a holding tray, with the instructions. The interviewer should continue the interview with the parent, and unobtrusively observe the following.

- Does the child comply with the request appropriately and independently?
- Does the child request help in completing set or does so independently?
- Does the child make eye contact and engage in other appropriate social communication in response to the interviewer?
- Is the child able to complete the task easily, or with difficulty?
- Is the set completed correctly?
- Does the child follow the directions in a step-wise fashion, or do they jump ahead, or complete the set without following the directions?
- Does the child modify the set or make something completely novel?
- Does the child show the end results to interviewer or parent(s) when done, or do they simply leave the set aside and move on?
- Does the child maintain contact by verbal or nonverbal communication while building?

ii. Free-style building.
After presenting the participant with the small set, the interviewer should invite them to utilize free-style materials to build their own creation. Free-style materials should include both large and small building pieces, architectural as well as vehicle components, human figures, and aircraft or spacecraft elements. The following should be noted by informal observation:

Extent and duration of preparation – i.e. evidence of planning versus impulsivity.
Organization and structure of the results: again, is there evidence of form and planning, or is it poorly constructed and chaotic.

- Evidence of a theme or predominant obsessive interest.
- Does the child request help with either ideas or construction?
- Does the child decide on a design, or do they change frequently, or change how they label or describe the creation frequently?
- How long does the child sustain focus independently on this task?
- Does the child show pride and request social approval following the task?
- Are they able to stop when requested or do they insist on continuing to build at the end of the interview?
- Do they exhibit any inappropriate behaviors related to frustration during building or in transitioning from the task?

<u>Initial Observation in Natural Setting.</u>

In addition to the initial interview and structured observations, the initial assessment process should include direct observation of the participant in a typical social setting. This has typically been done on the playground or in a group social setting at school, during recess or lunch break. The observation can be done by the leader or by a teacher or other adult capable of doing structured observation.

There are three targeted areas for observation, two of which are uniform across participants, and one which requires some individual operationalization, which is based on the initial interview and observations. The first target behavior is frequency of self-initiated social contact. This is operationalized as follows: "Number of times per fifteen minute whole-interval in which the child spontaneously approaches a peer, and initiates interaction, either by verbal or nonverbal communication, offering to share something, initiating joint attention, or by physical contact". The contact is not counted if it is prompted by an adult, based on a prior contingency arrangement, or if the child is approached by a peer. It is counted if the peer approaches the participant after the participant gestures or otherwise communicates with them, but then the peer delays response. If an interaction is interrupted or stops and the participant re-contacts the same peer, this is also counted.

The second target for observation is duration of social interaction. This is operationalized as follows: "Total time during which the child is engaged in social interaction with peers without adult direction or supervision, during a fifteen minute whole interval. The interaction can include parallel play, but must be within close proximity (i.e. less than two feet), and include some clear signs of joint attention or nonverbal communication. The interaction can be prompted or initiated by either an adult or a peer, but the recording of duration should include only non-supervised interaction. The total duration of interaction is divided by the number of interactions, giving the average length of social interaction."

The third target area is frequency of interfering or stigmatizing behaviors. Since this varies considerably across individuals, and there is usually more than one per participant, the operationalization of these behaviors is left up to the leader, family and educators. Typical examples include: engaging in over-elaborated monologues on favorite topics despite clear nonverbal signs that peers are not interested; stereotyped movements like hand-flapping or spinning; pacing; odd body postures; inappropriate touching or inappropriate intrusion into personal space, etc. In this category, the total number of these identified behaviors is recorded during the whole interval of a fifteen minute play period.

For older participants who do not have recess, these observations may need to be made during another unstructured activity at school (lunch, library, PE), during after school activities (study hall), or failing other options, during a LEGO® Club group.

Follow-Up Assessments

For purposes of progress tracking and treatment planning, it is essential to have at least annual re-assessments, including both interviews of parents, feedback from teachers, and repeated observations in natural settings. The use of standardized assessment instruments, such as the Wechsler intelligence tests, neuropsychological batteries, and adaptive rating scales (e.g. Vineland) are recommended for objective progress tracking, in addition to use of rating scales such as the Gilliam Autism Rating Scale. The best overall indicators of social adjustment and development, however, are the direct observational measures.

In this regard, it is important to keep observations consistent over time (i.e. use of the same raters, and same rating criteria), using the same settings and events. Improvements on one of the observed variables without commensurate gains on the others can indicate problems with generalization of gains, or with the intervention itself. At times, there may be interfering factors, such as persistent and frequent stigmatizing behaviors (e.g. thumb-sucking, scripting) which may require additional, focal intervention (see below).

The research on LEGO® interventions has indicated that increased frequency of self-initiated social contact tends to level off before the other two measures (LeGoff, 2004), although all three measures have inherent floor and ceiling effects. There is also a tendency for duration of contact to be inversely proportional to frequency of contact. Once these measures begin to become unreliable or invalid as measures of social competence, other objective measures should be substituted. This is often the case with older participants. In this case, the use of the Vineland Adaptive Behavior Scales (VABS, Sparrow, Balla & Cicchetti, 1984) or other ratings of social adaptation may yield more valid results, with fewer ceiling effects.

You can also observe behaviour in the group sessions themselves, and measure the frequency of appropriate social initiations, or any specific behaviour you want to work on. It is important to specify exactly what constitutes the behaviour you are measuring so that the behaviour can be coded accurately by any practitioner observing the groups. It is helpful to videotape children in the situations you want to observe them (if possible without the children knowing they're being taped!). This means that you can come up with consensus codes for behaviours and watch any sessions back.

Termination/Graduation.

Long-term outcome and "graduation," from LEGO® Club, is based on indicators of age-appropriate peer relationships. Typically, this takes the form of involvement in after-school social activities with peers, establishment of peer friendships, and loss of focus on the LEGO® group as the center of social activity for the participant. Leaders are encouraged to have consistent periodic meetings with families to discuss progress and graduation/termination. Including the participant in these discussions is important, although one must be careful to avoid negative impact of termination effects (i.e. self-sabotaging strategies to avoid graduation). For this reason, participants and families are given an "open door" policy post-graduation: the participant is always welcome to return for visits as a helper. The number of post-graduation visits is usually very low, and there have not been problems with abuse of this policy to date.

Presenting graduates with a brief ceremony and a mock-up diploma has become one of the LEGO® Club's more cherished traditions. Other group members are often strongly motivated to graduate as well, and are keen to achieve higher LEGO® Club status as they demonstrate improved technical and social competence.

Part of the progress monitoring involves participants' roles in the group. They start in the group as LEGO® Helpers (primarily finding parts, sorting parts, cleaning parts during restoration projects, etc.), and when they can build independently, graduate to the level of LEGO® Builder. Once they are able to demonstrate proficiency at set building, and have made some unique and well-designed freestyle creations, they are given the title LEGO® Creator. Finally, after showing proficient and ingenious freestyle building, and being willing and able to help other group members with their projects, including being proficient as an Engineer during larger group projects, the group member is given the status of LEGO® Master. The granting of higher status is usually made by the therapist based on observations and interactions with the group members over a number of weeks or months, and is usually marked by the giving of a diploma, along with congratulations (and expressions of envy) by other group members.

Conclusion

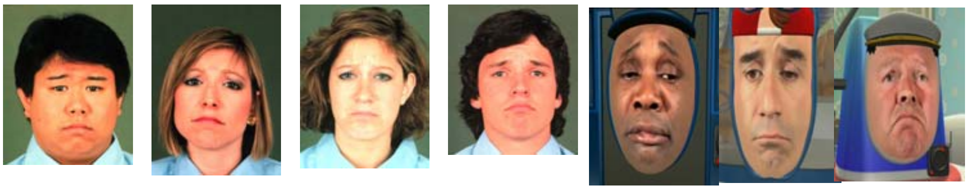
The LEGO® Therapy approach is a mixed form of intervention, combining individual and group approaches, as well as adult-directed, child-led, and peer-mediated approaches (cf. National Research Council, 2001). The interventions capitalize on the natural interests of many of these children in a construction toy system, and emphasizes the enhancement of peer identification, and development of social identity. The methodology is flexible enough to allow for both highly structured and adult-led methods (Level 1), leading to increased child-initiated and peer-mediated activities. To date, two outcome studies have shown clinically significant positive gains in social development for children with autism spectrum disorders who participated. Methods for utilizing this toy system as a remedial tool with this and other populations of children are continuing to be explored and expanded. A replication study using a randomly assigned comparison group design is currently underway at the Autism Research Center at Cambridge University, under the direction of Simon Baron Cohen.

While many current social intervention strategies focus on improving social reasoning (Gray, 1998) or on selecting specific behaviors using behavior analytic techniques (Koegel & Koegel), the LEGO® Therapy approach attempts to improve abilities, as well as skills and performance characteristics. That is, the method seeks to fundamentally change social development, leading to sustained and generalizable gains in social functioning. It is the author's belief that the benefits of an intervention are more likely to be meaningful to the extent that they are based on improvements in core social abilities and social identity, rather than reflecting more superficial changes in specific social behaviors. With regard to this belief, clearly there is a need for continued research on social development.

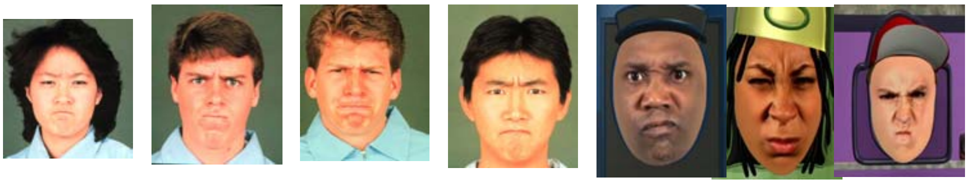
Appendix 2: Face stimuli used in posting task

HAPPY

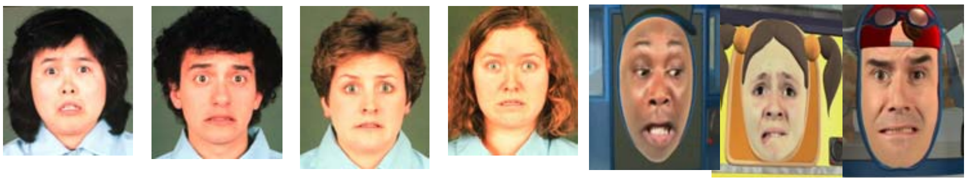
SAD



ANGRY



AFRAID



SURPRISE

Appendix 3: Coding scheme for structured play observation

Social Play

Code the highest social play seen in any interval. Only code an adult interaction if it takes up 7 or more seconds of the 10 second interval.

A. *Adult interaction*
   - code this if child is interacting with an adult rather than a child – this is ascertained by who the child is looking at when speaking, who responds to the child, and whose name the child uses.

0. *Unoccupied – no purposeful activity apparent*
   - Sits in one spot or stands around
   - Wanders aimlessly or walks around the edge of the room
   - Fleetingly watches anything of momentary interest
   - Seems unaware of the presence of others

1. *Independent, solitary play*
   - Plays alone and independently with toys different to those used by children within speaking distance
   - Pursues own activity without reference to others
   - No eye-contact or social behaviour

2. *Parallel, aware play*
   - Engaged in their own or similar activities but showing awareness of other children in the room by making eye contact, or looking at the face, body, or what the other child is doing
   - May turn towards peer to show awareness
   - May copy the peer without making any social overtures

3. *Associative play – any sort of interaction with a peer*
   - Responds positively and appropriately to peers approaches
   - Exchanges or shares toys
   - Speaks to peers- initiates a conversation or a game
   - Brief interactions, conversations
   - Child initiates or builds on a behaviour that is linked and co-ordinated with the other child's activity
   - May offer suggestions for attaining goals or extending play schemes
   - Interaction involving turn taking and swapping roles
   - E.g. playing tig, and taking turns to be 'it'*;* E.g. 'you be mummy and I'll be daddy' then swap

- Proximity
   - Is the child within 3ft distance (one carpet square, one croquet mallet) of another child or not?

Appendix 4: Playground observation coding scheme

Use ObsWin computer software to record the frequency of self-initiated interactions and the duration of all peer interactions, self- or other- initiated.

<u>Self-Initiated Interactions</u>
These include the target child carrying out one of the following behaviours that lead to some form of social exchange. Do not count adult interactions.

<u>Verbal Recruitment</u>

- Child appropriately performs an action and names it to another (e.g. 'Look at my sand castle').
- Child invites another to join a game, with the view of doing something together (e.g. 'Do you want to play "dinosaur chase"')
- Child initiates a conversation with a peer by asking a question, making a statement or indicating an interest in what the peer is doing/playing. For example, 'what are you doing?'; 'what football team do you support'?

<u>Non-verbal Recruitment</u>

- An attempt to engage another using a non-verbal gesture, such as beckoning, waving, pointing at a toy.

<u>Joins in</u>

- Child approaches a peer who is playing a game/ doing an activity and actively joins them in a collaborative fashion. This does not include a child going up and playing in parallel with a peer using the same apparatus (e.g. the swings), and it must be more than simply going to watch another peer. There must be some collaborative action or participation in conversation.

<u>Other Intitiated Social Interactions</u>

Same events as described in self-initiated interactions but the initiation of the conversation/ game/ activity comes from the peer not the target child. To be counted as an interaction, the target child must respond in an appropriate way, either by giving a verbal response, a non-verbal response, or joining in collaboratively. Do not count adult interactions.

<u>Duration</u>

Press the 'S' button when target child initiates a social interaction themselves. Press the 'O' button when a peer initiates an interaction with the target child. Press buttons again when the interaction ends. The end of an interaction is indicated by a verbal termination of the conversation (e.g. 'see you later'), by physical termination of the interaction (e.g. child walks off) or by the activity ceasing to be collaborative (e.g. child starts playing their own game in close proximity to peer, but they are no longer interacting, playing or talking together).

Appendix 5: Treatment fidelity checklist

Therapist ID.						
Session Structure						
How many children?						
Initial check in?						
Instruction building?						
Freestyle building?						
Kids tidy up?						
Give out certificates						
End summary						
Rules of Lego club displayed?						
Group activities						
Children working in groups						
Children sit together around table						
Adult working alongside or helping						
Children have different roles						
Children take turns in roles						
Children focused on task						
Children Interact with each other?						
Therapist						
Gives praise for good building						
Get other children to help each other						
Help children if they ask for difficulties						
Social Problem?	y	y	y	y	y	y
Highlight presence of social problems						
Prompt children to come up with solutions						
Give children opportunities to problem solve						
Give suitable alternatives to behaviour						
Ask children to role-play positive behaviour						
Remind children of strategies previously worked on						
Rule break?						
Highlight presence?						
Prompt other children to remind rule?						
Positive social behaviour?						
Gives praise						
highlight to other children						

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