

VOLUME 1

AN INVESTIGATION INTO THE USE OF THE TRANSPORTERS DVD TO ENHANCE
EMOTION RECOGNITION IN CHILDREN WITH AN AUTISTIC SPECTRUM
CONDITION

by

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ABSTRACT

Baron-Cohen (2002) developed an intervention for children with a diagnosis of Autistic Spectrum Conditions (ASC) which utilises a DVD called the Transporters. The Transporters is a make-believe world of imaginary characters where vehicles have feelings and contains a combination of systematic elements such as trains and trams with human faces.

The development of the Transporters is based on the 'empathizing-systemizing' theory. That is, in contrast to difficulties with emotion recognition, individuals with ASC have been shown to have an enhanced ability in 'systemizing' compared to typically developing children (Baron-Cohen, 2002).

An experimental design with multiple baselines was used to assess the impact of the Transporters DVD intervention on the emotion recognition of children with Highly Functioning Autism (HFA). A repeated measures method was used whereby participants completed three measures at Time 1, 2 and 3. The intervention took place between Time 2 and Time 3. Performance was compared across all three times using an analysis of variance statistical test.

There was no significant difference between Time 2 and 3 for any of the measures. The results from this research would suggest that more evidence is needed about the use of the Transporters within a school context before Educational Psychologists and other professionals recommend the Transporters as a tool to enhance emotion recognition when used in schools.

DEDICATION

For Sheila.

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CHAPTER 1- INTRODUCTION

Evidence from a variety of sources supports the idea that children with autism have a deficit in recognising emotions in others and responding appropriately to them (Baron-Cohen et al, 1997; Baron-Cohen, 1995; Heerey et al, 2003; Langdell, 1982; Losh & Capps, 2006; Rutherford & Towns, 2008). Research into the development of emotion recognition in typically developing children suggests that children begin to recognise their own emotions before they begin to recognise and respond to the emotions of others (Dogra et al, 2002). If we apply this pattern of development to children with ASC, then it is important to consider the use of interventions that focus on helping children recognise their own emotions before focusing on interventions that develop skills to recognise emotions in others. The focus of chapter two will be on the research that supports or criticises the idea that children with autism have difficulties recognising emotions in others and the implications that this may have on social functioning. Section 2.2.1 begins by giving a brief overview of the development of emotion recognition in typically developing children. Section 2.2.2 provides an overview of some of the research that supports the idea that children with autism have difficulties recognising emotions in others. One theory originally presented by Baron- Cohen et al (1985; 1991) suggests that an inability to recognise emotions in others is due to an underlying theory of mind deficit. Section 2.2.3 includes some contrasting evidence to this idea, section 2.2 then finishes with a critical overview of the research to date. Section 2.3 introduces three cognitive theories that attempt to explain the emotion recognition difficulties that children with autism present.

The first of these theories to be discussed is the theory of mind deficit hypothesis (Baron-Cohen, 1985; 1991). Sections 2.3.1 to 2.3.3 provide a broad overview of theory of mind development in typically developing children and then go on to look more specifically at the research which supports the idea that individuals with autism have a theory of mind deficit and it is this deficit that contributes to emotion recognition difficulties. The second cognitive theory that may account for an emotion recognition deficit in children with Autistic Spectrum Condition (ASC) is the weak central coherence theory (Frith & Happe, 1994) which is briefly discussed in section 2.3.4. Section 2.3.5 introduces the third cognitive theory which is the empathizing-systemizing theory (Baron-Cohen, 2002; Golan & Baron-Cohen, 2006). Individuals with autism may therefore demonstrate deficits in emotion recognition for a number reasons grounded in three different cognitive theories; they may have difficulties a) understanding that others hold beliefs that are different to their own (theory of mind), b) processing facial expressions and intonation correctly (weak central coherence theory) and c) understanding emotions because they are not always presented as a predictable 'system'.

There has also been a wealth of research into emotion recognition specifically from a neurological perspective. Section 2.3.6 goes on to discuss a number of studies that support an emotion recognition deficit from this perspective. The findings from this research suggest that individuals with autism process faces in quantitatively different ways to typically developing individuals; individuals with autism are more likely to process individual parts of the face such as the mouth and use this information to process emotions rather than synthesising information from the whole face. This evidence also supports the weak central coherence theory.

The empathizing- systemizing theory (Baron-Cohen, 2002; Golan & Baron-Cohen, 2006) presented in section 2.3.5 suggests that whilst individuals with autism may demonstrate deficits in emotion recognition, they also demonstrate particular strengths in their ability to systemize. Golan and Baron- Cohen (2006) argue that it may be possible to use this strength in systemizing to enhance emotion recognition in individuals with autism by designing interventions that utilise a systematic approach. Section 2.4 then discusses some of the interventions that have attempted to use this approach. Golan and Baron-Cohen (2006) demonstrated that emotion recognition in adults with autism improved after using the Mind Reading software over a ten week period although these improvements were not generalized to novel human faces. However Golan et al (2010) later went on to use an animated series called the Transporters which combines human faces that portray a range of emotions with predictable systems such as trains, trams and boats. Each episode explicitly addresses the different emotions that the characters display and describes the context that led to the display of that particular emotion. Golan et al (2010) asked three groups; an ASC intervention group, an ASC control group and a typically developing control group all aged between 4-7 to watch the Transporters DVD under parental supervision within the context of their home for a minimum of three times per day everyday for four weeks. Participants were tested before and after the intervention using three measures. The first of which was based on images from the Transporters that they were going to see as part of the intervention, the second was based on images also from the Transporters but that were unfamiliar to them at both times of testing and the third measure was based on the emotion expressions of real people which aimed to measure the generalization of emotion recognition to human faces. Golan et al (2010) found that after watching the DVD within their home context, children with ASC demonstrated an enhanced performance on each of these measures. Participants were able to generalize their

knowledge to perform at the level of typical controls on the measure which required emotion recognition from naturalistic clips of human characters that were not attached to systematic vehicles. There were no measures used within this study to assess how this improved performance may have affected social interactions and children's understanding of emotions in their everyday contexts. Perhaps observation schedules and data from teacher's observations could be used to assess whether this enhanced performance in recognizing emotions using the Mind Reading and Transporters software might then be generalized to enhancing emotion recognition in everyday social contexts if this study were to be replicated.

1.1 Rationale for Research

Golan et al (2010) demonstrated the effectiveness of the Transporters DVD in enhancing emotion recognition in children with high functioning autism within the context of their homes. However, we do not know if these findings could be generalized to other contexts, for example in educational settings. The current study therefore aims to explore the effectiveness of the use of the Transporters in a special school for children with autism. The underlying assumption of the intervention is that by explicitly teaching children with autism how to recognise emotions in others, their social functioning will partly be enhanced although the researcher recognises that there may be many other factors that contribute towards a deficit in social functioning for these children. Typically developing individuals seem to have an almost intuitive ability to detect often very subtle changes in the emotional reactions of others which can be interpreted within a specific context. If we were able to successfully teach this skill to children with autism then they may be more attuned and able to respond to the social context

in which they are surrounded. Whilst there is a very broad jump from enhancing social and emotional skills to enhancing social inclusion, ultimately the aim of these types of interventions is to promote social inclusion for children with autism by explicitly teaching them these skills.

CHAPTER 2- LITERATURE REVIEW

2.1 Terminology

In both educational and clinical contexts, there are many different terms that are used when referring to children with autism. The term Autistic Spectrum Disorder (ASD) was introduced by Wing (1996) and is commonly used as it encompasses all the different subgroups within the autistic spectrum. However the term disorder has some negative medical connotations. Some individuals with autism do not see themselves as disordered or deficient and so for the purposes of this *research*, the term Autistic Spectrum Condition (ASC) will be used throughout the report when referring to general findings that apply to all children on the autistic spectrum. Along the autistic spectrum continuum, there are a number of subgroups, for example individuals who are described as high functioning and autistic and individuals who are described as having Asperger Syndrome (AS).

It is recognised within this study and also within the DSM IV (1994) diagnosis criteria that there are differences between children on the autistic spectrum, which will be acknowledged throughout when referring to specific research findings. This can make the comparison between studies potentially difficult as some researchers will recruit individuals who are defined as autistic and high functioning whereas other individuals will be define as having AS.

2.1.1 Diagnosis of autistic spectrum conditions

A number of different systems for the diagnosis of autism have been published including Kanner's (1943) original criteria. However, the most recent classification system of autistic

spectrum disorders has been formulated by the American Psychiatric Association in the Diagnostic Statistics Manual IV (DSM IV, 1994). The term ASD (as described in the DSM IV, 1994) describes abnormal social interaction and communication behaviours combined with unusual or rigid or repetitive behaviours (NICE, 2009). Such behaviours are typically present in early childhood although the features of autism may not become apparent until later in childhood when the child perhaps has delayed language acquisition or more opportunities to interact with others. Approximately 50% of young people with ASC have an IQ of below 70 (NICE, 2009) and are therefore likely to have some difficulties accessing education in the classroom.

The DSM IV (1994) recognises that individuals with autism and individuals with AS will present slightly different characteristics (see Appendix 1 and 2 for an overview of the classification criteria for autism and AS). The general difference between an individual with autism and an individual with AS appears to be in the onset and development of language. Children with AS do not demonstrate a delay in language acquisition or cognitive development, however they do still display difficulties with social communication and interaction and may demonstrate rigidity of thought, although an apparent later onset of these difficulties may be a function of higher cognitive abilities (Volkmar & Cohen, 1988).

In the current study, it was important that participants could access the Transporters DVD and the instructions to complete the assessment measures. Participants therefore needed a good understanding of language. The participants that took part in the current study all had a diagnosis of High Functioning Autism (HFA) or AS. High functioning children with autism are defined as those individuals with average or above average intellectual ability (Tager-

Flusberg, 1993) and constitute the upper 25% of the population with autism (Rutter, 1978). Children with HFA or AS may also have additional language comprehension difficulties which need to be assessed separately and addressed within the context of both the home and the classroom.

Researchers in the field of autism tend to work with children who are classed as having HFA or AS in their initial studies, as the selection of this group reflects a research strategy which enables researchers to identify autism-specific impairments independently from the effects of cognitive difficulties. So, when working with children who are high functioning, one can assume that their findings will be due to difficulties associated with autism and not cognitive impairment. Of course, the use of control groups and matched samples may also support such findings. Within the current study, only children who were classed as autistic and high functioning or had a diagnosis of AS were considered as part of the overall sample. This was because it was important that the findings reflected an impairment of emotional recognition and social functioning within the group and not an impairment in the understanding of the language that led to lower scores on the task. In addition, the DSM IV (1994) demonstrates that a diagnosis of autism can often be associated with poor cognitive functioning and therefore a sample that were autistic and high functioning was used with a view to separate the effects of autism from the effects of poor cognitive functioning.

2.2 What is autism?

The term autism was first used by Leo Kanner (1943) to describe a group of eleven children with a previously unrecognised disorder. Kanner felt that this group of children had a number

of characteristics in common that one could not disregard (Kanner, 1943), including an inability to develop relationships with others, extreme aloofness, a delay in speech development, non communicative use of speech after it developed, a lack of imagination, and an insistence of sameness (Kanner, 1943). He adopted the term early infantile autism to describe this group of children (Gillberg & Coleman, 1992).

Around the same time that Kanner published his first accounts of early infantile autism, Hans Asperger (1944, as cited in Frith, 1991) independently published similar accounts of a condition later named Aspergers syndrome (AS). Both Asperger (1944, as cited in Frith, 1991) and Kanner (1943) identified difficulties with social communication and social interaction skills within the groups of children they worked with, however the children that Asperger worked with appeared to have higher levels of language and cognitive skills whereas the children that Kanner worked with had delayed language skills and marked cognitive impairments.

Kanner's diagnostic criteria have proved to be remarkably robust and have been replicated in many other subsequent psychiatric classification systems. Kanner's classic description of autism and Asperger's work have been brought together under the umbrella term of a spectrum or condition through the work of Wing and Gould (1979).

Wing and Gould (1979) argue that Kanner's syndrome is actually part of a continuum or spectrum of autistic disorders. They argue that the manifestations of characteristics associated with autism vary widely in type and severity and all kinds of variations in such characteristics

can be seen in clinical and educational practice. The spectrum therefore represents a concept of considerable complexity, rather than simply a line from mild to severe.

2.2.1 The development of emotion recognition in typically developing children

Before moving on to discuss the research about emotion recognition in children with autism, it is important to consider how social and emotional understanding develops in typically developing children when this is not disrupted by autism or deprivation. According to Darwin (1872), the recognition and understanding of basic emotional expression is an innate ability. Studies have indicated that in typical development, infants spontaneously attend and show recognition of qualitative differences in facial emotional expressions at as young as 10 weeks old (Caron et al, 1982; Izard 1994; Klinnert et al, 1983). Whilst it is difficult to assess how much of these expressions babies understand, these studies do indicate that the processing of facial information is one of the earliest means of social involvement (Begeer et al, 2006). Emotions are often depicted through a facial expression or non verbal cues. As soon as children begin to recognise that facial expressions reveal something about a person's inner state, attending to those expressions may become a stepping stone for the development of a much higher order skill that is a theory of mind (Baron- Cohen, 1995). Section 2.3.2 provides a more detailed overview of theory of mind development in typically developing children. Dogra et al (2002) state that in typically developing children, there are three tasks involved in emotional development;

- Recognising the significance of emotions and differentiating between emotion states (i.e. combination of feelings, associated behaviours and level of arousal) in the self and others;
- Learning to contain emotions and the socio-culturally appropriate and acceptable expression of emotions (the regulation of emotions); and as a result, distinguishing between emotions experienced and emotions expressed, both in the self and in others;
- Understanding the impact of emotions on behaviour and relationships (the regulatory capacity of emotions).

They also argue that at a preschool age the development of learning how and when to hide feelings occurs simultaneously with an understanding that others can do this (Dogra et al, 2002) and therefore relies on the development of social understanding and paying attention to the social actions of others which is partly dependent on the development of a theory of mind. The ability to share emotions with peers about third parties (e.g. disgust) is apparent by the age of five (Dogra et al, 2002) which is consistent with the development of a theory of mind in typically developing children (Astington & Edward, 2010). The development of social skills and emotion recognition are intrinsically linked and individuals who do not spontaneously attend to emotion expressions in others will often miss the crucial cues to infer the mental states of others which may further impede social interactions. Emotion recognition therefore plays a key role in social interactions and it has long been thought that deficits in this skill may account, at least partially for the social interactional difficulties often observed in children with autism.

2.2.2 Emotion recognition and ASC

In his original account of autism, Kanner (1943) concluded that children with this condition appear to have 'inborn disturbances of affective contact' with others (p.250). He observed that one such disturbance was the children's inattentiveness and apparent indifference towards the faces of other people.

One particular area of development for children with ASC is being able to recognise, demonstrate and respond appropriately to the emotions of others. Many children with ASC are unable to convey or comprehend information by using gesture, miming, facial expressions, body posture and vocal intonation (The National Autistic Society, 2011) all of which convey some level of emotional recognition using non verbal communication. Abnormalities in reciprocal social interaction, emotional expression and recognition are considered to be among the core deficits associated with ASC which are apparent at all ages, regardless of cognitive abilities or the onset of language.

The recognition of emotions in other human beings is a complex well developed skill that often appears to happen almost implicitly and sometimes without conscious thought. Adults and children who are good at detecting others emotions often become so well trained in this skill that even another's gaze or a look in a particular direction will be interpreted as a social action that one may then act upon. Baron- Cohen et al (1996) asked typically developing children and adults to interpret the mental states of others using their facial expressions. Using paintings and drawings, they found that participants were able to interpret complex mental

states such as guilt, regret and distrust as well as basic emotions such as fear and surprise through the use of facial expressions only. Moreover this was true across a range of different cultures which demonstrates that many mental states are displayed on the face simply 'waiting to be read by the observer (with a concept of mind)' (Baron- Cohen et al, 1997. p.313).

This suggests that the way that we employ our theory of mind in everyday situations is a combination of using inference from the broader context and indicators of mental states on the face or in behaviour (Baron- Cohen et al, 1997).

Several studies have demonstrated that individuals with ASC have difficulty interpreting the mental states of others through the use of facial expressions. A series of studies from the 1980's by Hobson (1982; 1986) and Langdell (1982) tested the ability of children with ASC to select appropriate emotions that were depicted on videotapes, drawings or photographs. These studies all demonstrated that children with ASC show qualitative differences in the processing and recognition of emotions in others. Langdell (1982) asked participants to sort photographs of happy and sad faces. Both autistic and non autistic participants were able to sort using whole faces or the lower halves of faces but the children with ASC were less proficient in sorting the upper half of faces. This finding is consistent with latter research from Baron- Cohen et al (1997) who also found that children with ASC have difficulty processing facial expressions using the eyes and this is particularly apparent when asking children with ASC to identify more complex emotions.

Baron- Cohen (1997) investigated which parts of the face (the whole face, mouth or eyes) provide us with the biggest clues to one's mental state. He asked typically developing adults to name the emotion that an actress on a photograph was displaying by giving them two choices (the answer and a foil choice). He then showed participants either just the eyes of the actress or just the mouth and asked them to name the emotion she might be feeling. He found that typically developing adults were more successful in recognising basic emotional states when they could process the whole face. However, for the more complex emotional states the eyes and the whole face were both equally informative and the eyes were significantly more informative than the mouth. When this experiment was repeated with sixteen subjects with HFA or AS who were all of normal intelligence, they found that the group with ASC performed significantly worse on the complex mental states compared to controls and these differences were even more marked for the eyes alone condition.

The first of these experiments shows that in judgements about complex mental states, the eyes convey as much as the whole face and typically developing adults are remarkably consistent with each other in how they interpret both basic and complex mental states. The second experiment demonstrates that whilst adults with HFA or AS are able to detect basic emotions using the whole face, they are impaired at recognising complex mental states particularly when using the eyes alone. This 'language of the eyes' (Baron- Cohen, 1995) appears to be an unspoken language that most adults have become fluent in, however for individuals with ASC the recognition of mental states using facial expressions remains an area of considerable difficulty.

When considering the literature on emotion processing in autism, it is important to consider what type of emotions are being presented to participants (Williams & Happe, 2010). Levenson (1999) differentiates between basic emotions such as fear, happiness and sadness and more social emotions such as embarrassment, pride and guilt. The latter type of emotions are assumed to be at least partly socially constructed whereas basic emotion recognition emerges in early infancy, from as young as just ten weeks old (Haviland & Lelwica, 1987). Given the diagnostic criteria, personal accounts of autism and previous research findings, it is likely that the recognition and interpretation of social emotions will prove more difficult for individuals with ASC to register in others or understand in themselves than other non-social emotions.

Individuals with HFA seem relatively unimpaired in their ability to recognise expressions of non-social emotions on the faces of photographed actors (e.g. Baron- Cohen, 1997; Heerey et al, 2003; Rutherford & Towns, 2008;) although there is greater evidence of deficits in the recognition of non-social emotions in low functioning individuals with autism (e.g. Braverman et al, 1989). Losh and Capps (2006) asked children with HFA to define a list of both basic and complex emotions as well as two non-emotions. Participants were also asked to tell the experimenter about a time they felt that way. Interactions were videotaped, transcribed and analysed. Their findings revealed a number of important differences between the emotional accounts of children with ASC and typically developing comparison children. In particular, although the accounts produced by children with ASC were the same length as control groups, the ASC group were less likely to organize and convey their accounts of emotional experiences in specific and personalised casual-explanatory narrative frameworks. Their accounts were therefore 'script' like and lacked reference to the cause of their emotions

leaving in question the depth of understanding of all types of emotional experiences that children with autism have compared to their typically developing peers. These differences were not observed in non-emotional events and thus Losh and Capps (2006) comment that it is unlikely that these difficulties stem from overall impairments in identifying causal elements or talking about past events in general but rather stem from qualitatively different ways of processing emotions and emotional experiences.

The research presented so far appears to indicate that whilst children with HFA can recognise some basic emotions in others, the ability to recognise the mental states of others in social situations is impaired. Reports of emotion processing deficits amongst individuals with autism, caregivers and clinicians also support the notion that emotion recognition is a core area of difficulty for individuals with ASC (Kanner, 1943; Grandin, 1996; Hobson et al, 2006). However, there have been a number of well designed studies that have found no difference in the ability to recognise emotions in others between individuals with ASC and control groups. When considering the results of well controlled cognitive- experimental studies, evidence of autism- specific deficits on recognizing emotions in others, or describing emotions in self, is mixed.

2.2.3 Evidence against deficits in recognising emotions for individuals with ASC

Hiller and Allinson (2002) presented children with HFA a series of written scenarios involving potentially embarrassing situations and compared their performances with a control group who were matched for both age and verbal ability. They found no significant

differences between these two groups in terms of either the overall degree of embarrassment attributed to the protagonist or the quality of explanation provided for these attributions. The emotion of embarrassment is regarded as a social emotion that is developed through social interactions and cultural expectations and thus we would expect individuals with autism to find the recognition of embarrassment particularly difficult, even those that are high functioning. However it is worth noting that the sample size used in the study was small (n = 10 per group) and the mean age of the ASC group was 12.3 which means that individuals have had time to possibly acquire their knowledge of emotion recognition for even the most complex emotions through an alternative compensatory route.

Wright et al (2008) compared the ability to recognise emotions in others in children with HFA or AS and typically developing controls who were matched by their verbal and non verbal performance. They found that across participants, emotion recognition of faces improves as the child develops, and as found with previous studies emotion recognition improves with age (Gross & Ballif, 1991). In addition, participants with HFA or AS demonstrated poorer recognition of happy and angry facial expressions but not in any other emotions. Participants with ASC were able to integrate pictorial context with facial expressions and occupations in order to interpret situations as well as the control group. Most of the children in this study had a diagnosis of AS and so these findings support existing research (Bowler, 1992) which suggests that children with ASC who have higher verbal skills and cognitive abilities experience less theory of mind difficulties. Perhaps then, cognitive ability and verbal reasoning skills are necessary for either the development of a theory of mind or the development of specific compensatory strategies that allow children with ASC to learn how to

recognise emotional expression in others. Whether they then respond appropriately to such emotional expression is of course another matter.

Williams and Happe (2010) asked participants to define and then describe previous experiences of social (pride, guilt and embarrassment) and non-social (happiness, sadness, fear, surprise, disgust and disappointment) emotions. Participants were then shown a series of video clips each depicting a character expressing one of these emotions. Participants were then asked to identify the emotion expressed in each clip. They compared the performances of children with autism (N = 21) and typically developing children (N = 21) who were matched against their verbal mental age. They found, contrary to their predictions, that children with autism were as able as age and ability matched comparison participants to recognise social and non-social emotions in others and to describe their own previous experiences of these emotions. These results support the findings from Hiller & Allinson (2002).

2.2.4 A critical overview

There are several points worthy of consideration when interpreting these results. The first is similar to those criticisms presented against Hiller and Allinson's (2002) study. The mean age of the ASC group was 12 years 3 months, whilst typically developing children may arrive at their understanding of emotions through their experience of early interpersonal relations, individuals with autism may acquire their knowledge through an alternative compensatory route (Hobson et al, 2006) and at the age of 12 years 3 months they have had plenty of time to acquire such strategies:

‘Intriguingly, reports of their laborious, computational approaches to social- emotional tasks and interactions suggest that in lieu of intuitive processes guiding typically developing individuals, persons with autism recruit their cognitive resources to develop compensatory techniques for contending with emotional stimuli.’

(Losh & Capps, 2006, p. 810)

In addition, recollective accounts of emotions such as embarrassment do not necessarily demonstrate emotional recognition in oneself but could merely reflect rote learning from previous stories and childhood recollections that parents may have shared with their children. Individuals may know that a particular story matches with the emotion of embarrassment but may not spontaneously be able to recall that without support from previous discussions with others. Furthermore, there appears to be a gap between reports from parents and individuals in real life and the results from experimental studies such as this one.

Williams and Happe (2010) asked participants to simply identify an emotion from a particular video clip, again a skill which may have been rote learnt. However in real life, children with ASC are not just expected to identify an emotion in another just from their facial expression but have to also understand that another’s belief is different to our own (theory of mind) and interpret the gist of the situation (weak central coherence theory) and the language that a person may be displaying, recognise the facial expression, tone, intonation etc, as well as then know how to respond appropriately. This study therefore lacks ecological validity. So whilst Williams and Happe (2010) may have demonstrated that older children with ASC can perform as well as age and ability matched peers on some elements of these tasks, they do not reflect the necessary requirements needed to be able to function well in a social environment, hence the discrepancy between real life reports from individuals with autism who have difficulties recognising and responding to emotions in others and the findings from this study.

Williams and Happe (2010) do recognise that emotion processing is not typical or unimpaired in individuals with autism but argue that studies where the null hypothesis cannot be rejected should not go unpublished or be disregarded as they may actually be contributing to a much wider picture of precisely how children with autism are recognising and processing both social and non-social emotions.

2.3 Theories of an emotion recognition deficit

The following section outlines three possible cognitive theories of an emotion recognition deficit in children with ASC. The first of these theories is the theory of mind deficit hypothesis (Baron-Cohen, 1985; 1991). Sections 2.3.1 and 2.3.2 explore an overview of what a theory of mind is and how this develops in typically developing children. Section 2.3.3 looks more specifically at the research that supports the hypothesis that children with ASC demonstrate a deficit in theory of mind development.

The second cognitive theory that may account for an emotion recognition deficit in children with ASC is the weak central coherence theory (Frith & Happe, 1994). Section 2.3.5 introduces the third cognitive theory which is the empathizing-systemizing theory (Baron-Cohen, 2002; Golan & Baron-Cohen, 2006). Section 2.3.6 then goes on to discuss a number of studies that support an emotion recognition deficit from a neuropsychological perspective.

2.3.1 Theory of mind and emotion recognition

A theory of mind is described as the ability to attribute mental states (beliefs, desires and intentions) to oneself and others in order to make sense of and predict behaviour (Tager-Flusberg, 1993). We, as human beings understand each others actions, thoughts and lives by construing people in terms of internal mental states which then guide all social action and interaction (Wellman, 1993). Difficulties with social interaction, including recognising intent in others and predicting the behaviour of other people is seen as one of the core areas of difficulties for children with ASC. The theory of mind hypothesis therefore holds that in children with ASC, the ability to recognise intent, belief and desires in others fails to develop in the typical way and therefore results in observed social and communication abnormalities in behaviour.

In order for one to develop a theory of mind, one must understand that the mental world is different from the real world. The contents and states of the mind are internal, mental and therefore subjective, whereas the contents of the real world are external, substantial and objective (Wellman, 1993). Not only are the mental world and physical world two very separate representations but they are also causally related. So an individual's beliefs about the world will affect their physical actions and therefore their mental representations will impact on the physical world and the action they take. Likewise, the physical world will influence one's mental states and therefore the physical world and the mental world interact, leading to an often complicated and extensive set of causal connections (See Figure 1 for a visual representation).

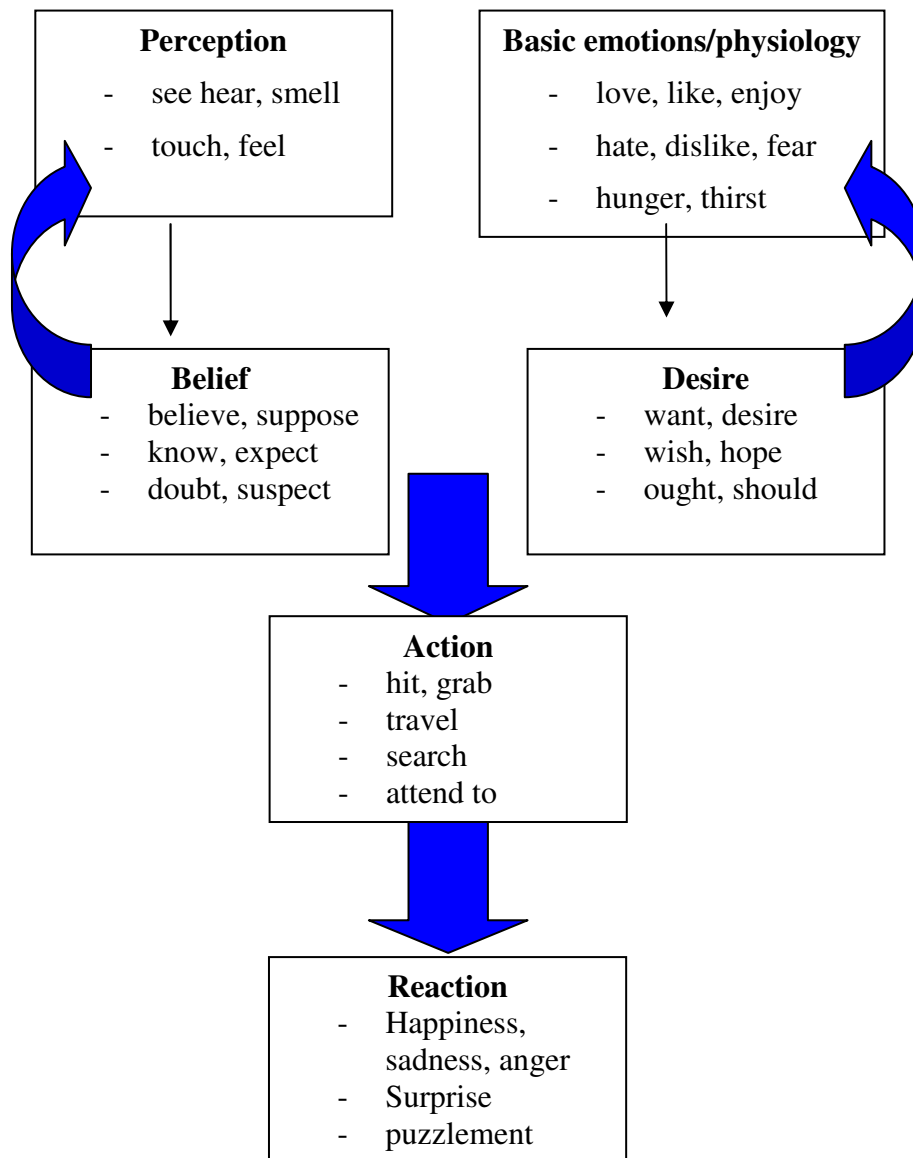


Figure 1. Belief- desire psychology: a schema of the organization of the constructs of our everyday theory of mind (Wellman, 1993)

2.3.2 Theory of mind in typically developing children

A great deal of research has investigated young children's understanding that persons have beliefs and how such beliefs guide behaviour. To understand mental causation, it is essential that children realize that people live their lives with regard to beliefs about the world and not with regard to the world itself (Wellman, 1993). False-belief tasks have been used to demonstrate children's understanding of mental states. A child's understanding that a person has a false belief- one whose content contradicts reality- provides compelling evidence for the understanding of a clear distinction between one's mind and the real world (Wellman et al, 2001). Wimmer and Perner's (1983) now classic false- belief study demonstrated that children as young as four are able to distinguish between one's beliefs and an external reality. They presented children with the following scenario; Maxi puts his chocolate in the kitchen cupboard and leaves the room to play. While he is away (and cannot see) his mother moves the chocolate from the cupboard to the drawer. Maxi returns. Where will he look for his chocolate? If a child said that Maxi will look in the drawer for the chocolate then this would demonstrate that the child believes that Maxi's belief is the same as their representation of the external world and therefore they do not have an understanding that someone's beliefs which impact upon actions could be different from their own. However if a child said that Maxi would look in the cupboard despite their understanding that the chocolate is actually in the drawer, then this would demonstrate that the child can distinguish their understanding of Maxi's beliefs and their representation of the external world and therefore have a theory of mind. Wimmer and Perner (1983) found that children aged four and five were indeed able to pass this task, although children aged three often made a specific false-belief error and assert that Maxi will look in the drawer to which the chocolate was moved.

2.3.3 Theory of mind deficit in children with ASC

There are currently two major hypotheses as to how a theory of mind impairment may account for autism. One is the proposal that autism represents a defective theory of mind possibly represented as a domain specific mechanism (Leslie, 1994). The failure of early spontaneous theory of mind in childhood autism can therefore be understood in terms of an impairment in the growth and functioning of this mechanism (Leslie, 1994). The second proposal is that a theory of mind is developed across a number of functions related to human reasoning rather than a specific domain and autism actually represents a serious delay in the normal progression of these thinking skills (Wellman, 1993).

Using Wimmer and Perner's classic false belief paradigm, Baron- Cohen et al (1985) compared the performance of children with ASC, children with Down Syndrome and typically developing children. The children with ASC had a mean non-verbal and verbal mental age of 9.3 and 5.5, respectively whereas the children with Down Syndrome had a mean non-verbal and verbal age of 5.11 and 2.11, respectively. Participants were asked to complete the Sally-Anne task. The procedure is illustrated in Figure 2. There were two doll protagonists, Sally and Anne. Sally first placed a marble into her basket. Then she left the scene, and the marble was transferred by Anne and hidden in her box. Then, when Sally returned, the experimenter asked the critical belief question: "Where will Sally look for her marble?" If the children pointed to the previous location then they would have passed the test, however if they pointed to the actual location then they would have failed the test as this demonstrated that they do not understand that another persons beliefs can be different from

reality. Baron- Cohen et al (1985) found that 23 out of 27 typically developing children and 12 out of 14 children with Down Syndrome passed the false belief task. However, only 4 out of the 20 children with ASC passed the false belief task which means that 80% failed the false belief task. The differences between the groups were significant and therefore supports the notion that children with ASC have difficulties representing the mental states of others and are thus at a great disadvantage when having to predict the behaviour of other people and operate well in social situations.

Figure 1. *Experimental scenario.*

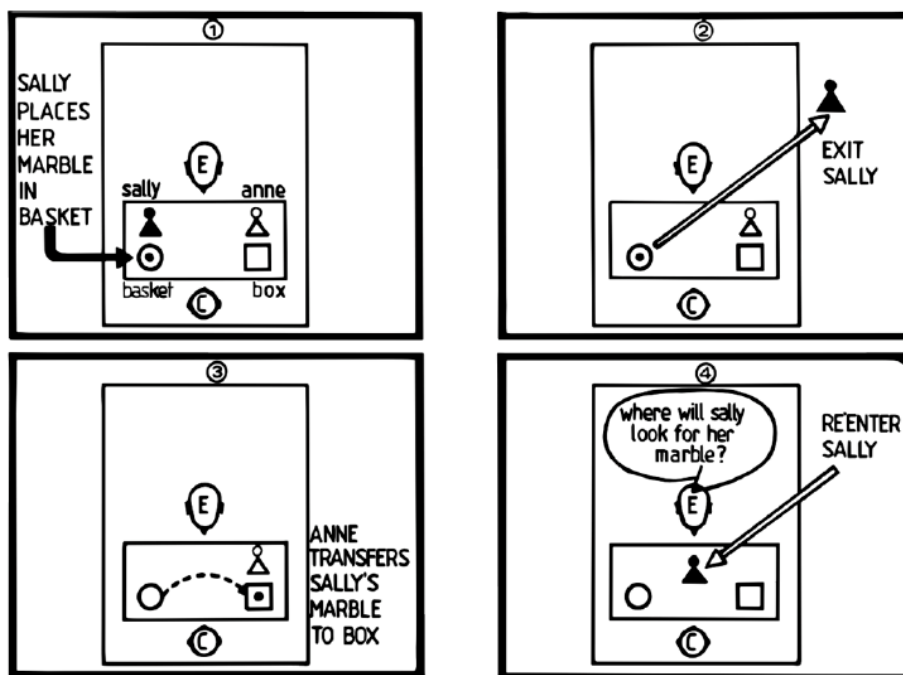


Figure 2. Experimental scenario used in Baron- Cohen, Leslie and Frith (1985).

In a later study, Baron- Cohen (1991) compared the performance of children with ASC, children with cognitive difficulties and typically developing children on a range of tasks that assessed their ability to recognise emotions, desires and beliefs. The three groups were

matched by their verbal and non-verbal reasoning skills and therefore the mean chronological ages of the groups was 13 years 8 months, 15 years, four months and 5 years and 3 months (ASC group, children with cognitive difficulties and typically developing children, respectively). The first test asked participants to understand the link between desire (caused by an external object) and emotion. On this test, the children with ASC performed almost as well as the typically developing children and therefore showed no impairment in their understanding of situations as a cause of emotion. However, the next question included the use of a false belief test. In contrast to the first desire question, children with ASC performed significantly worse than the other two comparison groups on this test. This study then suggests that children with ASC have difficulties that are more severe than would be expected for their mental age in attributing different beliefs to other people. Baron- Cohen (1991) therefore found that children with ASC could attribute basic emotions to situations but had difficulties attributing beliefs to other people and therefore demonstrated a theory of mind deficit. Whilst this study demonstrated that children with ASC could attribute basic emotions to situations, the mean age of the ASC group was 13.78, these children may therefore have developed compensatory strategies (Kanner et al, 1972) in their ability to recognise specific basic emotions and attribute them to basic real life scenarios.

This unimpaired understanding of situations and desires as causes of simple emotions is consistent with reports from Tager-Flusberg (1989). She found that if children with autism spontaneously produced any mental states terms in their speech, these tended to refer to basic emotions such as happiness and fear and to desires such as want, love and like. These children rarely referred to cognitions or beliefs affecting emotion.

2.3.4 The weak central coherence theory of ASC

There appears to be a substantial amount of evidence to support the idea that the way children and adults with ASC recognise emotions in others is quantitatively different to typically developing children and adults. This is interesting and in line with a second cognitive theory of autism. Whilst Frith and Happe (1994) support the notion that the theory of mind deficit hypothesis goes some way to explaining the core ‘triad of impairments’ (Wing & Gould, 1979), they argue that there are a number of other deficits that can not be well explained by a lack of an ability to ‘mentalize’. Such impairments include the following:

- Restricted repertoire of interests
- Obsessive desire for sameness
- Islets of ability
- Idiot savant abilities
- Excellent rote memory
- Preoccupation with parts of objects (Frith & Happe, 1994).

Frith (1989) therefore postulates that such deficits can be partly explained by a second cognitive theory of autism, the weak central coherence theory. Frith (1989) proposed that autism is characterised by a specific imbalance in integration of information at different levels. In typically developing children, there is often a tendency to draw together diverse information to construct higher-level meaning in context and therefore gain a ‘central

coherence' (Frith, 1989) or the gist of information. This type of information processing applies to a range of contexts including both non verbal domains as well as language. Evidence to support the weak central coherence theory comes from studies of language processing, which show that individuals with autism are unimpaired when processing the meaning of individual words but have difficulty integrating the meaning of different words in a sentence (Eskes, Bryson & McCormick, 1990; Frith & Snowling, 1983).

This theory also applies to the way in which individuals process visual information such as facial expressions. Typically developing individuals process information from the whole of the face as a clue to how a person might be feeling. They can then integrate information from the surrounding context to interpret the situation and respond to that situation more accurately. Frith (1989) proposes that this universal feature of human information processing is disturbed in individuals with ASC and that a lack of central coherence could explain the additional assets and deficits listed above. She therefore argues that individuals with ASC would be relatively good at tasks where attention to local information is necessary and poor at tasks that require the recognition of global meaning which would include the recognition of facial expressions. This idea is also supported by studies that show that people with autism have a local bias in visual perception and visuospatial construction, thus individuals with autism perform better than controls on embedded figure tasks in which a hidden shape has to be found in a larger picture (Jolliffe & Baron-Cohen, 1997; Shah & Frith, 1983).

2.3.5 Empathizing Vs systemizing

A third theory that may explain an emotion recognition deficit is proposed by Golan and Baron-Cohen (2006). Baron-Cohen (2002) describes empathizing as the drive to identify another person's emotions and thoughts and respond to these with an appropriate emotion. Empathizing allows you to predict a person's behaviour and to care about how others feel. Empathizing therefore requires an ability to recognise that others have mental states and to respond appropriately to the mental states of others, which of course requires a well developed theory of mind. Individuals that have a well developed theory of mind will therefore demonstrate an ability to empathize well with others. The social world in which we live is often unpredictable and can change in just a matter of seconds, therefore the ability to empathize is one of our most powerful tools which enables us to understand and predict our ever-changing social environments. The previous section has detailed evidence to demonstrate that individuals with ASC have difficulties recognising the emotions of others and using a theory of mind. As we might expect then, studies have also shown more specifically that individuals with ASC are likely to perform worse than controls on tests that require the ability to empathize (Lawson et al, 2004).

In contrast to these difficulties, individuals with ASC show good and sometimes superior skills in systemizing (Golan & Baron- Cohen, 2006). Systemizing is described as a drive to analyse the variables in a system, to understand the underlying rules that govern the 'behaviour' of that system and to construct new systems that allow you to predict and control what will happen next within that system. A system is described as anything that takes input and delivers output, when you systemize you often use if- then type rules (Baron- Cohen,

2002). Baron- Cohen (2002) describes six kinds of systems that the human brain can analyse and construct:

1. Technical systems: a computer , a musical instrument, a hammer etc
2. Natural systems: a tide, a weather front, a plant etc.
3. Abstract systems: mathematics, computer program, syntax etc.
4. Social systems: a political election, a legal system, a business etc.
5. Organisable systems: a taxonomy, a collection, a library etc.
6. Motoric systems: a sports technique, a performance, a technique for playing a musical instrument etc.

Baron- Cohen (2002) argues that the ability to systemize is associated with the development of the male brain and the autistic brain is an example of an extreme male brain. In a later paper, Baron- Cohen (2006) goes on to argue that we all possess a systemizing mechanism (SM), in different individuals this SM is set at different levels. Some individuals will have a high SM and are likely to be more attracted to systems, structures, rules and patterns whereas others will have a low SM and are therefore less likely to detect or see the world in systems. These individuals will also be more likely to tolerate change that falls outside of the ‘systems rules’ such as human behaviour. Typically males have higher SM than females and individuals with ASC have their SM set at a higher level than typical males. Individuals with ‘classic’ autism have their SM set at the maximum level and higher than individuals with AS, they can therefore tolerate less change.

Baron Cohen (2002) refers to several examples of evidence to demonstrate that some individuals with autism, particularly those that are high functioning have superior systemizing skills. Firstly, some individuals with ASC have ‘islets of ability’, that is, specialist abilities in areas such as mathematical calculation, calendrical calculation, syntax acquisition, music or memory for railway information (Baron- Cohen & Bolten, 1993). Secondly, individuals with autism are strongly drawn to structured, factual and rule based information and can demonstrate obsessions with closed systems that are predictable such as computer systems, electronics, timetables, trains, vehicles, engines etc (Baron- Cohen, 2002). Furthermore, on the embedded figure test which is a test that requires participants to locate a smaller shape within a larger collection of shapes, individuals with ASC score higher than typically developing individuals who were matched by both age and verbal ability (Jolliffe & Baron-Cohen, 1997). Whilst the embedded figure test is not a direct assessment of systemizing ability, it is a measure of detailed local perception which is a prerequisite for systemizing (Baron- Cohen, 2002).

The ability to systemize is a key strength in individuals with ASC, however in the social world some aspects of agentive change are highly unlawful, unpredictable, complex and varied. The rules that enable one to understand the social world change quickly and are too complex to systemize. According to the hyper- systemizing theory (Baron-Cohen, 2006), the core of autism is both a social deficit, as the social world does not operate within a rule bound system and a need for sameness, because any form of change would require one to amend the rules and boundaries of that particular system. In addition, individuals with a high SM will have difficulties generalizing learning as they are likely to have identified rules that might only apply to the current system in which they are observing.

2.3.6 Theories from neuropsychology

The use of compensatory strategies for children with ASC is further supported by recent neurofunctional studies. For example, Schultz et al (2000) used functional magnetic resonance imaging (fMRI) to study face and subordinate level object perception in adults with HFA compared with two matched control groups. Participants were shown pairs of stimulus including face, object and pattern tasks. Schultz et al (2000) found significant differences in the pattern of brain activation during face discrimination among individuals with ASC compared with controls. The primary difference involved decreased activity in the inferior temporal gyrus for participants with ASC. For controls, the activation of the inferior temporal gyrus was most strongly associated with object- specific perceptual discrimination. Therefore these results suggest that the perceptual processing of faces in individuals with ASC is more like the perceptual processing of objects in typically developing individuals. This study is powerful in that it may demonstrate that the use of compensatory strategies in individuals with autism have created structural changes in the brain, although could be criticised for the lack of ecological validity that it presents.

Klin et al (2002) measured visual fixation patterns during viewing of naturalistic social situations in individuals with ASC and fifteen age, sex and verbal IQ matched control subjects. This method involves viewing digitized videotape clips of complex situations while wearing a non-invasive eye-tracking device that superimposes the viewer's point of regard onto the viewed scenes. The total on screen area was divided into four areas of interest, the mouth, eyes, body and objects. The videotape was then coded for pattern of visual fixation.

The results demonstrated significant between- group differences for all four regions. The best predictor of group membership was the percentage of fixation time on the eye region; the control group were two times more likely to fixate on the eye region. Percentages of fixation time on the mouth and object regions were strong predictors of social competence measures, with higher mouth fixation time associated with higher levels of social competence and lower levels of autistic social impairment. The finding that a higher percentage of mouth fixation time but not eye fixation time predicted a higher level of social competence in participants with ASC is particularly interesting. This also related to Baron Cohen's (1995) finding in the 'language of the eyes'. Baron- Cohen (1995) found that adults with ASC or AS found it particularly difficult to detect basic emotions using the eyes only, perhaps this is why social competence is associated with mouth fixation rather than using the eyes or the whole face. Klin et al (2002) hypothesize that perhaps individuals with ASC are looking more at the mouth region because that is where speech comes from and by concentrating their efforts on something they can understand, they might attain a better understanding of social situations. Nevertheless, this compensatory strategy may not always be a successful one as in many cases language is supplemented by non verbal cues such as the position of ones eyes or facial expression.

However, what these studies show is that individuals with ASC are capable of developing qualitatively different strategies that enable them to pass some emotional recognition tests that impact on structural changes within the brain. Temple Grandin, a highly intelligent woman with ASC writes about her experiences and said "I had to think about every social interaction...a scientist trying to figure out ways of the natives" (1995, p. 133). These complex effort driven compensatory strategies seem far from the intuitive emotional

recognition and reasoning skills that we see in typically developing children and adults. Where studies such as William and Happe's (2010) demonstrate that children with ASC can recognise emotions in others, it is important to consider if and how they may have developed compensatory strategies and qualitatively different ways of reaching their conclusions, and it seems that children with HFA are better placed to develop such complex strategies. If individuals with HFA develop compensatory strategies in later life then this does not mean that they did not have difficulties recognising emotions when they were younger and thus the use of interventions in primary school may further enhance emotion recognition and the development of compensatory strategies at a younger age. If individuals with HFA do develop the use of compensatory strategies to enhance the recognition of emotion then we might question why we would need to intervene at all if eventually children with HFA will be able to recognise emotions in the same way as typically developing children. However, we do not know enough about the development of such compensatory strategies, for example, how do they develop? Which children develop such strategies and in which contexts? Do children who are autistic a low functioning also develop compensatory strategies or will they always have difficulty recognising emotion without appropriate support?

Research has therefore demonstrated that children with ASC have particular difficulties recognising emotion in others. This may be due to processing difficulties as children with ASC are more likely to focus on one part of the face rather than the whole face and therefore have difficulty interpreting the whole gist of the facial expression. However, in addition to this is the idea that even when children with ASC can recognise and process the whole face, they also experience deficits in understanding that other people have beliefs or desires. This understanding will impact the actions that an individual may take and therefore the

interpretation of social experiences which will inevitably include emotional recognition will be particularly difficult for a child with ASC.

2.4 Interventions designed to enhance emotion recognition and social skills

Interventions that aim to enhance emotion recognition, socio-emotional functioning and interpersonal skills are based on the rationale that children with ASC can indeed learn such skills through targeted interventions and more importantly that these learnt skills can be generalized to everyday contexts. Bauminger (2002) designed an intervention specifically for children who are classed as high functioning and autistic (aged 8-17) which aimed to promote both children's social cognition including emotional understanding and social interaction with peers, using a cognitive behavioural approach. The core assumptions of this interventions are as follows:

1. Interpersonal cognitive processes and emotions can mediate interpersonal behaviour
ie. any work that is completed with individual, small groups or whole classes will then have an impact of children's interactions in real world contexts,
2. Social problem solving and recognition of emotions can be taught cognitively and can influence behaviour,
3. Social problem solving and a more comprehensive understanding of emotions can lead to latter successful social adjustment.

Bauminger (2002) used pre and post-intervention measures which included observations of social interaction, measures of problem solving and of emotion understanding and teacher

rated social skills. The results demonstrated progress in three areas. Children were more likely to initiate positive social interactions with peers after the intervention, they made more eye contact and were more likely to share experiences with their peers. In addition, children provided less non-social solutions to social problems that they were presented with and children were able to give more examples of complex emotions. This study therefore demonstrates that children who are high functioning and autistic can be taught interpersonal skills and emotional recognition through the use of cognitive based strategies. Perhaps then, children with autism who are also high functioning are able to utilize their relatively high cognitive abilities to acquire a better understanding of the social world. However, as with many studies in this area, Bauminger (2002) was unable to demonstrate whether children's improvement exceeded the learned areas and was transferred into children's more global social competence with peers over a longer period of time. A control group was not used in this study so it is difficult to rule out the possibility that improvements in social cognition and emotion recognition stemmed from maturation and experience rather than the intervention itself. Furthermore, the intervention used in this study utilized a combination of cognitive behaviour strategies, social agents who delivered these strategies and the use of group support. The very implementation of different social agents and their interactions makes it difficult to assess the factors directly responsible for the progress that participants made. It may have been a combination of all of these factors that supported an increase in both social cognition and emotion recognition, although it is not clear if and how each of these factors might lead to an enhanced and sustained improvement in social and emotional function for children with autism who are also high functioning.

Based on the idea that high functioning individuals with autism may be able to use their enhanced systemizing skills to compensate for their empathizing difficulties (Baron-Cohen, 2002; Golan and Baron-Cohen, 2006), Baron- Cohen et al (2004) designed a systematic, interaction guide to emotions called Mind Reading. Mind Reading is based on a taxonomic system of 412 emotions and mental states, grouped into 24 emotions. The emotions and mental states are organised systemically according to emotion groups and developmental levels. Mind Reading consists of various activities and games that expose individuals to a range of emotions and can be accessed on a daily basis. The use of computer software for individuals with ASC has several advantages. Firstly, individuals with ASC favour a computerised environment as it predictable, consistent and free from social demands (Golan and Baron- Cohen, 2006). Secondly, workers can work at their own pace and the lessons can be repeated until mastery is achieved (Golan and Baron- Cohen, 2006).

Golan and Baron- Cohen (2006) completed two experiments investigating the impact of the Mind Reading interactive software. The first of their two experiments compared the effect of using Mind Reading in the home. Three groups of participants took part on this study; a group of adults who were HFA or had a diagnosis of AS who received the intervention, a matched group who did not receive the intervention and a control group which consisted of typically developing adults. Participants were asked to use the software for two hours per week over a ten week period. Three measures were used to assess the impact of the intervention that reflected three levels of generalization:

1. Close generalization
2. Feature- based distant generalization

3. Holistic distant generalization

Golan and Baron- Cohen found that individuals who had received the intervention significantly improved in their ability to recognise complex emotions and mental states compared to both their own performance before the intervention and the relative control group. However, improvement was limited to close generalization. That is, individuals were able to recognise emotions in the faces and contexts that they had already been exposed to from the Mind Reading software.

The second experiment completed by Golan and Baron- Cohen (2006) was very similar although in this experiment participants were asked to attend a support group on a weekly basis to discuss the intervention with other participants and the control group attended a social skills course group. Using group discussion, role play, worksheets and the analysis of emotions on television and in newspapers aimed to consolidate participant's knowledge from the software programme and enhance generalization. This experiment therefore compared the use of the Mind Reading software at home with weekly support of a tutor in group sessions to participating in a social skills course without the use of software. The findings demonstrated that those participants that had accessed the software and tutor groups had made significant improvement on measures of close generalization whereas no improvement was found for the social skills group. However, as with experiment one, software users failed to improve more than controls on the feature-based distant generalization and the holistic distant generalization measures. It is possible that the adults with ASC had learnt the responses of the characters in the Mind Reading software in a rote type fashion and were able to identify their faces after 10 weeks of repeatedly being exposed to the software. However, they were unable to generalize

these findings to unfamiliar emotions and scenarios using the Mind Reading characters or to actors in feature based films.

This relates to Baron- Cohen's (2006) systemizing mechanism argument. Perhaps the individuals in this study were able to formulate a rule based system that only applied to the Mind Reading software, and to generalize these rules would compromise the quality of ones systemizing. A good systemizer resists grouping variables together until there is reliable evidence that these variables have no functional differences, as grouping them together risks loosing key information (Golan & Baron- Cohen, 2006). With this view then, good systemizers will find it difficult to generalize. However, this does lead us to question the use of interventions designed to enhance emotional recognition and social cognition using computer software if individuals with ASC find it so difficult to generalize into every day contexts. Perhaps we need to explore the vehicles of generalization as well as some of the potential barriers that prevent individuals with ASC generalizing their learning. This study demonstrated that it is possible to teach adults with ASC who are also high functioning aspects of emotion recognition and empathizing skills using an intervention that harnesses their systemizing strengths. Lego therapy (Owens et al, 2008) is another example of an intervention that encourages young children with ASC to build lego in small groups thereby creating opportunities for social interaction. The rationale behind this is that the children will be intrinsically motivated by the lego as it draws on elements of systematising skills such as construction, predictable sequences and pattern recognition whilst also being encouraged to work within a social context. Whilst this does not rely on computer technology, lego therapy is based on the empathizing-systemizing theory.

Based on the same rationale, Baron- Cohen (2004) designed an animated series called the Transporters with a view to enhance the social functioning of children with ASC.

2.5 The Transporters

Intervention programmes that aim to enhance socio-emotional skills in ASC have attempted to use the idea of enhanced systemizing abilities to improve their effectiveness (Golan et al, 2010). Golan and Baron- Cohen (2006) theorise that if individuals with HFA possess good systemizing skills, then it may be possible for them to use this strength to compensate for some of their empathizing difficulties. Based on this rationale, Baron-Cohen (2004) developed an animated series called the Transporters which combines emotional recognition with predictable systems such as trains, trams and boats. The Transporters contains several characters that are based around particular modes of transport, for example Charlie the tram and Sally the cable car. There are nine characters in total. Each of these characters has a human face and each episode focuses on one key emotion, these emotions are happy, sad, angry afraid, excited, disgusted, surprised, tired, kind, sorry, proud, jealous, joking and ashamed. Whilst there is one key emotion in each episode, several other emotions are also demonstrated throughout the episode. There are fifteen episodes altogether and each of these episodes lasts for approximately five minutes. The idea behind the Transporters is that children are motivated to learn about emotional recognition through the use of characters that are attached to systematic and predictable vehicles. This is something new and different to previous interventions that have aimed to enhance emotion recognition in children with autism. The Mind Reading (Baron-Cohen, 2004) intervention uses computer technology to provide children with a motivating and interactive system of emotions that they will be drawn

to. Similarly lego therapy (Owens et al, 2008) uses lego as a key motivator within a small group context to encourage social interaction for children with ASC. However, the Transporters uses characters based on vehicles which children with ASC may be more drawn to because of their predictable nature. In addition the intervention uses computer technology which again is appealing to children with ASC. The characters are then seen within the context of an episode which is very different to the Mind Reading software as each episode talks about a specific emotion within the context of social settings. The Transporters therefore seems to have integrated key principles from the empathizing- systemizing theory, previous attempts to address emotion recognition in ASC and computer technology to form a product that is unique and appealing to children with ASC in an attempt to teach emotion recognition skills.

In the first study to look at the effectiveness of the Transporters, Golan et al (2010) recruited participants through an advert on the National Autistic Society magazine, *Communication* and via the Cambridge Research Centre website. They asked three groups; an ASC intervention group, an ASC control group and a typically developing control group all aged between 4 and 7 to watch the Transporters for a minimum of three times per day every day for a period of four weeks. Participants in the two clinical groups had been diagnosed with ASC using established criteria (APA, 1994) and had also completed the British Picture Vocabulary Scale II (BPVS) (Dunn, Whetton & Burley, 1997) to ensure that their verbal IQ was high enough to access the intervention. Participants were tested before and after the intervention using three measures which were similar to those presented in the Mind Reading study (Golan & Baron-Cohen, 2006). The three tasks represented three levels of generalization;

1. Familiar close generalization: Participants had to match familiar situations taken from the intervention series to facial expressions of familiar characters from the series.
2. Unfamiliar close generalization: Participants had to match novel situations with novel expressions from the Transporters characters. These expressions were not shown by these characters in the intervention series.
3. Distant generalization: To test generalization to facial expressions that are not attached to vehicles, participants had to match novel situations with novel expressions using selection of human non- Transporters faces taken from the Mind Reading software (Baron-Cohen et al, 2004).

Parents and carers were given a detailed guide to the DVD and were provided with suggestions of various ways in which the child's learning could be facilitated, for example, through the use of repeated episodes to reinforce their understanding, use of questioning to broaden understanding and the use of interactive activities that are provided with the DVD. All of these suggestions will also support the generalization of skills learnt from the DVD. Parents and carers were also encouraged to extend discussions with their children to look at the causes and consequences of emotions and why different people respond in different ways. This study therefore assessed whether the independent use of the Transporters DVD with parental supervision improves emotional recognition and contextual understanding of emotions in children aged 4-7 with high functioning ASC. The independent variable in this study is the use of Transporters and the dependant variable is the scores from the three measures of emotion recognition (familiar, unfamiliar and distant generalization).

Golan et al (2010) analysed their results using four one-way analyses of variance and Holm's sequential rejective Bonferroni procedure (Holm, 1979) and found that after watching the Transporters for four weeks, participants in the ASC intervention group demonstrated an enhanced performance at all three levels after the intervention. Participants were able to generalize their knowledge to perform at the level of typical controls on the distant generalization task which required emotion recognition from naturalistic clips of human characters that were not attached to vehicles. Participants were therefore able to generalize the learning of emotion recognition from the Transporters characters to both unfamiliar Transporters clips and then to human faces using the Mind Reading software. This is interesting because previous studies (Golan & Baron- Cohen, 2006) have not been able to demonstrate the generalization of such skills.

There are a number of factors which may have contributed to the generalization of skills learnt from watching the Transporters. Firstly, the children are much younger than previous studies and are therefore more amenable to learning (Golan et al, 2010). In addition, the series was designed so that every emotion and mental state was not only labelled by the narrator but also explained in terms of the context which other interventions such as the Mind Reading software do not. The Transporters was also designed to be entertaining and intrinsically motivating for children with ASC so that the children instead of avoiding faces might tune into them without even realising they are doing so which allows them to pick up crucial information for learning about emotional expressions (Golan et al, 2010). Participants were also recruited through a popular magazine and research website, it is likely that those parents who came forward to participate in the research were motivated and keen to enhance emotion

recognition in their children and thus may have engaged in huge efforts to support the generalization of skills through extensive discussion, activities and games with their child.

Whilst this study demonstrates that children with ASC were able to generalize their learning, we do not know if this learning a) was sustained over a long period of time or b) led to any improved social functioning. An extension of this study may have been to measure playground activities and interactions with others before and after the intervention. In addition, we do not know how effective this intervention might be in other contexts such as schools. As a Trainee Educational Psychologist (TEP), the researcher was keen to promote an evidence-based practice in the schools that she visited. Any recommendations and interventions that are suggested to schools should therefore be based on both psychological theory and evidence that demonstrates their effectiveness. This is a philosophy that is supported by the profession more widely and the local education authority by which the researcher is employed. Several of the schools that the researcher and her colleagues have visited have used the Transporters in school. Whilst this is anecdotal, it does suggest that schools are using an intervention that has been shown to be effective only in the context of individual homes with parental supervision. However, we do not know if the results that Golan et al (2010) found could be replicated within the context of an educational setting. The current study is therefore an attempt to replicate the findings from Golan et al (2010) using a similar cohort of children within a more ecologically valid context and by employing a different methodology.

2.6 An introduction to the current study

The current study used an experimental design with the same measures of Golan et al (2010) to assess the impact of the Transporters on emotion recognition for children aged 4-7 with high functioning ASC when delivered three times per day in the context of a whole group in a classroom. The school was a special school for children with ASC. It was decided to assess children who were all in the same school and the same class in order to reduce any confounding variables. Two full time classroom teachers took part in the study, they both taught all of the children that participated in the study. There were fourteen children in the class in total, the teachers were asked to select children that they felt were able to access the intervention and assessment measures using both their own professional judgement and national curriculum levels. From those children that were selected, a pen portrait was completed by parents in addition to the BPVS (Dunn, Whetton & Burley, 1997) which was used to assess understanding of language to ensure that the participants would be able to fully understand and follow the instructions to complete assessment measures throughout the study. The teachers were also asked to discuss the episodes with the class and conduct activities where possible to support the generalization of any skills that the children may have learnt from watching the DVD.

A repeated measures design was used whereby the same participants were tested using three measures which reflected three levels of generalization at Time 1, Time 2 and Time 3. The intervention took place between Time 2 and Time 3. If participant's scores significantly increase between Time 2 and 3 but not between Time 1 and 2, then the assumption would be that this improvement was due to the Transporters DVD. Whilst the study was based on the

work of Golan et al (2010), it was not an exact replication. The aim of the research was to see if the findings from Golan et al (2010) could be replicated within the wider context of a classroom and so the most obvious difference between the two studies was the context in which the research was carried out. In the current study, participants watched the Transporters DVD in their classrooms and this process was facilitated by their class teachers whereas in Golan et al's (2010) study, participants watched the DVD in the context of their homes supervised by their parents. Furthermore, in the current study participants watched the DVD as a whole group as opposed to individually watching the DVD. There are then several key differences between the current study and the work of Golan et al (2010). Children who have access to the DVD at home can request to see the DVD at any time of the day which may mean that they are more motivated at the time of viewing than children who have been subjected to the DVD as part of a classroom routine. In addition, parents may also be more motivated to have discussions with their children about the DVD both at home and in other contexts which may promote the generalisation of skills learnt from the DVD. In the context of a classroom, there are also more distractions in the environment which may prevent the children from paying close attention to the DVD which may therefore restrict learning. In the current study, the researcher was keen to investigate how effective the Transporters would be within the context of an educational setting as many schools and practitioners are already using the Transporters within education based contexts.

2.6.1 Predictions

1. It is expected that participants will score the same on Measures 1 (familiar close generalization) and 2 (unfamiliar close generalization) at Time 1 and 2 because at this time both measures will be unfamiliar to them.
2. After they have received the intervention, it is expected that participants' scores will be significantly higher on Measure 1 (familiar close) than 2 at Time 3 because it will be easier for participants to recognise emotional expressions in the characters that they have been exposed to for the last four weeks.
3. It is also expected that participants will score lowest on Measure 3 (distant generalization) at all three times because human faces are less motivating and the generalization of skills learnt from the Transporters to human faces will be more difficult.
4. It is expected that participants will score higher at Time 3 compared to Time 1 and Time 2 on all three measures.

In the current study the independent variable is the Transporters DVD, the dependant variable is the scores on the three measures of emotion reception (familiar, unfamiliar and distant generalization).

CHAPTER 3:- METHODOLOGY

3.1 Research questions

Hitchcock and Hughes (1995) state that a researcher's ontological assumptions gives rise to their epistemological assumptions, these in turn give rise to methodological considerations which in turn give rise to issues of instrumentation and data collection. The researcher's ontological and epistemological position will therefore be entwined with their decisions throughout the research process influencing the choice of problem, the formulation of questions asked, the characterisation of teachers and pupils and how data are sought and analysed (Cohen et al, 2007). Traditional researchers within educational psychology have relied upon research methods associated with a positivist approach relying on statistical analyses and interpretation with a view to discovering an external, objective reality. In contrast, paradigms such as social constructivism deriving from philosophical relativism maintain that there is no external reality, there are only different sets of meanings and classifications which people attach to the world (Robson, 2002). More recently there has been a growing body of literature within educational psychology that attaches significance to the social context of learning and the interrelationships between learner, activity and context through which constructions of reality are formed (Rust et al, 2005). The researcher's ontological assumptions and epistemic stance may be determined by the research area and more specifically the research questions.

The current study aims to address the following research questions:

Do participants' scores from measure 1 significantly improve after watching the Transporters DVD for four weeks in their educational context?

Can those children then generalize their increased performance of the recognition of emotions from the Transporters DVD to the recognition of human faces using the Mind Reading software (Baron- Cohen, 2004)?

An experimental methodology using a repeated measures method was employed in order to attempt to answer the above questions which reflects a positivist epistemological stance.

The following predictions were made:

1. It is expected that participants will score the same on Measures 1 (familiar close generalization) and 2 (unfamiliar close generalization) at Time 1 and 2 because at this time both measures will be unfamiliar to them.
2. After they have received the intervention, it is expected that participants will score higher on Measure 1 (familiar close generalization) than 2 (unfamiliar close generalization) at Time 3 because it will be easier for participants to recognise emotional expressions in the characters that they have been exposed to for the last four weeks.
3. It is also expected that participants will score lowest on Measure 3 (distant generalization) at all three times because human faces are less motivating and the

generalization of skills learnt from the Transporters to human faces will be more difficult.

4. It is expected that participants will score higher at Time 3 compared to Time 1 and Time 2 on all three measures.

3.2 Epistemological stance and assumptions

In the current study, the researcher has employed a positivist epistemic stance using an experimental methodology.

A researcher's ontological assumptions and epistemic stance typically reflect a much wider question, that of where knowledge comes from. If one believes that there is an objective reality that needs to be discovered then methods employed by positivists could be used to begin to discover this truth. However, if one believes that there is no such thing as an objective reality or truth but rather an interaction of individual constructions which are determined by the context which they are in then methods such as experimental designs would not help us to get any closer to the 'truth'.

Within the traditional scientific approach, the search for knowledge has progressed from deductive reasoning from authoritative figures which assumes that one can deduce a valid premise merely through the use of sequential and logical thinking to inductive reasoning which demands empirical evidence for verification (Cohen et al, 2007). Cohen et al (2007) argue that the use of deductive reasoning brought progression in science to a standstill and it was the introduction of inductive reasoning that formed the notion that knowledge is based on

experience and can be advanced through observation and experimentation. These assumptions are in line with the positivist approach which until a few decades ago, was the dominant account used in the social sciences (Phillips & Burbules, 2000).

Several assumptions therefore underlie a positivist approach. Firstly, positivists are deterministic in the sense that they believe all events have antecedents and circumstances, which are causally linked, and through the manipulation of controls and variables these links can be discovered. Secondly, methods from the natural sciences can be directly applied to social science, that is the use of experimentation and manipulation of variables can be used to discover causal relationships and bring us closer to the truth. Positivists are therefore likely to utilise methods such as surveys and experiments using statistical analysis to discover levels of significance. Natural science is therefore seen as the paradigm of human knowledge (Duncan, 1968).

Another assumption is that of empiricism. A theory or hypothesis should be confirmed or disconfirmed using evidence that is empirical which means that it is verifiable by observation, direct experience (Barratt, 1971) and strong data. The role of generality is also important for both the deductive and inductive methods of reasoning which are reflected throughout a positivist approach. Scientists aim to generalize their findings in a bid to reveal a deeper insight into the truth or objective reality. However, within the context of social science it is far more difficult to generalize one's findings and social scientists employing a positivist approach must exercise a degree of caution when generalizing their findings to particular populations.

3.3 Method and design

An experimental methodology was employed for the purposes of this study. The researcher felt that an experimental methodology was the most appropriate methodology to use in order to answer the research questions objectively. Objectivity in this sense refers to the idea that the assignment of raw materials to categories and the interpretation of data is free from the researchers own value system. The majority of research that informs practice within the field of educational psychology relies on findings from qualitative methods such as interviews, focus groups and observations. The data from this type of research are interpreted by the researcher and is therefore subject to their own value system and can not be ‘value free’. The researcher felt that in this case, an experimental methodology would lead to more ‘hard’ evidence about the use of the Transporters in schools. Of course, this research could also be complemented by the use of more qualitative methods such as interviews with teachers which may produce ‘softer’ data indicating how the teachers found the implementation of the Transporters within their own school settings.

Within this methodology, a true experimental design was used. A repeated measures method was used to assess the impact of the Transporters DVD intervention on the emotion recognition of children with ASC and who were also regarded as high functioning. A repeated measures method takes measurements of the same subject over time under different conditions. In this study, measures of emotion recognition were taken at Time 1, Time 2 and Time 3, each of which was 4 weeks apart. The participants received the Transporters intervention between Time 2 and 3 and did not receive any intervention between Time 1 and

Time 2. Performance was compared across all three times using an analysis of variance statistical test (see Figure 3 for a visual representation of the design).

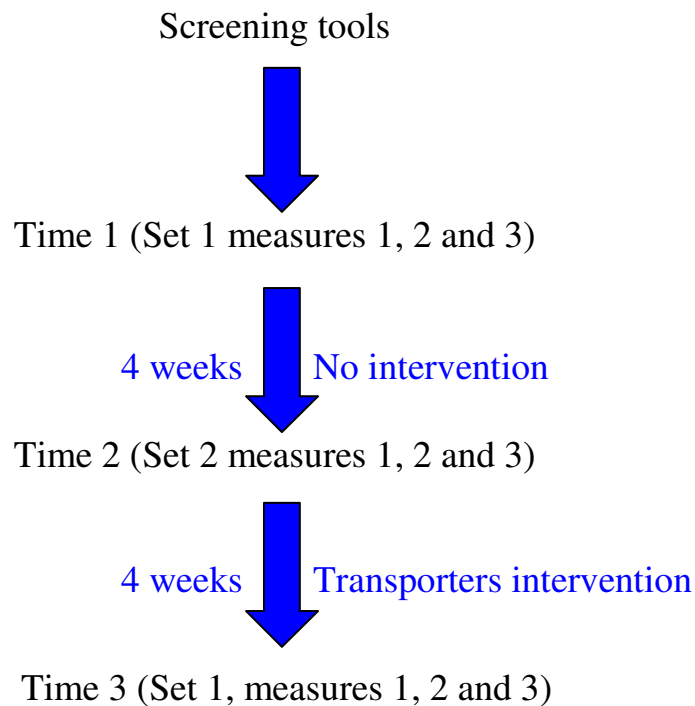


Figure 3. A visual representation of the design used in the current study.

This study is based on Golan et al's (2010) original study looking at the impact of the Transporters when delivered in the context of the home under parental supervision. Golan et al (2010) used a control group design whereby they compared the performance of an ASC intervention group with an ASC non-intervention group and typically developing peers. All of these groups were matched for age and verbal IQ. However, for the purposes of the current study, it was decided to use a repeated measures design for a number of reasons.

Firstly, using a repeated measures design controls for subject heterogeneity (individual differences). If a control group was used, they would need to be matched in terms of both verbal ability and age.

Individual differences between subjects within each group will be super-imposed over the treatment effects that may have been produced from the Transporters intervention and there is no way to tease apart these two sources of variation. This increase in error variance represents a direct decrease in economy and power and this provides a less powerful statistical outcome. In addition, repeated measure designs are more economical to run because less participants are needed as the same participants take part in each condition therefore reducing the amount of time spent collecting data. If a control group had been used and the intervention had proved to be successful then the researcher would be ethically obliged to offer the same 'treatment' to the control group as they would have also been identified as having similar needs. This is difficult because the intervention was delivered by teaching staff and so the researcher would have to rely on the good graces of those teachers to deliver the intervention in their classroom time to the control group. Using a repeated measures design avoids this ethical and potentially very time consuming dilemma. Furthermore, if the researcher had used a control group then they would have had to recruit that group from a different school due to the small class size in the special school that the data were collected from. This may have introduced a wide number of additional confounding variables, for example, the control group may have had an assembly on a particular emotion and therefore score higher at Time 3 resulting in a non significant difference between the groups, although this difference would not be due to the ineffectiveness of the Transporters but rather a confounding variable that had only had an impact on one of the groups.

The Transporters is a relatively new intervention and thus this study was an attempt to develop and refine the impact that it may have within a school context. For this reason and the many justifications above, it was decided that a repeated measures method would be more appropriate for the purposes of the current study.

3.3.1 Measures

A repeated measures method was used in this study. Each participant completed three measures (Measure 1, 2 and 3) at three times (Time 1, 2 and 3). Participants did not receive any intervention between Time 1 and Time 2. Participants received the Transporters intervention between Time 2 and Time 3. The measures used in this study were the same as those used in Golan et al's (2010) study and each consisted of 16 items. Each item included a photo depicting a scene with a short description. Below each photo, three silent video clips of the protagonist were played (one at a time). The protagonist was displaying a different emotional expression at each of these times and participants were asked to point to the face that best described how the character might be feeling in this scene (see Figure 4 and Figure 5). The term emotional valence is used to characterize and categorize specific emotions, usually referred to as either positive or negative. In every item, apart from the target face, there were two foils- one face of the same and one of the opposite emotional valence. For example if the target image was worried then it might be paired with the emotions disgusted (a negative emotion) and proud (a positive emotion) (see Figure 4 and Figure 5 for an example of the presentation of the target and foil items).

The three measures represented 3 levels of generalization:

1. Familiar close generalization: Participants had to match familiar situations taken from the Transporters series to facial expressions of familiar characters from the series.
2. Unfamiliar close generalization: Participants had to match novel situations with novel expressions from *The Transporters* characters. These expressions were not shown by these characters in the intervention series.
3. Distant generalization: Participants had to match novel situations with novel expressions using a selection of human non-*Transporters* faces taken from the Mind Reading software (Baron- Cohen et al, 2004).

Taken from: Golan et al, 2010.

4. Charlie is going to get the pieces for the new special clock.



Figure 4. Screen shot of the measure reflecting familiar close generalization.

6. The neighbour's dog has bitten people before. He is barking at Louise.



Figure 5. Screen shot of the measure reflecting distant generalization.

All of the facial expressions presented in the tasks were shown to a panel of 20 judges from the general population and only included in the final measure if at least 15 of the 20 confirmed the expression matched its emotional label (Golan et al, 2010).

Golan et al (2010) used a control group design with a pre and post test and therefore only needed two sets of measures of equal difficulty (set 1 and set 2). However, because this study utilised a repeated measures design, 3 sets of measures were needed. It was decided to use set 1 at Time 1, set 2 at Time 2 and set 1 again at Time 3 so there was an 8 week period between participants viewing the set 1 for the second time. Participants may have recalled set 1 which may have caused some systematic variation, that is, participants may have become bored or

better practiced at doing the task by Time 3 which may negatively impact on their performance. Participants were not given any feedback from the test items and so would not know if their answers were correct or incorrect. As a result, no learning effects would have occurred. One way to avoid the influence of systematic confounding variables such as practice effects is to randomise the presentation of the information or counterbalance the order. However, it was not possible to access set 2 of the measures at the time of the first assessment and so they could not be counterbalanced. As there was an 8 week period in-between the presentation of set 1 measures at Time 1 and Time 3, it was hoped that this lapse in time would override any practice effects.

3.3.2 Participants

Nine participants took part in the study; the mean age of participants was 7 years and 1 month. There were 8 boys and 1 girl who took part in the study. All of the participants attended a special school for children with ASC and all had a formal diagnosis of ASC. All of the participants were fluent in English (see Table 1 for further information about each participant). The participants that took part in this study were selected using a purposive sampling method.

Class teachers originally selected the children who they felt were the highest functioning in a class of fourteen. The teachers professional judgement and experience was used to determine which children they felt would be able to access the intervention. Each of these children then completed the British Picture Vocabulary test (BPVS II) (Dunn, Whetton & Burley, 1997). This was to ensure that participants were able to access the content of the DVD and that their scores were a reflection of their emotion recognition ability rather than any difficulties that

might have accessing the measures due to language barriers. All of the children who completed the BPVS II then went on to take part in the current study as they all scored with the criteria that was used in Golan et al's (2010) original study. National curriculum levels were also provided for each participant. In most cases the BPVS scores were consistent with national curriculum levels; however in some cases this was not apparent. However, it is important to consider that the children may be attending the special school for children with autism because of a range of other factors that may have affected their access to mainstream school in previous setting, e.g. behaviour, concentration, rigidity of thought. It may then be difficult to gain an accurate perception of a child's ability in assessments used to measure national curriculum levels. The researcher therefore took these levels into consideration but decided to use the BPVS scores in addition to information from teachers to determine the sample for this study. If the BPVS scores were within the same range as those used in Golan's study then it was felt that the participant's understanding of language would be developed enough to access the Transporters intervention.

There were no measures taken in the current study to assess participants ability to recognise emotions before the study, however scores from the first set of measures were almost identical to those that Golan et al(2010) reported and thus the researcher felt confident that the participant's emotion recognition skills would benefit from an intervention.

Participant number	Age (Years: months)	Gender	Ethnicity	Diagnosis	BPVS standardised score	NC level-Speaking	NC level-Listening	NC level-Reading
1	7:10	Male	White British	ASC	77	1	1	2c
2	7:8	Male	White British	Autistic Spectrum (Kanners)	82	1	1	2c
3	7:8	Male	White British	Autistic spectrum	85	1	1	2c
4	7:6	Male	White British	ASD	91	1	1	P8
5	7:2	Female	South Asian	Autism	95	1	1	1a
6	7:1	Male	White British	Autistic Spectrum	88	1	1	2c

				Disorder				
7	6:7	Male	South Asian	Autistic Spectrum Disorder	111	P4	P4	P4
8	6:6	Male	White British	Autistic Spectrum Disorder	80	P7	P7	P8
9	6:3	Male	White British	Autistic Spectrum Disorder	87	P5	P5	P7

Table 1. A summary of participant information (please note that the terminology used to describe each participant's diagnosis is that described by parents and not the researcher).

3.3.3 Procedure

Parents were initially given a questionnaire with a copy of the parental consent form which they were asked to complete if they gave parental consent to their child's participation in the overall study (see Appendix 3 for parental consent form). The pen portrait asked for more information about the participant's diagnosis of ASC, i.e. when was the child diagnosed? And what was the formal diagnosis? In addition, parents were asked if they could recall a time when their child had ever seen the Transporters before and if so how long ago. Information from the pen portraits suggested that 3 of the 9 participants had seen either a preview of the Transporters or an episode between 1 and 3 years ago. It was decided to include those participants in the study as they did not perform differently to the other participants on Measure 1 at Time 1 (familiar close generalization) and therefore it is unlikely that any learning had been retained from between 1 and 3 years ago. Moreover, when those participants were asked during the initial session if they had seen the Transporters before, they said no which indicates that they did not recall having seen it before.

During session one, participants were given information about the purpose of the researchers visit to see them and asked for their consent. The consent forms used more simplified language and visual images to ensure that each participant fully understood the purpose of the researcher's involvement and were giving informed consent (see section 3.4 for more details). Each participant was assessed individually for each of the sessions. Participants then completed the British Vocabulary Picture Scale II (BPVS II) (Dunn, Whetton & Burley, 1997). The BPVS II is designed to measure receptive vocabulary in children aged 3-16. The mean average BPVS score was 88.4 with scores ranging from 77-111. This is slightly lower

than the sample in Golan et al's (2010) study that scored a mean average score of 98.3 with scores ranging from 76-116. However the BPVS scores demonstrated that participants could access the Transporters DVD and additional measures. In addition, the teaching staff felt that the participants' national curriculum levels reflected high language and cognitive functioning.

During session two (Time 1) participants were asked to give their consent again using the child consent forms (see Appendix 4). The participants were asked to sit in front of a laptop which was positioned directly in front of them. All assessments took place one a one to one basis. Each participant was then given the following instruction:

I would like you to have a look at these clips for me. After you have watched each clip, I would like you to point to the face that you think matches how the character might be feeling?

Three practice items were administered first to ensure that the participants had understood the instructions and further clarification was given where needed. Feedback was given for the first three practice items (see Appendix 6 for details about the feedback given as part of the final script).

The emotion recognition tasks were then presented in level order (i.e. the easiest first) starting with Measure 1. For each of the 16 questions at each level, a still shot of the scene was presented, and a scenario description relating to the scene was read aloud to the participant. The 3 silent animated clips of a character showing different emotional expressions were then played one after another. The emotion recognition tasks were run using a powerpoint slide show and the answers were recorded manually using an assessment sheet specifically

designed for this purpose (see Appendix 5). Participants were given opportunities between each measure to have a break. At the end of this session, participants were praised for their efforts and told that the researcher would be returning in four weeks time (see Appendix 6 for a copy of the script used) to complete the second set of assessments. Golan et al (2010) used a four week intervention period and so it was decided to use the same time period between both Time 1 and Time 2 and then Time 2 and Time 3 in the current study.

Time 2 testing took place 4 weeks later (or as near to 4 weeks as possible). The experimental procedure was the same as that described in session 2. A different set of parallel form measures (1, 2 and 3) were administered at this time. At the end of this session, participants were told that they would be watching the Transporters with their class every day for the next four weeks and then the researcher would return to complete some more tasks with them.

The two classroom teachers then received a training session for approximately 30 minutes about the Transporters DVD and recording sheets (see Appendix 7 for an example of the recording sheets). They were asked where possible to use the resource booklet provided with the DVD to prompt class discussions about each episode of the Transporters. The teachers were asked to complete a data record sheet for each time that the class saw the Transporters detailing the time of the session, location, absentees, initials of the adult running the group, whether a group discussion had taken place and if so were all participants present (see appendix 14 for an overview of this information).

A four week intervention period then took place. During this time, the two class teachers were asked to show the DVD three times per day and where possible hold some discussion after.

The DVD was shown as part of a whole class activity and was facilitated by either of the two class teachers. The DVD was generally shown once in the morning and twice in the afternoon although this varied depending on which other lessons had to be delivered in the day. The DVD did replace elements of the timetable although again this varied and it was felt that the teachers could prioritise which lessons were replaced and when. Golan et al (2010) completed a correlation analysis to see if the number of times children watched the DVD per day enhanced their emotion recognition skills, they found that there was no correlation but recommended that children should watch the DVD a minimum of three times per day for the interventions to be successful. The children, where possible then watched the DVD three times per day in the current study. On reflection, it may have been useful to record the children watching the DVD to assess how engaged each of the participants were, the teachers reported that they felt the children responded well to the DVD and indeed looked forward to watching the Transporters three times per day. However, this is only anecdotal evidence and future research should consider how one might measure pupil engagement in the intervention.

The two teachers that facilitated the intervention felt that watching the DVD three times per day for a four week period was manageable, however they said that it would be unlikely that they would be able to fit this in for more than four weeks or to watch the DVD more than three times per day as they already felt that they had so many other things to fit into the curriculum on a daily basis. The researcher also felt that the teachers were incredibly flexible in accommodating this intervention within the current study and to ask staff to show the DVD more than three times per day or for more than a four week period may have compromised other areas of the curriculum. This has implications for the use of the Transporters within educational contexts on a long term basis and will be expanded upon further in this discussion.

Time 3 testing took place 4 weeks later (or as near to 4 weeks as possible). The experimental procedures were the same as that described in session 2 although the original set of measures used at Time 1 (measures 1, 2 and 3) were administered again. At the end of this session, participants were thanked for their time and efforts and told that I would contact them all about the results of my work. The researcher went into the school and provided a debrief presentation to staff (see Appendix 8) and a letter to participants and their parents (see Appendix 9). There was no informal feedback from parents or children although the teaching staff reported that on a long term basis they felt that they would not be able to fit the DVD in three times per day with other, what they deemed to be, more pressing aspects of the curriculum. In addition the teaching staff reported that they were not surprised that children found it difficult to generalize any learning that they may have gained from the Transporters to wider contexts such as understanding human emotions because this is something that the staff also struggle with on a day to day basis. Appendix 13 provides a detailed overview of the actions that took place as part of the research project, a timetable and an overview of the researchers' involvement at each stage of the project.

3.4 Ethical considerations

The Code of Ethics (British Psychological Society, 2009) and Birmingham University's Code of Practice for Research (University of Birmingham 2010-2011) were used as guidelines when addressing ethical issues within the context of the current research. An application of ethical review was also submitted to the Research Committee at Birmingham University who approved the application. The most prominent ethical considerations for the purposes of this research are outlined below.

3.4.1 Informed consent

The BPS Code of Ethics (2009) states that psychologists should:

‘Ensure that clients, particularly children and vulnerable adults, are given ample opportunity to understand the nature, purpose, and anticipated consequences of any professional services or research participation, so that they may give informed consent to the extent that their capabilities allow’ (BPS, 2009, p.12).

Informed consent was initially gained from the participants’ parents. A letter explaining the researcher’s role, background and purpose of involvement was sent to the parents of children identified as suitable for the research. A list of research criteria was attached to the letter, where after each criterion there were two boxes to tick which indicated that either the parent had understood or not understood what the criterion meant (see Appendix 3 for a copy of the parental consent form). The criterion referred to ethical issues and guidelines and included information about the following:

- Gaining children’s consent
- Right to withdraw from the research
- Right to withdraw information collected to date if participants do decide to withdraw from the research
- Storage of data
- Confidentiality and anonymity
- Information about the researcher
- Research audience

Informed consent was also gained from the participants using a child friendly consent form (see Appendix 4). This form included visual images and signs, differentiated language and large print to help participants understand the meaning of giving consent. The researcher read the consent form with the child and answered additional questions where necessary. The researcher revisited the consent form with each participant at the beginning of each assessment to ensure that they still wanted to take part in the research. The researcher also recorded that consent had been gained at the top of each data record that was completed at Time 1, 2 and 3.

3.4.2 Confidentiality and anonymity

Both the parental and child consent forms included information about confidentiality and anonymity. In addition, participant's details were recorded as a number rather than by their name on all data assessment sheets and were tracked using a numbered register across the assessment times. The name of the school or locality have not been mentioned in the write up of the study to further ensure anonymity.

3.4.3 Rights to withdraw

The BPS Code of Ethics (2009) states that psychologists should:

‘ Ensure from the first contact that clients are aware of their rights to withdraw at any time from the receipt of professional services or from research participation and... comply with requests by clients who are withdrawing from research participation that any data by which they might be personally identified, including recordings, be destroyed’. (BPS, 2009, p. 14).

Again, the parental and child consent forms detailed information about the parents/child's rights to withdraw from the research. They were informed that they could withdraw from the

research at any point without having to give a reason and that all data collected up to that point could be destroyed. Participants were also reminded of this at the beginning of each assessment.

3.4.4 Data protection

In alignment with the Data Protection Act (1998), the relevant data was stored in a locked cabinet with the Educational Psychology Service in which the researcher is employed.

The Code of Practice for Research details the following:

‘Unless already regulated by legislation or confidentiality agreements, or where there are valid ethical reasons for not doing so, primary research data and research evidence must be accessible in confidence to other authorised researchers for verification purposes for reasonable periods after completion of the research; data should normally be preserved and accessible for ten years’ (Birmingham University, 2010-2011, p.5).

The data will be securely stored for a period of ten years. The data will only be used for the specific purposes for which it was collected. The parental consent form detailed further information about data protection, data storage and confidentiality. Parents were also given a further opportunity to contact the researcher to ask questions or clarify information from the letters and consent forms they received.

3.4.5 Research audience

Parents were informed that anonymous findings from the study would be shared with parents, the school, individuals from the local authority and other members of the research community.

3.5 Piloting

A draft script (see Appendix 10) was designed for the purpose of the current study which was piloted alongside measures 1, 2 and 3 (Set 1). A letter was originally sent to parents (see Appendix 11) of children who were attending a special school for children with ASC. The school was based in a different area to the school where the current study took place. The letter explained the purpose of the pilot and included a check list of criteria based on guidelines for minimum standards of ethical approval in psychology research produced by the British Psychological Society (2009). Consent was gained from one set of parents. The participant was a male aged 6 years and he had a formal diagnosis of ASC. The researcher then gained consent from the child using a child friendly consent form (see Appendix 12), which also explained the purpose of the researcher's visit. After consent was gained, the researcher used the script to introduce the tasks which were completed by the participant. The pilot was used to assess a number of factors including the following:

- Did the participant demonstrate an understanding of the nature of the researcher's visit?
- Was the consent form used appropriate?
- Did the child demonstrate that he understood the consent form i.e. rights to withdraw?
- How appropriate was the language used in the script?
- Did the participant understand the nature of the practice items?
- Was the use of praise words appropriate?
- Did the script fully explain the nature of the task?
- Was the script too long or too short?

- Did the software for measures 1, 2 and 3 (set 1) work correctly?
- How long did the task take?
- Did the participant appear to be bored, tired or confused at any point?
- How difficult did he find the task?
- Was the scoring sheet appropriate and easy to complete during the assessment?

The pilot demonstrated that the script did need some amendments. The participant in the pilot was unable to answer the question ‘how is xxx feeling?’ when he was completing Measure 1 (familiar close generalization) because he did not know who the characters were. In some of the clips, there were two characters on the screen and so this could be confusing for the participant. The researcher felt that it would be useful to introduce the Transporters characters when the participants first saw the Transporters clip and point to the character in the clip that the question referred to. Introducing the Transporters characters and having a discussion about the Transporters before the assessments began also enabled the researcher to build a rapport with the participants and ease any anxieties that they may have felt.

The pilot research also demonstrated that the participant needed some feedback during the practice items to ensure that he had fully understood the task. It was also important to ensure that any feedback given was consistent and given to all participants. The researchers then added feedback for the practice items in the final script (see Appendix 6 for a final copy of the script used in the current study).

3.6 Data analysis

A repeated measures analysis of variance (ANOVA) statistical test was initially conducted on the data. Follow up paired t-tests were then conducted.

3.6.1 The sphericity assumption

In between-group ANOVA, the accuracy of the F-test depends on the assumption that scores in different conditions are independent. When repeated measure designs are employed, this assumption is violated, scores under different conditions may be related because they are being carried out by the same participants. An assumption of using an ANOVA between groups is therefore that the variance across conditions will be the same and that no two conditions are any more dependant than the other two. This is known as the assumption of sphericity. Sphericity refers to the equality of variances of the differences between treatment levels (Fields, 2005).

Mauchly's test assesses the hypothesis that the variances of the differences between conditions are equal. If Mauchly's test has a probability value of less than 0.05, then one can conclude that there are significant differences between the variances of differences and the condition of sphericity is not met. If the assumption of sphericity is violated then the F value is less powerful. If Mauchly's test statistic produces a probability value of more than 0.05 then it is reasonable to conclude that the variances of differences are not significant.

Mauchly's test of sphericity for the current data produced non significant results.

Time- Mauchly's test indicated that the assumption of sphericity had not been violated ($X^2 2$)
= 4.37, $p > .05$.

Measures- Mauchly's test indicated that the assumption of sphericity had not been violated
($X^2 2$) = .571, $p > .05$.

Any differences between the test conditions would therefore be a result of extraneous factors
rather than a result of existing significant variance across the data.

CHAPTER 4- RESULTS

4.1 Descriptive statistics

The groups' mean scores and standard deviations (SD) on the different tasks at Time 1, 2 and 3 are shown in Table 3.

	Time 1	Time 2	Time 3
Measure 1 (familiar close generalization)- Mean scores	8.6 (max- 16) 54%	9.8 (max- 14) 70%	16.6 (max-16) 85%
Measure 1 - SD	13.62	18.37	9.37
Measure 2 (unfamiliar close generalization)- Mean scores	11.4 (max-16) 71%	7.4 (max-13) 57%	10.7 (max-16) 67%
Measure 2 - SD	16.67	14.45	15.5
Measure 3 (distant generalization)- Mean scores	10 (max-16) 62.5%	9.3 (max-16) 58%	10 (max-16) 62.5%
Measure 3- SD	11.27	17.12	17.68

Table 3. Mean scores and standard deviations of the group on all tasks at Time 1, 2 and 3.

The groups' mean scores are also represented visually in Figure 5

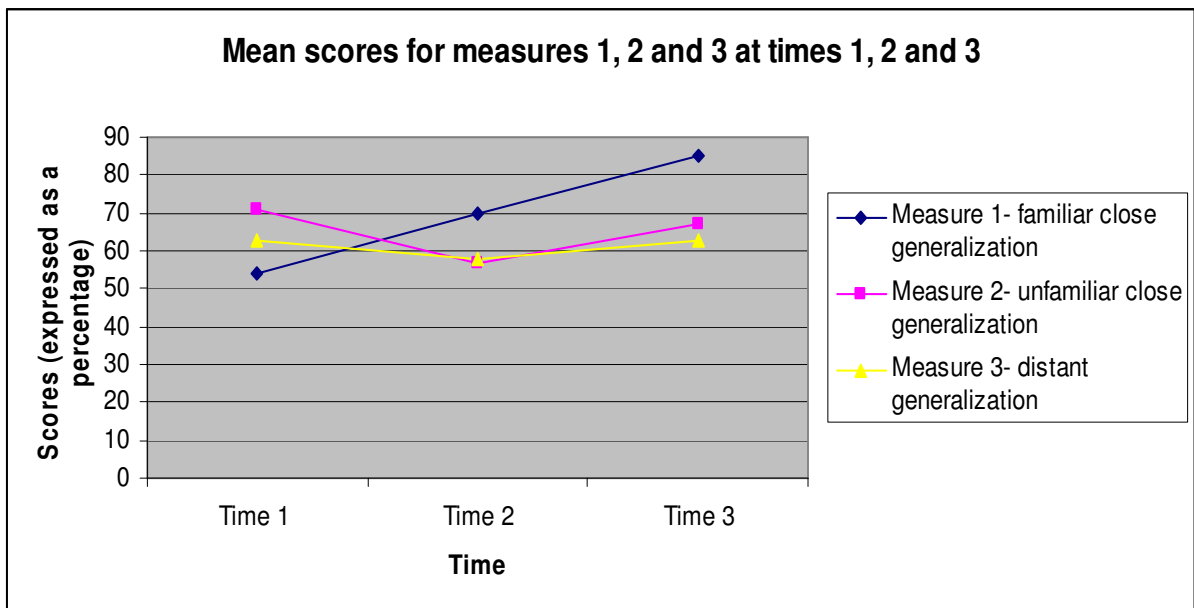


Figure 6. Estimated marginal means

There were no outliers within the data and it was felt that it was beyond the scope of the aims of this particular research project to investigate how each participant responded to each emotion.

Figure 5 and Table 1 indicate a trend within the data. Scores for Measure 1 increased from a mean of 54.2 (%) to 70.6 (%) to 85.4 (%) from Time 1 to 2 and Time 2 to 3, respectively.

Whilst there was a drop in scores for Measure 2 at Time 2 there does not appear to be an increase in scores between Time 1 and Time 3.

There does not appear to be an increase in scores for Measure 3 between times 1, 2

and 3. These trends may suggest that if any learning did occur from watching the Transporters, it was not generalized to novel situations and human faces.

4.2 ANOVA

After checking that the assumption of sphericity had not been violated, a factorial repeated measures ANOVA was conducted.

The results show that there was a significant effect of time $F, (2, 6.282) = 0.010, p < .05$.

There was no significant effect of measure $F, (2, 3.186) = 0.68, p > 0.05$.

There was a significant interaction between time and measure $F, (4, 6.876) = .000, p < .05$.

The ANOVA demonstrated a significant effect of time and a significant interaction between time and measure although the ANOVA does not detect where the significant differences lie. From looking at the means and patterns within the data, one can see that the interaction between time and measure appears to be between Measure 1 (familiar generalization) at times 1, 2 and 3. In addition, the significant effect of time also appears to be due to increases in Measure 1 at all three times and therefore it is the interaction which is of relevance. Follow up paired T-tests were therefore conducted to detect the specific differences between the measures and time.

4.3 Follow up paired T-tests

Follow up paired T-tests demonstrated the following:

There was a significant difference for Measure 1 (familiar close generalization) between Time 1 and Time 2, ($t(8) = -2.425, p < 0.05$).

There was no significant difference for Measure 1 (familiar close generalization) between Time 2 and Time 3, ($t(8) = -2.088, p > 0.05$).

There was no significant difference for Measure 2 (unfamiliar close generalization) between Time 1 and Time 2, ($t(8) = \text{the value of T statistic}, p \not< 0.05$).

There was no significant difference for Measure 2 (unfamiliar close generalization) between Time 2 and Time 3, ($t(8) = \text{the value of T statistic}, p \not< 0.05$).

There was no significant difference for Measure 3 (distant generalization) between Time 1 and Time 2, ($t(8) = \text{the value of T statistic}, p \not< 0.05$).

There was no significant difference for Measure 3 (distant generalization) between Time 2 and Time 3, ($t(8) = \text{the value of T statistic}, p \not< 0.05$).

4.4 Summary of results

These results demonstrate that there was a significant difference between the group's performance on Measure 1 (familiar close generalisation) between Time 1 and Time 2. Whilst there was also a positive difference between participants' performance on Measure 1 at Time 2 and Time 3 this was not significant. There were no significant differences for Measure 2 or Measure 3 from Time 1 to 2 and Time 2 to 3. This suggests that where learning did occur, only performance on Measure 1 was enhanced, although this enhanced performance happened between Time 1 and Time 2 when the Transporters intervention was not taking place.

CHAPTER 5- DISCUSSION

This study aimed to evaluate the impact of the Transporters DVD on the emotion recognition of children with HFA. The study investigated the effectiveness of watching the Transporters three times per day in the context of a classroom over a four week period. The results demonstrated that the Transporters intervention did not enhance participant's emotion comprehension and recognition skills for the 15 key emotions presented in the Transporters. The results demonstrated that there was no significant difference between Time 2 and Time 3 (when the intervention occurred) for measures of familiar situations from the Transporters (Measure 1), novel situations also using the Transporters characters (Measure 2) and human faces (Measure 3). This would suggest that if any learning had occurred, participants were unable to generalize their skills to novel situations and human faces.

5.1 Research questions

The initial research questions that were asked in the current study are as follows:

1. Do participants' scores from measure 1 significantly improve after watching the Transporters DVD for four weeks in their educational context?
2. Can those children then generalize their increased performance of the recognition of emotions from the Transporters DVD to the recognition of human faces using the Mind Reading software (Baron- Cohen, 2004)?

With regard to research question one, the results from the current study suggest that the emotion recognition of children with HFA did not significantly increase after watching the Transporters DVD for four weeks in their educational context. The results show an increase in participant's scores for Measure 1 (familiar generalization), i.e. images from the DVD that they had been watching for four weeks previously. However, the results show an increase in this measure between both Time 1 and 2 (no intervention) and between Time 2 and 3 (Transporters intervention). It is therefore difficult to conclude that this increase in performance was due to the Transporters intervention as a significant increase was found between Time 1 and Time 2 when the children were not watching the Transporters.

With regard to research question two, there may have been some learning between Time 2 and Time 3 for Measure 1 (familiar close generalization) although as stated previously we can not conclude with any confidence that this was due to the Transporters. However the mean scores for Measure 1 were 54%, 70% and 85% at Time 1, 2 and 3, respectively. There was therefore a directional positive increase between Time 2 and Time 3 which suggests that participants' performance had increased although not to a level of significance. The mean scores for Measure 2 (unfamiliar close generalization) were 71%, 57% and 67% at Time 1, 2 and 3, respectively. These scores demonstrate that participants' performance had increased by 10% from Time 2 to Time 3. The mean scores for Measure 3 (distant generalization) were 62.5%, 58% and 62.5% at Time 1, 2 and 3, respectively. The scores for Measure 3 have therefore slightly increased (by 4.5%) between Time 2 and Time 3. These scores suggest that if any learning did occur as a result of the Transporters between Time 2 and Time 3, then this learning was not generalized to measures 2 and 3 which suggests that children with HFA can not generalize their learning to non-familiar and human faces. This is of course, if any

learning did occur as a result of the Transporters although results from Measure 1 would suggest that this learning could not be attributed to the Transporters.

Assuming that these findings are correct then there are a number of implications following this research. One of the main implications of this research is based on the idea of generalization. Golan et al (2010) found that their participants' comprehension and recognition of emotions significantly improved after watching the Transporters DVD every week day for four weeks in the context of their homes with the supervision of adults. Whilst this study demonstrates the effectiveness of the Transporters in the context of the home, there has been no further research to suggest that the same results would occur if the Transporters were to be used in the context of a school and thus Golan et al's (2010) results may not be generalized to other settings. The results from this study suggest that further research needs to be conducted within educational contexts in order to explore whether the use of the Transporters in educational settings is an evidence based and effective intervention.

5.2 Empathizing- systemizing theory

The Transporters was developed as a result of Baron-Cohen's (2002) theory that individuals with autism are particularly good at systemizing. Systemizing is described as a drive to analyse the variables in a system, to understand the underlying rules that govern the 'behaviour' of that system and to construct new systems that allow you to predict and control what will happen next within that system. A system is described as anything that takes input and delivers output, when you systemize you often use if- then type rules (Baron- Cohen, 2002). In a later paper, Baron- Cohen (2006) goes on to argue that we all possess a

systemizing mechanism (SM) and individuals with ASC have their SM set at a higher level than typical developing individuals which means that they are likely to be more attracted to systems, structures, rules and patterns and are less likely to tolerate change that falls outside of the 'system's rules' such as human behaviour.

Based on the idea that individuals with ASC are good at tasks that require a high level of systemizing, Golan and Baron-Cohen (2006) theorise that it is possible that individuals with HFA may be able to use their enhanced systemizing skills to compensate for their empathizing difficulties (Baron-Cohen, 2002; Golan & Baron-Cohen, 2006).

There is a wealth of research (Baron-Cohen & Bolten, 1993; Jolliffe & Baron-Cohen, 1997; Baron-Cohen, 2002) to support the idea that individuals with ASC demonstrate enhanced skills in systemizing, however the current study suggests that either the participants are not able to use their strengths in this area to develop emotion recognition or the Transporters is not a systematic representation of emotion recognition that children with ASC can respond to. Golan et al (2010) found that their participants' ability to recognise emotion did increase after watching the Transporters which suggests that they were able to use their strengths in systemizing to support their emotion recognition development. However, as previously stated these participants were exposed to the DVD between approximately 4 and 25 times more than the participants in the current study. Perhaps then, individuals need a high amount of exposure to the 'system' before they can generalize this 'system of emotions' into other contexts.

5.3 Weak Central Coherence theory

An alternative theory to Baron Cohen's (2002) systemizing theory is the weak central coherence theory. It is possible that the participants in the current study did not show enhanced performance on the tests of emotion recognition because they had difficulty processing the features of the Transporters faces and were therefore unable to recognise if a particular character was happy or sad because they may have only been focusing on one part of his or her face. This is in line with the weak central coherence theory which suggests that autism is characterised by a specific imbalance of the integration of information at different levels (Frith, 1989). In typically developing children, there is often a tendency to draw together diverse information to construct higher-level meaning in context and therefore gain a 'central coherence' (Frith, 1989) whereas individuals with ASC demonstrate an unusual bias towards piecemeal rather than configurational processing and a reduction in the normal tendency to process information in context. Frith (1989) therefore argues that individuals with ASC would be relatively good at tasks where attention to local information is necessary and poor at tasks that require the recognition of global meaning which would include the recognition of facial expressions. Findings from neuropsychology (Schultz et al (2000; Klin et al, 2002) would also support the idea that children with autism have difficulty processing the whole of the face and tend to pay attention to the mouth area.

Perhaps then, interventions aiming to enhance emotion recognition in individuals with ASC should focus on how to explicitly teach those individuals to process the whole face rather than specifically focus on elements such as the mouth. Further developments from neuroscience may then support the design of such intervention programmes. The Transporters could then be

used alongside such an intervention to help children understand the surrounding context of understanding and responding appropriately to emotions in others.

5.4 Research design

It is possible of course that the Transporters DVD does lead to enhanced emotion recognition skills for children who are autistic and high functioning when viewed within the context of a classroom and that potential flaws within the research design could account for the results. The current study was based on the work of Golan et al (2010). Although this was not an exact replication of their design, perhaps the differences between the research designs led to different results.

5.5 Sample selection and sample size

Although this research sought to replicate Golan et al's (2010) study there were some differences in its implementation which may have affected the results. One such difference was the composition of the sample used in the research. Golan et al (2010) selected their sample through placing an advert in the National Autistic Society magazine, *Communication* and via the Cambridge Autism Research Centre website. Parents who were interested in this research were perhaps more likely to respond to the advert and be more motivated to ensure that the intervention was carried out correctly. The parents in this study may have been more likely to create opportunities to discuss the emotions seen in the Transporters and therefore promote the generalization of these skills. Participants in this study also watched the DVD in the comfort of their own home without distractions and could watch the DVD as many times

as they liked. In the current study, a local special school for children with autism was selected for the research. Within this school a number of children were selected for the study based on their age, cognitive and verbal ability. Whilst the teachers were interested and supportive of the intervention, they were perhaps not as motivated as parents who had responded to the advert in Golan et al's (2010) original study. There are also a number of practical considerations to consider when implementing the Transporters within the context of a classroom. The teaching staff felt that they could show the DVD three times a day but that would be the maximum amount of time that they could take out of their already busy schedules and this could only be sustained for the four week intervention period.

Furthermore, only nine participants took part in the current study. Perhaps this study should be replicated with more participants before firm conclusions about the use of the Transporters in the context of a special school could be drawn.

One of the key differences between the sample used in Golan et al's (2010) study and the current study is that the participants from Golan's research all attended a mainstream school whereas the participants in the current study attended a special school. Children with ASC who attend a special school usually do so because they have been unsuccessful in a mainstream school or their autistic characteristics have been deemed as 'too severe' to function sufficiently in a mainstream school. In addition, parents may have chosen for their child to attend a special school. There could potentially be a range of differences between the two samples that have led to two contrasting results. Such differences may include behavioural, attitudinal or motivational factors or the 'severity' of autism.

5.6 Exposure

Whilst the current study sought to replicate the work of Golan et al (2010) within the context of a school setting, there were some key differences in the exposure to the Transporters between the groups of participants. Different levels of exposure may have affected the results. In Golan et al's (2010) study, the minimum number of episodes the children were requested to watch was 3 per day every weekday i.e, 15 episodes per week. However, because of the appeal of the DVD and obsessive nature of children with ASC, many watched more than this (49-382 episodes in one week). Correlation analysis conducted between task improvement scores and the total number of episodes watched showed no significant result which suggests that individuals' performance did not improve the more they watched the DVD. It was also apparent that there was wide variation in the amount of parental involvement in helping the child to learn during the intervention period. The minimum number of times participants were exposed to the Transporters in one week was therefore 49 with a number of opportunities to discuss with parents throughout the intervention period. Research has demonstrated that emotion understanding during our early years of life is associated with how often parents discuss feelings with their children and the richness of their conversation prompts (Dunn, 2002). Thompson (2006) argues that the construction of understanding by the inductive young mind is profoundly aided by the conversation prompts of a mature partner. It therefore seems rational to assume that children will be better at recognising and discussing emotions when they have had opportunities to discuss their learning with their parents across a variety of contexts about a range of topics and scenarios.

In the current study, the teachers were asked to show the DVD 3 times per day for a total of 4 weeks which is a total of a possible 60 times. During the period of the intervention, participants in this study saw the DVD a total of 50 times as sometimes it was difficult to fit in all three sessions during one day and the teachers also had a teacher training day. Unfortunately there were even less opportunities to have discussions about the content of the Transporters after the viewings and out of the 60 possible sessions, a discussion about the content happened 22 times.

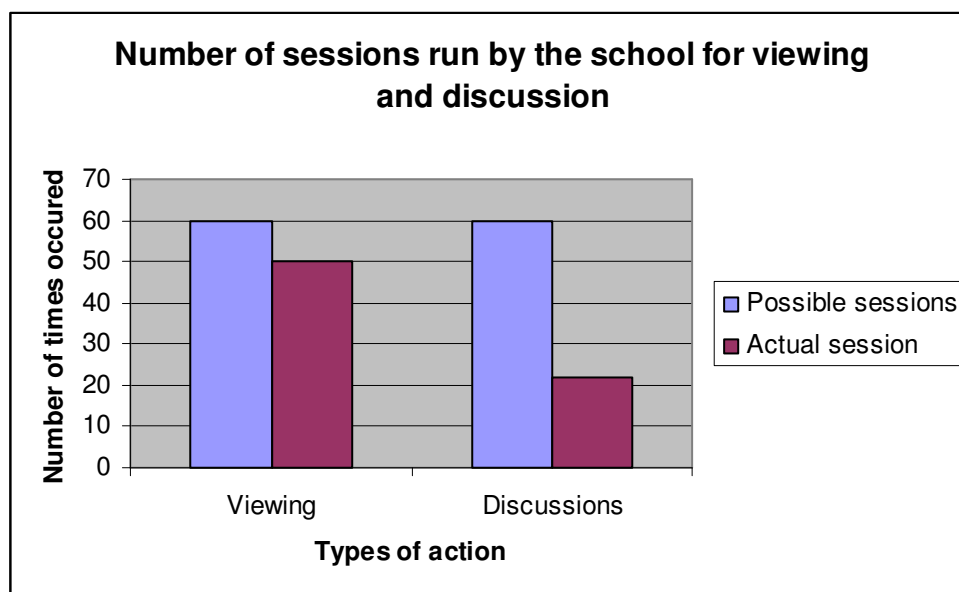


Figure 7. A visual representation the possible and actual viewings and discussions held as part of the study.

The literature review introduced Golan and Baron-Cohen's (2006) study which evaluated the impact of the MindReading software as a programme that aimed to enhance emotion recognition in adults with HFA or AS. They found that using the MindReading software for a relatively short period of time allows users to learn to recognise a variety of complex emotions and mental states although participants were unable to generalize these skills to everyday interactions. Golan and Baron- Cohen (2006) suggested that their participants may

have rote learnt the correct responses from the MindReading software and could therefore perform well on measures including images that they were familiar with but had difficulty generalizing this to more novel situations. Golan and Baron- Cohen (2006) also found that software usage time was correlated with the task scores for distant generalization (novel images) suggesting that the more participants used the software, the higher they scored on the distant generalization task. They conclude by saying that it is possible that a longer period of usage would have led to improved performance amongst software users.

Perhaps then, if the participants in the current study had more exposure to the Transporters intervention, they would be better able to 'rote' learn the answers to images that they were familiar with (Measure 1) and then generalize this learning to novel Transporters images (Measure 2) and perhaps then human faces (Measure 3). Future research into the use of the Transporters could manipulate the amount of exposure each group might receive in order to determine the minimum amount of exposure needed for children to consolidate their learning. Of course, this consolidation of learning may also be supported by other variables such as discussions with adults, peers, games and seeing the Transporters in a range of contexts. In addition, individual learning styles will also determine how many times a child may need to watch the Transporters before they are able to consolidate and generalize their learning.

5.7 Discussion and generalization

The minimum number of times participants viewed the Transporters in Golan et al's (2010) study was 49 per week whereas the participants in the current study viewed the DVD a total of 50 times in four weeks, an average of 12.5 times per week. The quantity, regularity and

nature of the episodes watched by participants in the two studies therefore differed significantly. Perhaps then participants in the current study needed more exposure to the Transporters with more opportunities for discussion to support the consolidation and generalization of learning.

This has implications within the context of a school as actually the teachers reported that they simply did not have time to fit in discussions about each episode of the Transporters with the class with the existing demands of the curriculum. Furthermore, where discussions within the context of the home could happen on a one to one basis at a time where the child perhaps demonstrated an interest or a desire to have a discussion about the Transporters, within the context of a school these discussions happen at a whole class level at specific points in the day. During these times not all children will be motivated to participate in the discussion and may not be paying attention and listening to what is being said. The participants in the current study may have been exposed to a discussion 22 times out of a possible 60 but it is not known if they actually contributed to this discussion or even listened to what was said. Opportunities to generalize one's learning may therefore be restricted within this context. If further research supported the use of the Transporters in schools, practitioners would need to carefully consider the ways in which they would promote the generalization of these skills.

The participants in Golan et al's (2010) study all attended a mainstream school whereas all of the participants in the current study attended a special school. This may also impact the number of opportunities that children in the current study have to generalize their learning. If a child with ASC in a mainstream school correctly identified and responded to another's emotion within a social context then they may receive some form of positive reinforcement

e.g. response from a peer who did not have difficulty with the recognition of emotions in others. This positive response may then reinforce such behaviours and support the generalization of emotion recognition skills learnt from watching the Transporters at home. In addition, discussions with adults in the home will also support the generalization of these skills and adults may well have anticipated and prepared their child for such an event. However, in the context of a special school, where a child does recognise and responds appropriately to the emotions of others, they may not receive the same positive reinforcement because the other children they are interacting with also have difficulties recognising emotions in others. So unless these behaviours are reinforced by adults which would be dependent on adults observing these incidental behaviours, then positive reinforcement may be less likely to occur thus further reducing opportunities to generalize the emotion recognition skills learnt from the Transporters.

5.8 Measures and practice effects

One of the disadvantages of using a repeated measures design is that participants may experience some practice effects, e.g. boredom, tiredness etc. Whilst different measures were used that were deemed to be of equal difficulty, the images looked very similar and participants may have thought that they were completing the same assessments at all three times. This may have created some practice effects as they may have felt bored or complacent and therefore just pointed to any picture rather than the correct picture, which would impact on their total scores and the likelihood of significant difference between scores at Time 1, 2 and 3.

Furthermore, the two sets of measures that were used in this study were the same measures that were used in Golan et al's (2010) study and so it was assumed that these two sets were parallel forms. However, it is possible that participants found one set easier than the other which would also impact on the likelihood of a significant difference. For example, if participants found set 2 (used at Time 2) easier then their scores would be higher than their scores for set 1 (used at Time 1 and Time 3) and so their scores at Time 1 and 3 would be lower. The difference between their scores at Time 2 and Time 3 would therefore be lower than if they had also scored highly on the set 1 measures at Time 3 therefore reducing the likelihood of detecting a significant difference. If this was the case then regardless of any intervention that participants received between Time 2 and Time 3 their scores at Time 3 would still be lower if the measures were actually more difficult, therefore a non significant result would not be a reflection of the effectiveness of the Transporters DVD but of the measures used to measure emotion recognition.

It is also possible that the measures were not sensitive enough to measure any change in emotion recognition and therefore a non significant result is not a reflection of the ineffectiveness of the Transporters, but rather that the measures did not detect the changes.

5.9 Confounding variables

It is also possible that there were other interventions aiming to enhance emotional literacy happening across the school that may have enhanced participants' performance in addition to the Transporters. The results demonstrated a significant difference between Time 1 and Time 2 for Measure 1 (familiar close generalization). However, the participants did not receive the

intervention during this time and so there must have been another confounding variable that impacted on the results at Time 2. Further research could look at how the use of the Transporters might interact with other programmes aiming to enhance emotional literacy and emotion recognition. Such programmes may include Promoting Alternative Thinking Strategies (PATHS) and Social and Emotional Aspects of Learning (SEAL) which tend to focus on skills such as labelling emotions, reducing aggression and promoting social skills. For example, the aims of the PATHS programme are as follows:

- Enhance self-control
- Enhance self-esteem and self-confidence
- Improve communication about emotions/feelings
- Develop children's thinking about their feelings
- Improve understanding of how one's behaviour affects others
- Enhance motivation and creativity
- Improve logical reasoning
- Improve problem solving skills
- Involve parents (Kusche and Greenberg, 1994)

The aim of the Transporters DVD is to use a systematic approach to explicitly teach children with autism how to recognise faces that convey particular emotions. As the aims of these two programmes are quite different, it is possible that the use of an emotional literacy programme such as PATHS would compliment the use of the Transporters in schools. The school in the current study were piloting the use of PATHS in the same class that the Transporters DVD was being shown in with a view to extend this to the whole school. They had been using

PATHS from January 2009. The Transporters DVD was shown in May 2009. Further research in this area could explore the interactions between the uses of such programmes in addition to the Transporters used in schools.

5.10 Strengths and limitations of the current research

One of the key strengths of the current research is that the study employed a quantitative objective method as oppose to a qualitative subjective method. The use of an experimental design minimised the influence of the researcher's own values influencing results.

A further strength of this research is the use of ecological validity. The current study aimed to assess the effectiveness of the Transporters in a real world setting where the participants were assessed in school and watched the Transporters DVD within the context of their classroom. The results demonstrated that there was no significant effect of using the Transporters within the context of a special school. The Transporters is currently used in a number of schools across the city, however this research would demonstrate that within the context of a special school the Transporters is not effective.

The research also used a repeated measures design which included a period where no intervention took place. This method allowed the researcher to identify if any changes in emotion recognition were as a result of the Transporters or other confounding variables. Most studies within the field of educational psychology use pre and post test designs which do not allow the researcher to identify if any other confounding variables impacted upon the

outcomes of the intervention and so the method used in the current study is more rigorous than other quantitative research in the same field.

One limitation of the research relates to the sample that was used in the current study. The sample was an opportunity sample which consisted of eight boys and one girl, a ratio which is not representative of the general population (Rutter, 1978). All of the participants had a diagnosis of autism or AS and were all classed as high functioning as determined by parents, class teachers and the screening tools used during the initial stages of the research. All of the participants attended a special school for children with autism although some of them had previously attended a mainstream school. True positivists might argue that findings from quantitative research can only be generalized when a random or stratified sample has been used. The participants in this study are not representative of the general population of children with autism and so the findings from this research can not be generalized to all children who have a diagnosis of ASC.

On reflection, it may have been possible to add further screening assessments to enhance the rigidity of the entry criteria for the current study. BPVS scores were used to determine if the children could access the language used in the DVD. National curriculum levels and reports from teachers were also used to determine if the children were high functioning and therefore able to access the intervention. However there were no measures to determine the children's current level of emotion recognition and this could be an area for development in future studies. A simple check list of emotions or the use of animated pictures/bear cards could be used to address children's understanding of basic and complex emotions and this could be used as an additional baseline for the intervention. However, it is reassuring to know that the

mean scores at Time 1 for all of the measures were very similar to the results obtained from Golan et al (2010) for the ASC group at Time 1 which suggests that the children used in both of the studies were at similar levels in terms of their emotion recognition skills.

A further limitation of the current study is the lack of control over confounding variables, for example, the use of the emotional literacy programmes, PATHS. This highlights a general difficulty when using experimental designs in real life settings; the researcher is not always able to control for confounding variables that may impact the overall findings of the research.

5.11 Future research

There are number of potential areas of research using the Transporters DVD that could be explored in the future, some of which have been referred to previously. A replication of the current study with a larger sample size across both mainstream and special schools would be interesting. In addition, further research could explore the relationship between emotion recognition and the amount of exposure to the Transporters in the context of a range of settings. Future research could also look at the impact of the Transporters used in addition to other interventions aiming to enhance emotion recognition.

It would also be interesting to explore the children's views of the use of the Transporters in schools; how did they find the process? Did they enjoy watching the Transporters? How do they think this might have helped them in class? There are several methods that could be used to gain children's views including a short questionnaire, a brief discussion with the researcher or class teacher, a focus group with the researcher or a whole class discussion.

If this project were replicated, it would be useful to record the children watching the DVD in the context of the classroom perhaps using a video recorder with permission from parents. This would give a better indication of how the Transporters was received within the context of the classroom and could be used to explore confounding variables. In addition, researchers could then try to replicate the same classroom situation if they had a model of how this intervention was delivered.

5.11.1 Implications for Educational Psychologists

This study has highlighted the potential difficulties with generalizing the findings from one study of an intervention used in a specific setting to promoting the use of such interventions within educational contexts. The Code of Ethic and Conduct (2009) produced by the BPS suggests that interventions used by Educational Psychologists (EPs) should have a sound evidence base. The findings from this research would suggest that the use of the Transporters in schools when delivered three times per day over a four week period as part of a whole class intervention does not enhance emotion recognition for children with ASC who are also high functioning. EPs should therefore be cautious about recommending the use of the Transporters to be used in the context of schools until further research has been conducted and can demonstrate that the findings from Golan et al (2010) can indeed be replicated across a range of settings.

As mentioned in section 5.10, one of the key strengths of the current research is the use a quantitative objective method. Much of the research published in popular educational psychology journals tends to employ a qualitative method and therefore the question of how

subjective the findings are is a key question for EPs to ask when generalizing the findings from such research to school settings. Perhaps the findings from this research may encourage other EPs to consider the use of more ‘scientific’ quantitative methods within the context of social settings.

A particular strength of this research is the use of ecological validity. The assessments and the intervention was carried out in a real life setting whereas Golan et al (2010) assessed their participants in a clinical setting and asked parents to supervise the use of the Transporters within the context of the home. The two studies produced different results and this may be due to the context in which the research was undertaken. The current research highlights that EPs are in an ideal position to carry out research in real life settings and should be encouraged to carry out this research to further enhance our existing knowledge and evidence base around the use of specific interventions such as the Transporters.

5.11.2 Summary and conclusions

The current study demonstrated that there was no significant improvement in the emotion recognition skills of children with HFA who watched the Transporters DVD within their educational context for a period of four weeks. The current study was a replication of Golan et al’s (2010) study which demonstrated a significant impact of the use of the Transporters in the context of the home under the supervision of parents. There are a number of methodological considerations that may have impacted upon the results in the current study, however it may also be the case that there are key differences between the use of the Transporters within the

context of the home under the supervision of parents and the use of the Transporters in an educational setting.

The current findings could be supported by the weak central coherence theory which suggests that individuals with autism have difficulty integrating information across different brain regions and therefore find processing whole faces and therefore emotion recognition particularly difficult.

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5.12 APPENDICES

Appendix 1: Classification criteria for autism

Appendix 2: Classification criteria for aspergers

Appendix 3: Parental consent form

Appendix 4: Child consent form

Appendix 5: Assessment sheet

Appendix 6: Final script

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Appendix 8: Presentation to school staff

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Appendix 13: Timeline and overview of key actions

Appendix 14: An overview of the information gathered from the data record sheets completed by teaching staff.

Appendix 1: Classification criteria for autism (DSM IV, 1994)

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) qualitative impairment in social interaction, as manifested by at least two of the following:

(a) marked impairment in the use of multiple non-verbal behaviours, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction

(b) failure to develop peer relationships appropriate to developmental level

(c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)

(d) lack of social or emotional reciprocity

(2) qualitative impairments in communication, as manifested by at least one of the following:

(a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)

(b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others

(c) stereotyped and repetitive use of language or idiosyncratic language

(d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(3) restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities as manifested by at least one of the following:

(a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

(b) apparently inflexible adherence to specific, nonfunctional routines or rituals

(c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole-body movements)

(d) persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

Appendix 2: Classification criteria for aspergers (DSM IV, 1994)

A. Qualitative impairment in social interaction, as manifested by at least two of the following:

- (1) marked impairment in the use of multiple non-verbal behaviours, such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
- (2) failure to develop peer relationships appropriate to developmental level
- (3) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
- (4) lack of social or emotional reciprocity

B. Restricted, repetitive, and stereotyped patterns of behaviour, interests, and activities, as manifested by at least one of the following:

- (1) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
- (2) apparently inflexible adherence to specific, non-functional routines or rituals
- (3) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
- (4) persistent preoccupation with parts of objects

C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.

D. There is no clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years).

E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behaviour (other than in social interaction), and curiosity about the environment in childhood.

F. Criteria are not met for another specific pervasive developmental disorder or schizophrenia.

Appendix 3: Letter to parents and consent form

To the parent or carer of.....

I am currently training to be an Educational Psychologist with xxx Local Authority Educational Psychology Service and Birmingham University. One of the requirements of the doctorate is to carry out a piece of research that may contribute to improved outcomes for children. I have previously carried out research at The Pines School for my undergraduate degree where I was warmly welcomed and produced an evidence based successful piece of work around learning and memory in children with autism. My interests have now broadened somewhat and I am now interested in researching the emotion recognition skills of children with autism.

The aim of my research is to develop effective and evidenced based interventions to enhance children's ability to recognise the emotions of others in social situations. The research involves the use of the Transporters DVD which was developed by Baron- Cohen in 2004.

The Transporters DVD is a make- believe world of imaginary characters where vehicles have feelings. The DVD has been created especially for children with autism spectrum conditions as a way of enhancing their understanding of the causes of emotions and of emotional expressions. Research investigating the use of the Transporters found a significant improvement in the ability to understand and recognise emotions with children who have autism after four weeks of using the DVD in the context of their home environments. We are interested to find out more about the impact of the Transporters when used within an educational context.

The process

Individual children will be asked to complete some assessments around emotional recognition which will involve matching emotions to a number of situations. This will happen at the beginning, middle and end of the research.

Children will then be asked to watch an episode of the Transporters three times per day whilst at school. The episodes will last for five minutes each and so children will be out of class for around 15 minutes per day for a total of four weeks. This process will allow us to compare the performance of each child before and after they watched the Transporters DVD. The research is scheduled to begin in April 2010 and end in July 2010. If you would like more information about the project please do not hesitate to contact me on

If you are happy to give consent for your child to be part of this project, please read the following information and sign the consent form. The forms can be returned to by.....

Yours sincerely

Heather Ball
Trainee Educational Psychologist
The Transporters research project - Informed consent form

Please indicate that you understand the following information by putting a tick in the appropriate box:

Research criteria (Based on guidelines for minimum standards of ethical approval in psychological research produced by the British Psychological Society).	I understand this information (√)	I <u>do not</u> understand this information (√)
Your child will be asked to watch the Transporters DVD three times per day in school.		
Your child will complete assessments of emotional recognition a total of three times throughout the study. Each of these sessions should take approximately 45 minutes to 1 hour although these assessments may take place over a period of several days.		
We will also have a discussion with your child to gain their consent to be part of this research in addition to your consent.		
You or your child has the right to withdraw from this research at any point during the study without notice or reason.		
If we have already collected information about your child and you choose to withdraw from the research, you also have the right to withdraw all the information you have given us to date.		
Data from the research will be kept in a secure location within Birmingham's Educational Psychology Service		
Children's names will be kept confidential when findings are published.		
Individual scores will not be shared with schools.		
Anonymous findings from the study will be shared with parents, the school, individuals within the local authority and other members of the research community.		
Data from the study will be stored securely for a minimum of 10 years.		
We will de-brief all those involved in the research within three months of completing the research.		
Data will be gathered by Trainee Educational Psychologists and Graduate Psychologists within Birmingham's Educational Psychology Service.		
All those involved in the research will already have had a criminal records check by the authority within the last 12 months.		

I have read and understood the above information and give my consent for to be involved in this study.

Signed:.....

Name:

Parent or guardian of:

Appendix 4: Child consent form

The Transporters

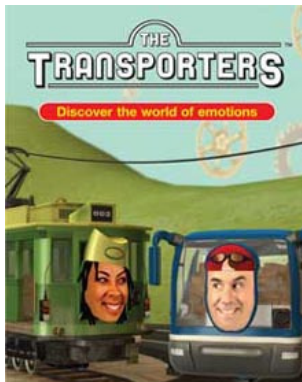
Hello, my name is Heather



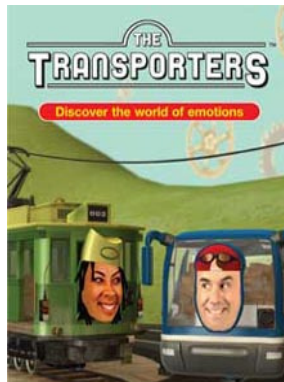
I would like to do some activities with you around how you can tell if someone is happy or sad just by looking at their faces.



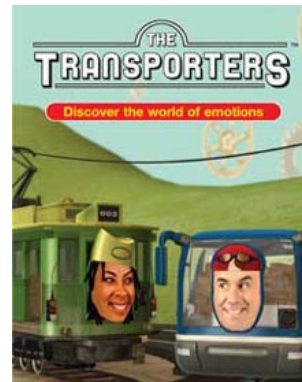
I would like you to watch this Transporters DVD with some other children in your school every day for 4 weeks.



1. Morning



2. Afternoon



3. Afternoon

The Transporters is a programme about trains, here is a clip.

I will come and see you and do some activities with you three times to see how you are getting on.

Would you like to be part of the Transporters project?

Yes I would

No I would not

Ok thanks that's great!!

There are a few things I need you to understand before we carry on. If you understand these things can you tick the box and then write your name at the end please?

I can stop doing activities with Heather if I want to, I just need to tell her that I do not watch the Transporters anymore. I will not have to give a reason.

If I do stop, I can not start watching the Transporters again later.



Other people will see my answers but only Heather will know they are mine.



I understand what Heather has said to me and I would like to be part of the Transporters project.

My name:

My class:.....

Appendix 5: Assessment sheet

The Transporters - assessment data sheet completed by researcher

Participant number:

DOB:

Today's date and time:

Location:

Child consent gained:

Measure 1

Item	Correct response	Actual response	Score	Additional comments
Practice item 1	3			
Practice item 2	1			
Practice item 3	3			
1	1			
2	1			
3	3			
4	1			
5	2			
6	2			
7	1			
8	2			
9	2			
10	3			
11	1			
12	1			
13	2			
14	3			
15	1			
16	2			

Measure 2

Item	Correct response	Actual response	Score	Additional comments
Practice item 1	2			
Practice item 2	1			

Practice item 3	1			
1	2			
2	1			
3	3			
4	2			
5	2			
6	1			
7	3			
8	2			
9	1			
10	3			
11	3			
12	2			
13	1			
14	3			
15	2			
16	1			

Measure 3

Item	Correct response	Actual response	Score	Additional comments
Practice item 1	1			
Practice item 2	1			
Practice item 3	2			
1	1			
2	1			
3	3			
4	2			
5	2			
6	3			
7	2			
8	3			
9	2			
10	2			
11	2			
12	1			
13	3			
14	3			
15	1			
16	1			

	Measure 1	Measure 2	Measure 3
Total score			

Observations:

Signed:



Appendix 6: Final script

Session 1

Hello my name is Heather.

What is your name?

Well it is nice to meet you I am working with a few other children in your school today and am trying to find out more about how children learn about the type of faces people make and what this might mean about how they are feeling.

I would like to do some activities with you around how you can tell if someone is happy or sad just by looking at their faces

I would like you to watch this Transporters DVD with some other children in your school every day for 4 weeks.

The Transporters is a programme about trains, here is a clip.

- show clip (Introduce characters).

Have you seen the Transporters before?

I will come and see you and do some activities with you three more times after today to see how you are getting on.

Would you like to be part of the Transporters project?

Ok thanks that's great!!

There are a few things I need you to understand before we carry on. If you understand these things can you tick the box and then write your name at the end please? Refer to consent form.

Read boxes- gain consent

I can stop doing activities with Heather if I want to, I just need to tell her that I do not want to watch the Transporters anymore. I will not have to give a reason.

Do you understand what that means?

If no, expand...

If I do stop, I can not start watching the Transporters again later.

Do you understand what that means?

If no, expand...

Other people will see my answers but only Heather will know they are mine.

Do you understand what that means?

If no, expand...

I understand what Heather has said to me and I would like to be part of the Transporters project.

Do you understand all those things? If so would you like to just write your name at the bottom of the page please.

Ok so now I know that you understand what we are going to be doing. Now I am going to do the first activity with you.

BPVS guidelines

Thank you so much..... I can see that you have tried really hard for me today/thank you for concentrating so well.

Give stickers

I am going to be back in school on the 4th and 5th June to do some more activities with you, is that OK with you?

Excellent, what lesson do you have now? Is this one of your favourites? Ok lets go back to class now then.

Session 2

Hi.....

Do you remember me from the other week?

Great, can you remember what we talked about?

We talked about the Transporters DVD and I asked you if you would watch the DVD every day for four weeks and do some activities with me too.

Just to remind you I have the sheet that we looked at together. You ticked these boxes which said that: (refer to participants previous consent form).

I can stop doing activities with Heather if I want to; I just need to tell her that I do not want to watch the Transporters anymore. I will not have to give a reason.

If I do stop, I can not start watching the Transporters again later.

Other people will see my answers but only Heather will know they are mine.

I understand what Heather has said to me and I would like to be part of the Transporters project.

Do you still want to be part of the Transporters project?

Ok excellent.

Well today, I have some different activities for us to do.

Measure 1 -

I would like you to have a look at these clips for me, after you have watched all of each clip. I would like you to point to the face that you think matches how the character might be feeling?

Lets have a practice first so you know what you are doing?

Read scenario for the child.

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Practice item 1- Oliver is helping Sally. He likes to help Sally. – Number 3

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either,

That's right, Oliver feels happy because he is helping Sally and he likes to help Sally.

Or

Umm actually I think that Oliver might be feeling happy which is this one (point to 3) because Oliver likes to help Sally and this makes him happy.

Practice item 2- Dan made Barney and Jennie laugh with his funny song. Dan sees Oliver and wants to make him laugh too. (Option 1)

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Dan is excited to see Oliver so he can make him laugh too.

Or

Umm actually I think that Dan might be feeling excited to see Oliver, the excited face is this one (number 1)

Practice item 3- Sally was cleaned for her trip with the children, but on her way to see the children, she got splashed with mud (Number 3)

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Sally is feeling sad because she got splashed with mud.

Or

Umm actually I think Sally might be feeling sad (point to 3) as she was splashed with mud.

Ok lets do some more.

After each clip- Ok, how do you think x might be feeling, like this (1), like this (2) or like this (3)?

Words of encouragement- well done, I can see you're working really hard at this, well done I can see you're concentrating really well.

Measure 2

Lets have a practice first so you know what you are doing?

Read scenario for the child.

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Practice item 1- Nigel has been traveling very fast all day and now he needs to rest.

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either,

That's right, Nigel feels tired because he has been traveling very fast all day?

Or

Umm actually I think that Nigel might be feeling tired which is this one (number 2).

Practice item 2- Nigel tells Dan to stop making silly faces

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Nigel is feeling unfriendly because he told Dan to stop being silly

Or

Umm actually I think that Nigel might be feeling unfriendly towards Dan which is this one here (number 2)

Practice item 3- Sally laughed at Oliver because he had oil stains all over his door

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Oliver is feeling sorry that he got oil stains on himself

Or

Umm actually I think Oliver is feeling sorry that he got oil stains on himself.

Ok lets do some more.

After each clip- Ok, how do you think x might be feeling, like this (1), like this (2) or like this (3)?

Words of encouragement- well done, I can see you're working really hard at this, well done I can see you're concentrating really well.

Break- well, you have been working really hard, we have a few more clips to look at, would you like to have a break and a stretch or shall we carry on?

Measure 3.

Ok now I am going to ask you to do the same as before but this time there are real people in the films rather than characters from the Transporters.

So I would like you to watch the clips and at the end, tell me which of these faces (point to faces) would best match how the person in the clip might be feeling?

Lets have a practice first so you know what you are doing?

Read scenario for the child.

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Practice item 1- Luke hasn't been to bed all night and is feeling very sleepy. (number 1)

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either,

That's right, Luke is feeling tired because he has not been to bed all night.

Or

Umm actually I think that Luke is feeling tired because he has not been to bed all night

Practice item 2- Anne dropped her favourite cup on the floor and it broke (option 1)

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Anne is feeling nervous because she broke her favourite cup.

Or

Umm actually I think that Anne is feeling nervous because she broke her favourite cup.

Practice item 3- Tom wouldn't speak to Suzy (number 2).

Lets look at all of the possible answers first, do you think X feels like this (play number 1), like this (play option 2) or like this (play option 3)?

Either

That's right, Tom is feeling unfriendly because he will not speak to Suzy.

Or

Umm actually I think that Tom is feeling unfriendly because he will not speak to Suzy.

Ok lets do some more.

After each clip- Ok, how do you think x might be feeling, like this (1), like this (2) or like this (3)?

Words of encouragement- well done, I can see you're working really hard at this, well done I can see you're concentrating really well.

Ok well done for working so hard today, I am going to come in again in four weeks time to do some different activities with you. In this time, I am not going to ask you to watch the Transporters DVD but after the next time I come in I am going to ask the school to show you the DVD every day for four weeks. So you might have to wait a few more weeks to see the DVD because I need to get some more information first.

What lesson are you going back to now? Do you like this lesson? Ok lets go back to your lesson.

Session 3 and 4

- Intro will be the same as session 2 with different practice examples
- Session 3 will include at the end of the session:

Ok, I am now going to ask your teacher to show you and the rest of the class the Transporters episodes three times a day for the next four weeks and then I am going to come back and have one more session with you. Is that ok with you xxx?

- Session 4 will include:

Well that's our last session together, thank you again for helping me. Now I have to go back to my office and think about all the information that I have from your school. I am then going to write a report but would like to contact you again to tell you about what I found out. I will send a letter to you and your parents.

Appendix 7: Teachers recording sheets

The Transporters- Data record sheet

Date:

Session number:

Time of session:

Location of session:

Initials of children present:

Absentees:

Initials of adult running the session:

Did the group discussion take place in this session?

If so, were all participants present during the discussion?

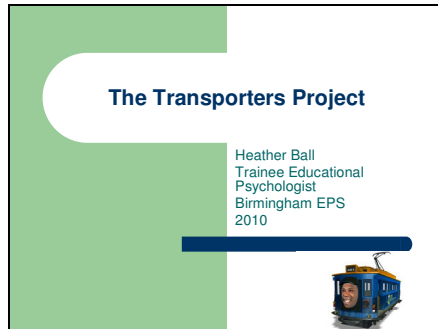
Additional comments:

Data record sheet completed by:



Appendix 8: Presentation to school staff

Slide 1



Slide 2



Hello and welcome


I am familiar with some of you here but those of you who don't know me, my name is Heather Ball and I am a TEP working in Birmingham.

You may have seen me around the school in May time when I collected the data that I am going to talk about today, as part of the universities requirements to complete my doctoral studies I have to conduct a 25,000 word research prjec.

Slide 3

How the project evolved

- Personal interest, previous research around learning, memory and autism.
- Birmingham's EPS were developing the Transporters research on a larger scale across Birmingham
- Evidence based practice



Third point- we often recommend interventions in schools as EP but there is now an increasing focus on the evidence that supports such interventions and so as a service we would be keen to contribute to the existing evidence base for the Transporters.

Slide 4


Research questions

- Does the emotional recognition of children with highly functioning autism who are attending specialised educational provision increase after watching the Transporters DVD for four weeks in their educational context?
- Can those children then generalise their increased performance of the recognition of emotions from the Transporters DVD to the recognition of human faces using the Mind Reading software (Baron- Cohen, 2004).

Slide 5


What is the Transporters?

- The Transporters is a make- believe world of imaginary characters where vehicles have feelings.
- For children with autism, the Transporters acts as a bridge between a mechanical, predictable and systematic context.



Slide 6


The characters



Dan

A slide titled "The characters" with a blue horizontal line. Below the line is a small image of a character named Dan, who is a man with a purple helmet and a purple visor, looking forward. The name "Dan" is written in bold blue text to the right of the image.


Slide 7



Nigel

A slide with a blue horizontal line. Below the line is a small image of a character named Nigel, who is a man with a red helmet and a blue visor, smiling. The name "Nigel" is written in bold blue text to the right of the image.


Slide 8



Oliver


A slide with a blue horizontal line. Below the line is a small image of a character named Oliver, who is a man with a yellow and black helmet and a black visor, looking forward. The name "Oliver" is written in bold blue text to the right of the image.

Slide 9




Jenny

Slide 10



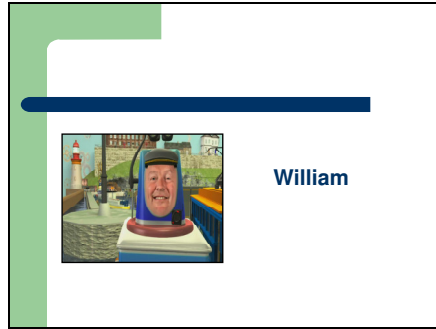
Charlie

Slide 11

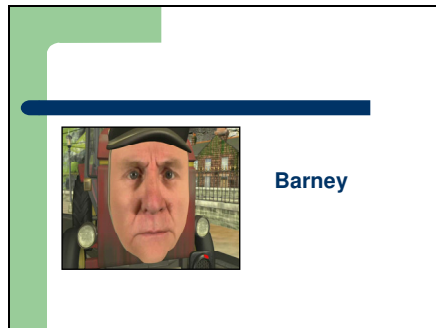


Sally

Slide 12




Slide 13



Slide 14

The theory...



- One particular area of development for children with autism is being able to recognise, demonstrate and respond appropriately to the emotions of others.
- Individuals with ASD have been shown to have an enhanced ability in 'systemizing' compared to typically developing children (Baron-Cohen, 2002).
- Golan and Baron Cohen (in press) theorise that children with ASD may be able to use their enhanced skills in systemising to compensate for difficulties in recognising basic and complex emotional states

As you are all aware, one area of difficulty for children with autism is the ability to recognise emotions in others and respond appropriately to emotional situations. Some children with autism will develop these skills over time and of course these skills will be dependant on where the individual is on the spectrum but certainly emotional recognition is not a skill that seems to come naturally to children with autism.

However, children with autism are good at systemizing which is the ability to detect


relationships with systems and includes a high level of predictability.

Golan and Baron Cohen theorise that children with ASD may be able to use their skills in systemizing to compensate for difficulties in recognising basic and complex emotional states.

Slide 15

The theory

- Baron Cohen (2004) therefore developed an animated series called the Transporters.
- Children are therefore motivated to learn about emotional recognition through the use of characters that are attached to systematic and predictable vehicles.




Baron Cohen therefore developed the Transporters which combines emotional recognition with predictable systems such as trains, trams and boats.

Slide 16

Golan & Baron- Cohen (in press)

- 20 children with ASC aged 4-7
- Matched control groups, ASC and typically developing children
- Emotional recognition measures before the intervention
- Watched the Transporters every day for 4 weeks at home
- Found a significant improvement in the ability to understand and recognise emotions for children with ASC and that children could generalise these skills to human faces too.



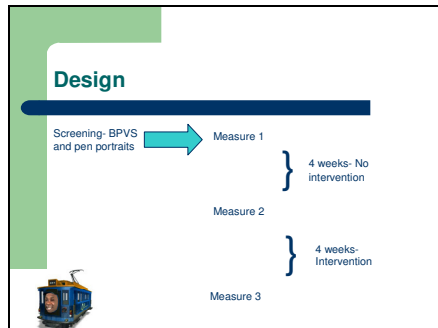
Slide 17

My research

- Investigating the impact of the Transporters DVD on emotional recognition for children with ASC in an educational setting
- Using a repeated measures design



Slide 18



Slide 19

Measures

- Each measure consisted of three levels
- Level 1- novel transporters clips (16)
- Level 2- familiar transporters clips (16)
- Level 3- human faces (16)

Aims to assess the generalisation of skills

Slide 20

Example of the measures


- See clip

Measure 1 and measure two consisted of different clips to reduce practice and boredom effects.

Slide 21

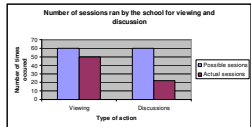
The intervention

- Viewing the Transporters DVD 3 times per day every day for four weeks
- Each episode is around 5 minutes long, there are 15 episodes in total
- Promoting discussion using questions from the resource book once per day



Slide 22

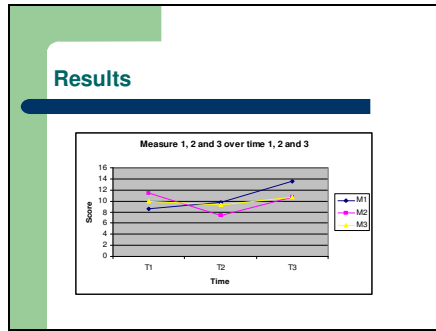
The delivery



Type of action	Possible sessions	Actual sessions
Viewing	20	15
Discussions	10	5

The group of participants saw the DVD 50 times out of a possible 60 and had discussions about the clip 20 times out of a possible 60.

Slide 23



Ok so the results show that for measure 1 which was the familiar transporters clips there was an effect in the right direction, that is that children scores slightly higher in measure 1 after the intervention but unfortunately this just fell short of significance. We use statistical tests to see if the difference between two or more scores was big enough to say that the intervention had a significant impact and in this case it didn't for measure 1 although was in the right direction.

For measure 2 which was novel familiar clips, children's performance actually decreased slightly, this was novel clips so clips that the children had not seen from the transporters intervention

And for measure three, their performance pretty much stayed the same and were therefore not significant.

Slide 24

What does this mean??

- Rote learning?
- Difficulties with generalisation?
- More research?
- Lots of questions!!

The results suggest that children may have rote learnt the correct emotional response from the DVD which is how their performance increased between time 1 and time 3 for measure 1, however they were unable to apply this to unfamiliar transporters clips and human faces.

Slide 25

Findings...

- My research would suggest that we need a bigger evidence base for the transporters programme for use in special schools.
- Need to consider generalisation more carefully.
- Think about possible vehicles for generalisation, discussion? Role play?

Slide 26

However...

- This was a very small scale research study with a population of children from one setting
- We don't know the impact that the transporters might have in a mainstream school or in collaboration with additional interventions such as PATHS
- The measures may have not been sensitive enough

Slide 27

Practical implications...

- Time for teachers to use in the classroom
- Difficult to always have discussion around the content although this may be a useful vehicle for generalisation
- Time consuming with little impact
- Use of other emotional literacy interventions in school, could they compliment emotional recognition interventions?

Slide 28

Next steps

- To conduct some further analysis on the data
- To look more closely at the patterns of data
- Integrate results with the literature review
- Write up!
- Send report to school and parents who would like a copy.

Slide 29

Thank you

Huge thank you to all of those that participated in the project and helped with the organisation and delivery.

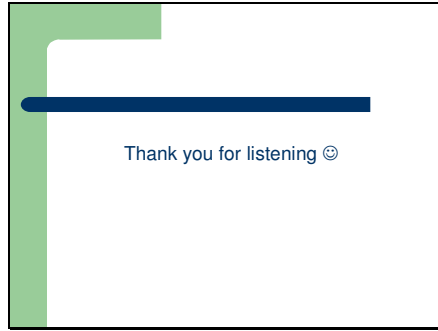
Slide 30

How to contact me...

Heather Ball, Trainee Educational Psychologist
0121 303 0100
Heather.ball@birmingham.gov.uk



Slide 31



The Transporters project



Dear xxx,

You may remember that a few months ago I came in to do some work with you about the Transporters.

I would just like to say thank you for all your hard work.

The project that you were part of has helped me to understand more about how some children can tell how a person is feeling from looking at their face.

Thanks again for taking part in the project.

Heather

The Transporters Project



Dear Mr and Mrs xxx,

You may recall that a few months ago you gave permission for your child to be involved in a piece of research about the Transporters DVD. The project would not have been possible without your consent so thank you for your co-operation and support.

Previous research has shown that the Transporters DVD significantly enhances emotion recognition in children with autism when used within the context of the home. I was interested to see if this was also the case when the Transporters was used in school. I found that the watching the Transporters in school three times per day for four weeks did not significantly enhance emotion recognition in children with autism. However there are many reasons why this may be the case and my research suggests that further studies need to be undertaken in this field before firm conclusions can be drawn about the use and effectiveness of the Transporters in schools.

If you wish to discuss my research in detail, please do not hesitate to contact me.

Many thanks

Heather Ball
Trainee Educational Psychologist
0121 303 0100
Heather.ball@birmingham.gov.uk

Appendix 10: Draft scripts

Introductions

Hello my name is Heather.

What is your name?

Well it is nice to meet you I am working with a few other children in your school today and am trying to find out more about how children learn about the type of faces people make and what this might mean about how they are feeling.

I would like to do some activities with you around how you can tell if someone is happy or sad just by looking at their faces

There are a few things I need you to understand before we carry on. If you understand these things can you tick the box and then write your name at the end please?

(See consent form pilot)

Read boxes- gain consent

Ok so now I know that you understand what we are going to be doing. Now I am going to do the first activity with you.

I would like you to have a look at these clips for me, after you have watched all the clips. I would like you to point to the face that you think matches how the character might be feeling?

Practice items

Lets have a practice first so you know what you are doing?

Show clip (3 practice items)

Ok, which one of these faces do you think best matches how xxx might be feeling?

If incorrect- umm actually I think that xxx might be feeling xxx (point to correct picture) as xxx.

If correct- well done that's right, xxx would be feeling xxx if xxx.

Ok lets do some more.

After each clip- Ok, which one of these faces do you think best matches how xxx might be feeling?

Words of encouragement- well done, I can see you're working really hard at this, well done I can see you're concentrating really well.

Measure 2

Ok lets have a look at the next ones

After each clip- Ok, which one of these faces do you think best matches how xxx might be feeling?

Break- well, you have been working really hard, we have a few more clips to look at, would you like to have a break and a stretch or shall we carry on?

Measure 3.

Ok now I am going to ask you to do the same as before but this time there are real people in the films rather than characters from the Transporters.

So I would like you to watch the clips and at the end, tell me which of these faces (point to faces) would best match how the person in the clip might be feeling?

Finish

Ok that's all I would like to ask you to do today, well done for working so hard today

Would you like a sticker for working so hard today? Give stickers

What lesson are you going back to now? Do you like this lesson? Ok lets go back to your lesson.

Appendix 11: Letter to parents and parental consent form for pilot study

To the parent or carer of.....

I am currently training to be an Educational Psychologist with Birmingham Local Authority's Educational Psychology Service and Birmingham University. One of the requirements of the doctorate is to carry out a piece of research that may contribute to improved outcomes for children.

The aim of my research is to develop effective and evidenced based interventions to enhance children's ability to recognise the emotions of others in social situations. As part of the research, I will be asking children to watch a series of clips of animated characters and human interactions and then to match the most appropriate emotional response to that situation. It is often useful when carrying out the research to practice any assessments with other children before the actual research is carried out.

I therefore would like to carry out these assessments with two or three children at xxx and wondered if you would be happy to consent to your child's involvement in the project.

The assessments should take around 40 minutes per child and will give me an opportunity to practice administering the assessments and also check that children the same age as those in the actual project will be able to understand instructions and maintain concentration. Melissa Jones who is an Educational Psychologist in Birmingham may also be administering parts of the assessment and observing the process.

This would be a big help towards the overall research project. The final write up of the project will be available to parents of those children involved in the piloting process upon request.

If you are happy to give consent for your child to be part of this project, please read the following information and sign the consent form. The forms can be returned to by.....

Yours sincerely

Heather Ball
Trainee Educational Psychologist

The Transporters research project - Informed consent form

Please indicate that you understand the following information by putting a tick in the appropriate box:

Research criteria (Based on guidelines for minimum standards of ethical approval in psychological research produced by the British Psychological Society).	I understand this information (√)	I do not understand this information (√)
Your child will complete assessments of emotional recognition a total of three times throughout the study. Each of these sessions should take approximately 40 minutes.		
We will also have a discussion with your child to gain their consent to be part of this research in addition to your consent.		
You or your child has the right to withdraw from this research at any point during the study without notice or reason.		
If we have already collected information about your child and you choose to withdraw from the research, you also have the right to withdraw all the information you have given us to date.		
Data from the research will be kept in a secure location within Birmingham’s Educational Psychology Service		
Children’s names will be kept confidential when findings are published.		
Individual scores will not be shared with schools.		
Anonymous findings from the study will be shared with the local authority and other members of the research community.		
School and parents can have access to individual scores if requested		
Data from the study will be stored securely for a minimum of 10 years.		
Data will be gathered by a Trainee Educational Psychologists from Birmingham’s Educational Psychology Service.		
All those involved in the research will already have had a criminal records check by the authority within the last 12 months.		

I have read and understood the above information and give my consent for to be involved in this study.

Signed:..... Name:
Parent or guardian of:

Appendix 12: Child consent form for pilot study

The Transporters

Hello, my name is Heather



I would like to do some activities with you around how you can tell if someone is happy or sad just by looking at their faces.



Would you like to be part of my project?

Yes I would

No I would not

Ok thanks that's great!!

There are a few things I need you to understand before we carry on. If you understand these things can you tick the box and then write your name at the end please?

I can stop doing activities with Heather if I want to, I just need to tell her that I do not want to do these activities

--

Other people will see my answers but only Heather will know they are mine.

--

--



I understand what Heather has said to me and I would like to be part of her project.

My name:

My class:.....

Appendix 13: Timeline and overview of key actions

Date	Action	By Whom	Researchers involvement	Outcome
Jan 2010	<ol style="list-style-type: none"> 1. Research proposal and ethics from 2. Negotiation meeting with head and deputy of the school, Jan 19th 2010. 	Researcher	Submitted research proposal and ethics form and attended meeting.	Research was agreed with the school, dates set for next steps.
Feb 2010	<p>Letters to parents sent.</p> <p>Literature review</p> <p>Preparation for data collection</p>	Researcher and school.	Research drafted letters and school sent them to parents.	Consent gained from all parents.
March/ April	<ol style="list-style-type: none"> 1. Literature review and write up 2. BPVS screening 3. Clarified which children would 	Researcher	Researcher went into school and completed BPVS with all children.	BPVS scores were used to determine which children should take part in the project.

	take part in the study.			
Last week in April 2010 WC May 10th	1. Contacted parents again to let them know study is starting and to check they still want their child to be part of it. 2. Gained children's consent. 3. Begin test 1 period- 4 weeks	Researcher	Carried out all assessments with all the children.	Children's consent was gained and measures were scored.
7 th and 8 th June	Measure 2	Researcher	Carried out all assessments with all the children.	Scored measures
WC 14 th June	Begin test 2 period and intervention	Researcher	Carried out all assessments with all the children.	Scored measures
16 th June	Observed children watching the DVD and had discussions with the teachers.	Researcher	Observed the class watching DVD	Teachers felt happy to continue and were following the intervention accurately.
WC July 12th	Begin test 3 period and debrief to children.	Researcher	Carried out all assessments with all the children.	Scored results and children were debriefed about the project.
July- September	Analysis of results.	Researcher	Completed analysis	Letters sent to parents and children to thank them.

Appendix 14: An overview of the information gathered from the data record sheets completed by teaching staff.

Date	Session number	Time of session	Location of session	Absentees from test group	Initials of adult running the group	Did the group discussion take place?	If so, were all participants present?	Additional comments
14/06/10	1	9.20	Classroom	None	YS	No	NA	None
14/06/10	2	11.15	Classroom	None	YS	Yes	Yes	None
14/06/10	3	13.05	Classroom	None)	YS	No	NA	None
15/06/10	1	13.05	Classroom	1	AH	No	NA	None
15/06/10	2	14.45	Classroom	1	AH	No	NA	None
16/06/10	1	9.15	Classroom	None	AH	Yes	Yes	None
16/06/10	2	11.15	Classroom	None	AH	Yes	Yes	None
16/06/10	3	13.10	Classroom	None	YS	No	NA	None
17/06/10	1	9.25	Classroom	1	YS	Yes	Yes	None
17/06/10	2	11.20	Classroom	1	YS	Data record sheet not completed	Data record sheet not completed	Data record sheet not completed
17/06/10	3	13.10	Classroom	1	AH	Data record sheet not completed	Data record sheet not completed	Data record sheet not completed
18/06/10	1	9.25	Classroom	None	AH	Yes	Yes	None
18/06/10	2	11.25	Classroom	1	AH	No	NA	None
18/06/10	3	14.50	Classroom	1	AH	Yes	Yes	None
21/06/11	1	9.55	Classroom	1	YS	No	NA	None
21/06/11	2	11.25	Classroom	1	AH	Yes	Yes	None
21/06/11	3	13.10	Classroom	1	YS	No	NA	None
22/06/11	1	9.20	Classroom	1	YS	Yes	Yes	None
22/06/11	2	13.10	Classroom	1	AH	No	NA	None

22/06/11	3	14.45	Classroom	1	AH	Yes	Yes	None
23/06/11	1	14.45	Classroom	1	AH	No	NA	One session only because of school trip
24/06/11	1	9.20	Classroom	1	YS	Data sheet not completed	Data sheet not completed	Data sheet not completed
24/06/11	2	11.50	Classroom	1	AH	Data sheet not completed	Data sheet not completed	Data sheet not completed
24/06/11	3	14.50	Classroom	1	AH	No	NA	None
25/06/11	1	9.20	Classroom	1	YS	Yes	Yes	None
25/06/11	2	11.20	Classroom	1	YS	No	NA	None
28/06/10	1	9.30	Classroom	None	AH	No	NA	None
28/06/10	2	13.10	Classroom	None	AH	No	NA	None
28/06/10	3	14.45	Classroom	None	YS	Data sheet not completed	Data sheet not completed	Data sheet not completed
29/06/10	1	9.20	Classroom	None	YS	Yes	Yes	None
29/06/10	2	13.20	Classroom	None	AH	Data sheet not completed	Data sheet not completed	Data sheet not completed
29/06/10	3	14.45	Classroom	None	AH	No	NA	None
30/06/10	1	NA	Classroom	NA	NA	NA	NA	Teacher training day
01/07/10	1	9.20	Classroom	None	YS	Yes	Yes	None
01/07/10	2	13.10	Classroom	None	AH	Yes	Yes	None
01/07/10	3	14.45	Classroom	1	AH	No	NA	None
02/07/10	1	9.50	Classroom	None	YS	Yes	Yes	None
02/07/10	2	14.50	Classroom	None	YS	Yes	Yes	We smelt fish food to see our disgusted faces afterwards- Jenny's smelly adventure.
05/07/10	1	9.30	Classroom	2	AH	No	NA	None
05/07/10	2	14.45	Classroom	2	YS	Yes	Yes	None
06/07/10	1	Data record not	Classroom	None	AH	Yes	Yes	None

		comple ted						
06/07/10	2	13.15	Classroom	1	AH	Yes	Yes	None
06/07/10	3	14.45	Classroom	1	AH	No	NA	None
07/07/10	1	09.20	Classroom	None	AH	Yes	Yes	None
07/07/10	2	11.20	Classroom	None	AH	No	NA	None
07/07/10	3	13.10	Classroom	None	YS	No	NA	None
08/07/10	1	09.30	Classroom	None	YS	Yes	Yes	None
08/07/10	2	Data record not comple ted	Classroom	None	YS	Data record not completed	Data record not completed	Data record not completed
08/07/10	3	14.45	Classroom	None	AH	Yes	Yes	None
09/07/10	1	9.20	Classroom	None	YS	No	No	None
09/07/10	2	13.20	Classroom	None	AH	Yes	Yes	None