Do children with autism use the Picture Exchange Communication System (PECS) to make spontaneous requests?

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List of Contents

List of Tables

Chapter 1.

Chapter 2.

List of Figures

Chapter 1.

Chapter 2.

Declaration of Authorship

I, AMY FARRER, declare that the thesis entitled 'Do children with autism use the Picture Exchange Communication System (PECS) to make spontaneous requests?' and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself; and
- none of this work has been published before submission

Signed: ……..

Date: …….

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Chapter 1. Literature Review

The Journal of Applied Behavior Analysis (JABA) has been used as a guide for determining the style of the paper.

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF MEDICINE, HEALTH AND LIFE SCIENCES

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Do children with autism use the Picture Exchange Communication System (PECS) to make spontaneous requests?

By Amy Farrer

1.1. Abstract

This review examines the research on the Picture Exchange Communication System (PECS), which has become a popular communication strategy for children with autism and other communication disorders. A growing body of research has shown that the system is a promising mode of communication. There is, however, a paucity of research that examines the conditions under which the PECS is used, specifically whether children use the PECS to make spontaneous requests. A lack of agreement currently exists over the definition of the term 'spontaneity' and so researchers of the PECS who do report instances of spontaneity may be basing the judgment on different patterns of behaviour. Skinner's (1957) analysis of verbal behaviour and the continuum model of spontaneity (Carter, 2002,2003a; Carter & Hotchkis, 2002; Chiang & Carter, 2008) can be used to understand the development of self-initiated requesting behaviour. Both frameworks state that requests can only be considered as fully spontaneous if they occur without prompts from another person and when the desired item is not in sight. There is a lack of research that examines whether children are able to use the PECS to make requests under these conditions. Furthermore, this literature review shows that some children may be unable to use the PECS to request items not in sight because of the teaching conditions used and/or because the reinforcement practices of the community may be inefficient, and, therefore, ways of promoting spontaneity are considered.

1.2. Introduction

Autism is characterised by a collection of symptoms including impairment in social and language skills, poor imaginative abilities and a tendency to engage in repetitive thoughts and behaviours (American Psychiatric Association [APA], 2000). A survey by the Office of National Statistics found that approximately one per cent of children in the United Kingdom aged 5-16 years had an autistic spectrum disorder, with the majority of these children being boys (Green, McGinnity, Meltzer, Ford, & Goodman, 2005). One of the primary impairments in autism is a deficit in language and communication skills (APA, 2000). Often parents of children with autism recognise the absence or impairment of their child's communication skills early in the second year (Tager-Flusberg, Paul & Lord, 2005). It is now recognized that language in children with autism is extremely variable, but most of these individuals will begin to speak late and develop speech at a significantly slower rate than typically developing children (Anderson, Moore & Bourne, 2007; Tager-Flusberg et al., 2005). It has also been estimated that a significant number of children and adults with autism will never develop functional speech (Frea, Arnold & Vittimberga, 2001; Mirenda, 2003; Tager-Flusberg et al., 2005).

The inability to communicate effectively with others is one of the most significant obstacles to independent living for those with autism and can result in a host of problems (Frost & Bondy, 2002). Language and communication difficulties may prevent children from making their needs and wants known to others (Durand, 1990; Jennett, Harris & Delmolino, 2008). Language and communication underlies most learning in typically developing children, so difficulties in these areas will have a significant impact on a child's overall development (Sundberg & Michael, 2001). Communication difficulties may also mean that children could begin to use other, less socially appropriate, means to get their needs met, such as engaging in challenging behaviour (Carr & Durand, 1985; Durand, 1990; Jennett et al., 2008; Lancioni et al., 2007). Therefore, the priority in early intervention for children with autism is given to the development of their social and functional communication abilities (Steyaert & De La Marche, 2008).

Deficits relating to spontaneous communication are frequently reported in children with autism (American Psychiatric Association [APA], 2000; Carter, 2002;

Carter, 2003b; Carter & Hotchkis, 2002; Carr & Kologinsky, 1983; Chiang & Carter, 2008; Reichle & Sigafoos, 1991b; Tager-Flusberg, Paul & Lord, 2005), and so a desirable goal of communication programs with this group of children is to promote their spontaneous communication skills. A communication program that has become popular for children with a autism (and also for individuals with a range of communication disorders) is the Picture Exchange Communication System (PECS) (Bondy & Frost, 1994; Frost & Bondy, 1994), which now has widespread use across the UK (Howlin, Gordon, Pasco, Wade & Charman, 2007; Preston & Carter, 2009). The current review will examine whether children with autism have been shown to use the system to make spontaneous requests.

The PECS is a pictorial based system that was developed by Bondy and Frost (reported in Bondy & Frost, 1994, and Frost & Bondy, 1994) to teach children with autism, who had no functional speech, a rapidly acquired, self-initiated functional communication system (Bondy & Frost, 1994; Frost & Bondy, 1994, 2002). Children are initially taught to request items by exchanging a pictorial symbol, corresponding to a desired item, with a communicative partner (Figure 1.1. shows the PECS materials). Children can progress through a series of phases (shown in Table 1.1). In phases 1 to 3 children are taught to request items by actively seeking out a communicative partner, with a range of adults and in different environments, and to discriminate between different pictures. In phases 4 to 6 children are taught to use simple phrases and to comment on objects and events in the environment. In the latter phases of the PECS, techniques

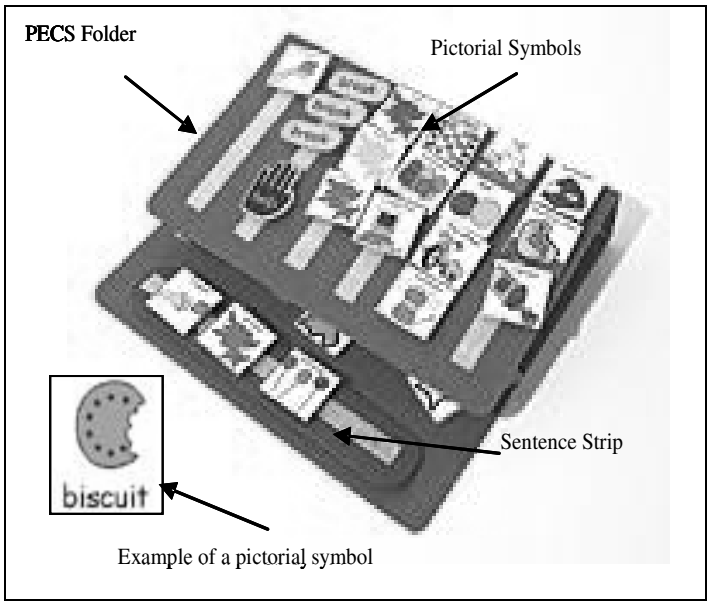

Figure 1.1. PECS materials (Pyramid Education Consultants UK Ltd)

are used to encourage speech (see table 1); however, speech is never insisted upon and Frost and Bondy stress that PECS should be taught to give children a method of communication through picture exchange and not in order to teach the child to speak.

Table 1.1. Summary of the six phases of the PECS

Phase	**Teaching Target** (criteria for success in each phase is 90% accuracy)	**Description**
I	Children are taught to make requests for desired items through picture exchange.	Only one picture and item are available at a time. When the child reaches for the desired item he is physically prompted by a second trainer to exchange the picture with a communicative partner. After the exchange the communicative partner will say 'I want [item child has requested]'. Prompts from the second trainer are quickly faded.
II	Children are taught persistence when initiating communication.	One picture at a time is placed on the PECS folder. The communicative partner and the PECS folder are moved further away from the child. The child is taught to go to the PECS folder, take off the picture, move to the trainer and exchange the picture. The number of communicative partners is increased.
III	Children are taught to discriminate between pictures.	Initially two pictures (for preferred and neutral/disliked items) are presented on the PECS folder. Children are taught to choose the picture that corresponds to the item that they desire. More pictures are then added, with pictures for more than one preferred item displayed at a time. Correspondence checks are carried out to check that the child is accurately discriminating between the pictures.
IV	Children are taught to use simple phrases.	Children are taught to use a sentence strip. Children are taught to request items that they desire by placing a 'I want' picture onto a sentence strip followed by the picture corresponding to the item they desire, and then to exchange the sentence strip with a

		communicative partner. To encourage speech the communicative partner immediately 'reads' the sentence strip back to the child after an exchange. When the child has learnt this routine the communicative partner then pauses before reading the sentence to see if the child will fill in the gap.
V	Children are taught to answer a question with a request.	Children are taught to answer the question "What do you want?" by placing the 'I want' picture and a picture corresponding to the item that they desire on the sentence strip and exchanging the strip with the communicative partner.
VI	Children are taught to comment.	Children are taught to answer a variety of questions (e.g., "What do you see?", "What do you have?" and "What do you hear?") and to use a number of different sentence starters (e.g., 'I see', 'I have' and 'I hear').

Research on the effectiveness of the PECS has tended to focus upon the ease of acquisition of the system by users, the maintenance and generalisation of the system, and the collateral benefits (e.g., the impact of the PECS on the users speech development and behaviour) (this research will be considered further in section 1.6). One area where there seems to be a lack of research is whether children use the PECS to emit spontaneous requests. This gap in research may be because researchers feel the question has already been answered, as one of the primary aims of the PECS is to promote spontaneous communication. The PECS protocol aims to promote spontaneity by reducing the likelihood of children becoming dependent on verbal or physical prompts from a communicative partner (Bondy & Frost, 2001; Frost & Bondy, 1994, 2002). This is done by having two trainers; the first trainer acts as the communicative partner and interacts socially with the child[1], and the second trainer is positioned behind the child and will physically prompt him to make the pictorial exchange (Bondy & Frost, 1994; Frost & Bondy, 1994, 2002). The communicative partner, therefore, does not need to provide any vocal or physical prompt prior to the pictorial exchange. To further enhance spontaneity, training takes place with a variety

[1] For ease of communication the male pronoun will be used when describing a child or adult.

of communicative partners, in a variety of contexts, and with a variety of reinforcing items.

Therefore, the PECS aims to promote spontaneity by reducing the likelihood of the user becoming dependent on prompts from another person. However, the PECS tends to be used when the desired item is visible because this allows communication to be initiated by the child (e.g., when the child reaches for the desired item he can be prompted to exchange a pictorial symbol) (Bondy & Frost, 1994; Frost & Bondy, 1994, 2002). Section 1.8.4.1 will discuss how these training conditions may cause children to become dependent upon seeing an item before making a request. Many researchers do not take into account the presence of the item when defining spontaneity, but the ability to request out of sight items is an essential skill as it will give individuals more control over their environment, enabling them to emit requests based on internal cues (Carter & Grunsell, 2001; Carter & Hotchkins, 2002; Skinner, 1957). This means, for example, that when the individual is hungry or thirsty he can request food or drink irrespective of whether the desired item is in sight. Therefore, as will be discussed in section 1.8.1, some researchers contend that requests which occur in the presence of the requested item should not be considered as fully spontaneous (e.g., Bondy, Tincani & Frost, 2004; Carter, 2002,2003a; Carter & Hotchkis, 2002; Chiang & Carter, 2008; Skinner, 1957; Sweeney-Kerwin, Carbone, O'Brien, Zecchin & Janecky, 2007). The current paper will review the research on the PECS with there being a specific focus on the notion of spontaneity and whether children with autism have been shown to use the PECS to emit spontaneous requests.

1.3. Acquisition of Communication Skills in Typical Development

To understand how the PECS can promote the communication skills of children with autism, this paper will begin by providing a brief overview of how communication skills are acquired in typically developing children. It is thought that typically developing children learning any language will all go through the same periods of development, albeit at different rates (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; Bates, Dale & Thal, 1995; Bates, Thal, Finlay & Clancy, 1992; Brown, 1973; Moerk, 2000; Slobin, 1985; Carpenter, Nagell, Tomasello, Butterworth & Moore, 1998). An infant will begin to use speech from around 12 months of age (Bates et al., 1979; Tomasello & Bates, 2001; Bates, Bretherton &

Snyder, 1988; Lock & Fisher, 1988) and vocabulary then continues to grow throughout the individual's lifetime (Bates et al., 1992). From around 20 months of age infants will begin to combine words into two or three word utterances (Bates et al., 1988; Lock & Fisher, 1988) and most typically developing children will have acquired the basic structures of grammar before they begin school, although syntactic development will continue into the school years (Bates et al., 1992).

Therefore, the use of conventional spoken language begins around the time of a child's first birthday; however, communication encompasses more than speech alone and it is thought that typically developing children will begin to exhibit communicative behaviours from birth (e.g., screeching, cooing, babbling, reaching) (Bates et al., 1979; Laakso, Poikkeus, Katajamäki & Lyytinen, 1999; Lock & Fisher, 1988). It is believed that these communicative behaviours will form the basis for the later development of language skills (Bates et al., 1979; Bates & Dick, 2002; Iverson & Goldin-Meadow, 2005; Laakso et al., 1999). To understand the wide range of behaviours that can be considered as 'communicative' Skinner's (1957) notion of 'verbal behaviour' can serve as a useful framework.

1.3. 1. Development of Early Communicative Behaviours

Skinner (1957) used an applied behavioural analytical framework to understand the development of language and communication in humans, by examining language from a functional perspective rather than focusing on the structure of language. His suggestion was that verbal behaviour was shaped and maintained by the same selection mechanisms that shape and maintain nonverbal behaviour, such that the consequences of verbal behaviour determine its future probability of occurring. Skinner proposed that, while nonverbal behaviour was reinforced directly through contact with the physical environment, verbal behaviour was reinforced through the mediation of another person's behaviour and so included both vocal and non-vocal acts[2]. There is a growing body of research that has provided support for the utility of Skinner's framework in the understanding of communication

[2] In the present paper, the terms 'speaker' and 'listener' will be used in reference to the individual communicating a message and the receiver of the message, respectively, but these terms will refer to all types of verbal behaviour and not just vocalisations.

and in the treatment of communication difficulties (see review by Sautter and LeBlanc, 2006).

Skinner (1957) proposes that verbal behaviour will only be emitted in the presence of a listener[3] and is therefore under the stimulus control of that stimulus. Skinner contends that this stimulus control occurs because of differential reinforcement, that is, the verbal behaviour will only be reinforced in the presence of the listener and not in the absence. If an individual emits a behaviour irrespective of there being a listener present, it can not be said to be under the stimulus control of a listener. Some researchers refer to communicative behaviours that only occur when a listener is present as 'intentional' (Bates et al., 1979; Tomasello, 2001; Shwe & Markman, 2001). According to these researchers 'intentional' communication is said to occur when a speaker is aware that his behaviour has an impact on the mental state, and subsequently on the behaviour, of a listener. However, it can be difficult, if not impossible, to determine the intention of a child's early communications, so Skinner's analysis of verbal behaviour can be used to understand the causation of a communicative behaviour from observing prior events rather than from attempting to infer the mental state of the person emitting the behaviour.

In typical development, during the first 6 months of life infants will make many sounds which enable them to exert a significant amount of control over the environment (for instance, when a child cries the mother infers that he is hungry and so gives him food) (Bates et al., 1979). From early in development infants will also produce gestures that enable them to convey messages to a listener (for instance, reaching for an item will indicate to a 'listener' that the item is desired) (Bates et al., 1979). It is thought that these initial sounds and gestures may be interpreted by a listener as communicative, but that the infant may demonstrate the behaviours irrespective of whether a listener is present until around 9 months of age (Bates et al., 1979). From this age, children will only emit the behaviour when a listener is present and so the behaviour can be said to be under the stimulus control of the listener. At around 10 months, typically developing infants will begin to demonstrate more

[3] Skinner did consider that, when a person talks to himself the speaker and the listener are the same person, but when a person is not speaking to himself, verbal behaviour will only be observed when an external listener is present. Communication between people will be the focus of this paper and self talk will not be considered any further.

conventional communicative sounds and gestures whose form and function are agreed upon and recognized by both parent and child (e.g., pointing, shaking/nodding head) (Bates et al., 1979; Bates & Dick, 2002; Goodwyn, Acredelo & Brown, 2000; Laakso et al, 1999). By the end of a child's first year it is thought that an infant will be exhibiting a variety of communicative behaviours that will serve the same function as the words that are acquired in the coming months (e.g., to request and to comment) (Bates et al., 1979; Bates & Dick, 2002).

1.3.2. Function of Early Communicative Behaviours

Skinner (1957) contends that verbal behaviour consists of a number of key verbal operants, including the 'mand', the 'tact', the 'intraverbal' and the 'echoic', which will differ in function. According to Skinner each of these operants has different antecedent and reinforcement conditions. A 'mand' is a verbal operant in which *'the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation'* (1957, p35-36). In other words, the reinforcement of a 'mand' is specific to the response (e.g., a child saying "biscuit" and consequently being given a biscuit), and the antecedent which affects the likelihood of an individual demonstrating a 'mand' is the deprivation associated with the specific reinforcement (e.g., individuals are more likely to 'mand' an item of food if they have experienced a period of food deprivation). This operant is commonly referred to as a 'request' or 'demand'.

Skinner (1957) distinguishes the 'mand' from the other verbal operants by the type of reinforcement associated with it. Only the 'mand' specifies its only reinforcer, while all the other verbal operants are established and maintained by the verbal community via social reinforcers (e.g., praise). A 'tact' is occasioned by a *'particular object or event or property of an object or event'* (1975, p82) and is maintained by social reinforcers (e.g., with a plane in view a child says "plane" and the listener replies "Yes that's right"). The 'tact' is commonly referred to as a 'comment' or 'label'. An 'intraverbal' is a verbal behaviour that is occasioned by another person's verbal behaviour (e.g., a child hears "one, two, three...." and then says "four, five"). Finally, the operant known as the 'echoic' is also occasioned by another person's verbal behaviour but its form directly matches that of the other person's verbal behaviour (e.g., a child hears "ball" and then says "ball").

In typical development it is thought that a child's earliest communicative behaviours function as requests (mands) (Bates et al., 1979; Bruner, Roy & Ratner, 1982; Skinner, 1957). There are a number of reasons why requesting skills may be acquired first. Requesting skills are very important as many objects and activities need to be obtained through the mediation of another person. The ability to request would provide the individual with a means of accessing desired or needed items that are not directly accessible and so allow the individual to exhibit some measure of control over his environment (Reichle & Sigafoos, 1991b). Requests are highly reinforcing to the individual as they can produce changes in the environment that are of direct benefit to him and presentation of the desired item will provide strong reinforcement for the response, increasing the likelihood that the same behaviour will be repeated in the future (Reichle & Sigafoos, 1991a; Skinner, 1957).

It seems that in typical development there is a hierarchy of communicative forms which reflect a child's growing sophistication in producing requests. As previously mentioned, early on in development infants will emit pre-linguistic requests (e.g., reaching, whining, fussing) (Bates et al., 1979). Initially these behaviours may be directed towards the object of interest and occur irrespective of a listener being present, but over time the infant will learn that he can use other people as a means of obtaining desired objects. For instance, the infant may initially reach for a distant object to determine if he can obtain the item for himself, but then will learn that his own actions are unsuccessful and that he requires another person to retrieve the object for him; subsequently the infant will learn to emit the behaviour in the future only when a listener is present (Carpenter et al., 1998). Between 9 and 12 months an infant will begin to emit requests using more conventional gestures and sounds (e.g., pointing and ritualized reaches) (Bates et al., 1979). A ritualised reach develops when an infant continues to perform the reaching motion but it is abbreviated in form to a short open-shut hand movement aimed at the listener.

A child's pre-linguistic requests are initially 'generalised' (Reichle, 1991; Reichle & Sigafoos, 1991a) or otherwise termed 'non-referential' (Bates et al., 1979). This type of request can be ambiguous in terms of the item that is being requested because the behaviour remains the same irrespective of what is being requested (e.g., reaching/pointing). A generalised request is efficient in the sense that specific gestures/vocabulary need not be linked to specific objects, and the initial use of

generalised requesting enables the child to communicate about a large array of objects and activities with no need for discrimination skills. However, a generalised request is limited in the sense that it may require that the listener has knowledge of the child and the situation in order to interpret the speaker's utterance. This could mean that it places a large burden on the listener to respond appropriately. In comparison, a 'specific' request (Reichle, 1991; Reichle & Sigafoos, 1991a), otherwise termed a 'referential' request (Bates et al., 1979), is specifically linked to its referent. This type of request is unambiguous and so can be interpreted by anyone. It is thought that at around 13 months of age typically developing children will begin to emit referential requests where specific sounds or gestures are used in reference to particular stimuli (Bates et al., 1979).

1.4. Communication in Autism

One of the primary deficits in autism is a deficit in language and communication skills (APA, 2000), and it has been estimated that a significant number of children and adults with autism will never develop functional speech (Frea et al., 2001; Mirenda, 2003; Tager-Flusberg et al., 2005). Children with autism also show limited gestural use, tending to use motoric gestures (e.g., leading or pulling a person to indicate what is desired) rather than conventional gestures (Lal, 2010).

There are many Augmentative/ Alternative Communication (AAC) systems that have been developed to either supplement, or to provide an alternative means of, communication (Mustonen, Locke, Reichle, Solbrack & Lindgren, 1991). There are two types of AAC systems: unaided and aided (Mirenda, 2003). Unaided communication systems do not require any equipment external to the body and involve the use of symbols (e.g., British Sign Language (BSL) and Makaton). Aided communication systems incorporate devices or materials that are external to the individual who uses them. Aided approaches can be further divided into those that are selection-based, whereby the individual selects a graphic symbol from a display by pointing or scanning (e.g., Voice Output Communication Devices (VOCAs); see Lancioni et al., 2007 for a review; Sigafoos, 2005; Sigafoos, Ganz, O'Reilly, Lancioni & Schlosser, 2007), and exchange-based, whereby the individual exchanges a symbol with a communicative partner. The PECS (Bondy & Frost, 1994, Frost & Bondy, 1994, 2002) is an example of an aided, exchange-based system.

1.5. The Benefit of the Picture Exchange Communication System (PECS)

The wide range of AAC systems available means that it is very important to understand what benefit the PECS may have over the alternative communication systems.

1.5.1. Focus upon Requesting Skills

The PECS is heavily influenced by Skinner's framework (Frost & Bondy, 2002), with a focus on the function rather than the form of the responses taught. In comparison, many other communication programmes pay little attention to Skinner's framework of verbal behaviour or distinguish between the different verbal operants (Bondy et al., 2004; Sundberg & Michael, 2001). In the PECS, children are initially taught to request (or mand) items that they desire. It is thought that the skill of requesting will be more motivating for children with autism, because their social difficulties may mean that they are more reinforced by tangible reinforcement (e.g., food or toys) rather than social reinforcement (e.g., praise) (Frost & Bondy, 1994; Ganz, Cook, Corbin-Newsome, Bourgeois & Flores, 2005; Jennett et al., 2008). In comparison, other communication training programmes (e.g., the Lovaas-based approach, see Lovaas & Ivar, 1977) often begin by teaching children to label items, which is followed by social reinforcement.

1.5.2. Parallels Typical Language Development

Requesting skills are first taught in the PECS and this parallels typical development because the function of a child's earliest communications tends to be to request (discussed in section 1.3.2). In addition, Frost and Bondy (2002) contend that the PECS protocol closely parallels typical language development in that it teaches children how to communicate and then how to communicate specific messages. As noted in section 1.3.1, to communicate effectively the 'speaker' must learn to direct his behaviour towards another person. This is a key deficit in autism and so the PECS specifically teaches the child to engage in an attention-getting response (Ganz et al., 2005). Pictorial based communication systems have often relied upon children having to point to or touch pictures that correspond to objects or events (Bondy & Frost, 1993). Bondy and Frost found that children using these systems would often look away from the picture and the trainer, which meant the researchers found it difficult

to determine whether the child was attempting to communicate, and also the 'listener' could easily miss the behaviour if he had not been attending to the child at the time. By encouraging the child to exchange a pictorial symbol with a communicative partner, the PECS moves on from picture pointing systems because it ensures a listener must be present before the child is able to emit the request.

The PECS teaches children how to communicate by capitalizing on nonverbal behaviours that are already in the child's repertoire (Yoder & Stone, 2006b). The communicative partner entices the child by showing him the item that is available and then takes advantage of the child's tendency to reach towards it. Once the child reaches towards the item a second trainer prompts the child to pick up the corresponding picture and give it to the communicative partner (Bondy & Frost, 2001). In the early stages of the PECS the child is learning 'how' to communicate. Initially, there is only one item and one picture (corresponding to the item) available at a time, so the child does not learn to discriminate between pictures. This type of requesting is similar to the generalized requests that are seen in the first year of typical language development (see section 1.3.2), as the form of the behaviour remains the same across all objects (e.g., the child simply learns that any picture should be exchanged with a communicate partner to request something). In the PECS, once children have learnt how to perform this generalised request, then they are taught to emit specific requests by discriminating between different pictures and the corresponding reinforcement items (Bondy & Frost, 1994; Frost & Bondy, 2002).

1.5.3. Requires Few Prerequisite Skills

The PECS does not require any demanding prerequisite (e.g., eye contact, sitting or other attending skills, vocal and non-vocal imitation skills, complex motor movements etc.) (Bondy & Frost, 1993, 1994; Frost & Bondy, 2002). The only prerequisite skill that individuals must demonstrate before the PECS training can begin is that they can clearly indicate what they want by reaching for an item; this behaviour can then be shaped into the individuals exchanging a pictorial symbol (Frost & Bondy, 2002).

1.5.4. Pictorial Symbols are Iconic

The PECS uses pictorial symbols which can be iconic as they permit a very explicit representation of their referent (Ganz et al., 2005; Reichle, Sigafoos & Remington, 1991). Consequently, the pictures are easily recognizable and so adults working with the child do not need to be previously trained to be able to respond to a child's request (Bondy, 2001). Therefore, there will be many potential communicative partners for a child to interact with. This is essential if a communication system is to be considered truly functional, as the system must be easily understood by both familiar and unfamiliar communication partners (Doss et al., 1991; Mirenda, 2003); if the communicative partner is unable to comprehend the 'speaker's' message then the reinforcement of the communication exchange is unlikely to occur and so the skill will not be maintained. The pictures may also be easier for children with autism to understand, compared to more abstract symbols (Reichle et al., 1991). Furthermore, the pictures offer a permanent display, lessening the memory burden on the learner (Chambers & Rehfeldt, 2003).

1.6. The Effectiveness of the PECS

The PECS has become the subject of a burgeoning body of research. Preston and Carter (2009) and Sulzer-Azaroff, Hoffman, Horton, Bondy & Frost (2009) both provide comprehensive reviews of the empirical literature on the PECS, identifying 27 and 34 studies, respectively. The majority of the interpretable data comes from single subject research design studies (e.g., Adkins & Axelrod, 2001; Chambers & Rehfeldt, 2003; Charlop-Christy, Carpenter, Le, LeBlanc & Kellet, 2002; Frea et al., 2001; Ganz & Simpson, 2004; Kravits, Kamps, Kemmerer & Potucek, 2002; Marckel, Neef & Ferreri, 2006; Rehfeldt & Root, 2005; Tincani, 2004; Tincani, Crozier & Alazetta, 2006; Yokoyama, Naoi & Yamamoto, 2006) with most studies using replications across two or three participants. More recently a small number of studies have adopted a comparative group design (e.g., Carr & Felce, 2007a,b; Howlin et al., 2007; Yoder & Stone, 2006a,b).

Around half of the studies on the PECS have investigated whether the communication system enables non-speaking participants to initiate communication. The research has shown that children with autism can master the system with relative ease and in a relatively short period of time. Bondy and Frost (1993) introduced the

PECS to a Peruvian centre for children with autism and other developmental disabilities and showed that the system was rapidly acquired; of the 74 children who were trained over a 3-month period, 38% learned to use the system up to phase 1, 38% were working with phase 2, and 24% were at phase 3. Charlop-Christy et al. (2002) examined the acquisition of the PECS for three children (aged between 3 and 12 years) with autism. The researchers found that all three children successfully acquired the PECS skills up to phase 4 during an average of 170 minutes of training. Carr and Felce (2007a) showed that, with a group of 24 children (aged between 3 and 7 years) with a diagnosis of autism, just 15 hours of training was sufficient to teach them up to phase 3. Therefore, although only 3 studies (101 children in total) have been considered, the findings provide preliminary evidence that the PECS may be learnt with relative ease by children with autism. Having said that, there will be some children who find it more difficult to acquire the system, but investigators have shown that these difficulties can be overcome with only slight modifications to the typical protocol (see Ganz et al., 2005; Malandraki & Okalidou, 2007).

To be functional, a newly learnt communication skill must be generalised (e.g., used in settings other than those associated with the training) and maintained (e.g., ongoing use of the skill over time) (Ostryn, Wolfe & Rusch, 2008). Individuals with severe disabilities often fail to generalise acquired behaviours to new people, settings, tasks or materials (Carter & Grunsell, 2001; Reichle & Sigafoos, 1991b). Failure to generalise limits the usefulness of newly established communicative behaviours, because it can mean that communication is only exhibited in the teaching context. Preston and Carter's (2009) review showed that 15 of the 27 studies included generalisation of the PECS and they concluded that the findings generally indicated that some degree of generalisation had occurred. However the researchers of these 15 studies varied over what they considered generalisation to be. For instance, Yoder and Stone (2006a) considered generalisation as behaviour that occurred in an environment very different to the teaching context (e.g., different location, persons present, materials, activities and interaction style), while Adkins and Axelrod (2001) considered generalisation as simply behaviour that occurred without adult prompts. With regard to the maintenance of the skills acquired via the PECS, only five studies have provided data on this, assessing participants at a 6 to 10 month follow-up (Charlop-Christy et al., 2002; Howlin et al., 2007; Malandraki & Okalidou, 2007;

Yoder & Stone, 2006a; Yokoyama et al., 2006). The findings of these studies were mixed, although it is worth noting that Howlin and colleagues (2007), who employed a Random Controlled Trial (RCT), found that the use of the PECS was not maintained once active intervention had ceased. It appears that further research is needed to examine generalisation and maintenance following training in the PECS.

Investigators of the PECS have examined the collateral benefits of the system, including the acquisition and use of speech. Many parents and professionals are concerned that the use of the PECS may impede their child's speech development (Bondy & Frost, 2001). However researchers have shown that the mastery of the PECS can enhance the development of speech (Anderson et al., 2007; Bondy & Frost, 1994; Carr & Felce, 2007a; Charlop-Christy et al., 2002; Ganz & Simpson, 2004; Kravits et al., 2002; Lancioni et al., 2007; Yoder & Stone, 2006a). Bondy and Frost (1994) observed that 59% of children with autism, who started using the PECS before age 6 and who used the system for over a year, came to use speech as their sole modality. A further 30% were shown to use speech alongside the PECS. Kravits et al. (2002) found that a 6-year-old girl with autism showed an improvement in her intelligible verbalisations following the PECS training. Charlop-Christy et al. (2002) demonstrated that all three children with autism who were taught the PECS showed concomitant increases in verbal speech. Ganz and Simpson (2004) also showed that mastery of the PECS led to an increase in the number of words spoken and in the complexity of grammar in three children with autism. Further, in an experimental group study, Carr and Felce (2007a) found that following 4-5 weeks of the PECS training (phases 1 to 3), 5 out of 24 children showed concomitant increases in speech production and no children demonstrated a decrease in speech. In comparison, Carr and Felce found that in the control group (which did not receive the PECS training) after the same period of time only 1 out of 17 children showed a minimal increase and 4 out of 17 showed a decrease in speech.

The studies described above suggest that children taught to use the PECS may subsequently begin to use speech; however, these findings should be treated with caution. Some of the studies described above indicate that only a small proportion of children who are taught the system may acquire speech (e.g., 59% of participants in the study by Bondy and Frost (1994) and 21% in the study by Carr and Felce

(2007a)). In addition, Preston and Carter (2009) examined the data from four single subject studies that looked at speech development (Charlop-Christy et al., 2002; Tincani, 2004; Tincani et al., 2006; Yokoyama et al., 2006). Preston and Carter (2009) calculated the mean Percentage of Non-overlapping Data (PND) and the mean Percentage of data points Exceeding the Median (PEM) for the data obtained from the four studies on participants' speech before and after PECS training. These calculations are often used to analyse data from single-subject designs. The PND represents the percentage of data points collected after PECS training that were above the highest baseline data point. The PEM represents the percentage of data points collected after the PECS training that exceeded the median baseline data point. Preston and Carter calculated that the PND was 49.8% (range 19.5-100) and the PEM was 54.2% (range 25.0-100), and they surmised that the PND and PEM values were in the non-effective or at best very mildly effective range, with wide variation. Furthermore, Ganz, Simpson and Corbin-Newsome (2008) investigated the implementation of the PECS with three preschool children with characteristics of autism, with the findings demonstrating that participants did not significantly increase in their use of word approximations and intelligible words. Howlin et al. (2007) used a randomized group comparison design and examined the effectiveness of the PECS training on the communication and speech of 84 children with autism. Howlin and colleagues found that the PECS training led to an increase in participants' rates of initiations and symbol use, but the treatment had no effect on participants' rate of speech acquisition despite 7 months of experience with the system. It appears, therefore, that the effects on speech development remain unclear and so, unsurprisingly, this indicates that the PECS is most effective in providing a successful means of communication through picture exchange. In line with this, Frost and Bondy (2002) clearly state that the PECS should be taught to promote functional communication skills and not in order to teach speech.

Studies have found that the acquisition of the PECS may reduce a child's challenging behaviour. Frea et al. (2001) examined the affects of the PECS on the aggressive behaviour of a nonverbal preschooler with autism, and found that the student's aggressive behaviour was eliminated in a brief period of time when the system was in place. Charlop-Christy et al. (2002) also demonstrated that children showed a decrease in challenging behaviours following the PECS training. Children

who do not have the verbal skills to communicate their needs to others may learn to demonstrate certain behaviours that are less socially appropriate but that serve the same function as speech (Carr & Durand, 1985; Durand, 1990). The PECS may be effective at reducing challenging behaviour as the system may teach children a more socially acceptable skill that serves the same function as their challenging behaviour (e.g., to obtain a tangible/gain attention); further research is needed to test this hypothesis.

1.7. The PECS vs. Other Communication Systems

The research on the PECS has included a number of studies that examine how communication skills are acquired in the PECS compared to other communication systems. Adkins and Axelrod (2001) examined the acquisition of a requesting repertoire for one child with pervasive developmental disorder and ADHD. The child was taught to request some items using sign language and other items using the PECS. The study found that with the PECS the child met criterion within a smaller number of trials and also produced more generalisations and initiated more responses, compared to sign language. Ziomek and Rehfeldt (2008) also found that, compared to sign language, the PECS was acquired in less time and generalised more readily for adults with severe developmental delay. The PECS may be easier for some individuals to acquire compared to manual signing because it does not require complex motor movements or motor imitation skills (Chambers & Rehfeldt, 2003; Rogers & Williams, 2006). Tincani (2004) demonstrated that the acquisition of the PECS and sign language varied as a function of pre-treatment characteristics and some children with autism who had good motor imitation skills acquired sign language more successfully than the PECS.

Using a randomized group comparison design Yoder and Stone (2006a,b) compared the PECS and Response Education and Prelinguistic Milieu Teaching[4] (RPMT) for 36 preschoolers with autism. Yoder and Stone (2006a) found that the PECS was more successful that RPMT in increasing the frequency and the number of

[4] RPMT is composed of two components: (1) Response Education, which supports parents in facilitating their child's communication and language development (e.g. using linguistic mapping), and (2) Prelinguistic Mileu Teaching, which is a child-led play-based incidental teaching method designed to teach intentional communication (e.g. using verbal prompts) (see Yoder & Warren, 1998, for further details).

different words spoken without prompts, although this effect was only evident for children who began treatment with relatively high object exploration (e.g., an interest in objects and desire to touch and play with them). For children with initially low object exploration RPMT proved to be more successful. This difference in results may be because both the PECS and RPMT use access to objects as reinforcement for the behaviours taught, but the RPMT may be more likely to directly teach children that objects are interesting, which could be necessary for children who initially have low object exploration. In a second article, Yoder and Stone (2006b) examined the effect of the interventions on initiating joint attention, requesting and turn-taking. They found all three behaviours increased significantly for both interventions. Again, the study found differing effects according to participants' pre-treatment characteristics. The PECS was more successful for participants who were poor at initiating joint attention prior to treatment, while the RPMT was more successful for participants who were higher in this skill.

The findings of these studies indicate that the PECS may not be the most effective AAC for all children with autism and pre-treatment characteristics should be taken into account. Currently, there is not any formal evaluation procedure to determine for whom the PECS may be best suited (Ostryn et al., 2008) and so this will be an area where further research is needed. It seems that, from the research so far, children who would be most suited for the PECS would be those who have weak motor imitation skills, have good object exploration but are poor at initiating joint attention.

1.8. Spontaneous communication

It is evident that, although more research is needed, there is a growing body of literature on the PECS which has shown that the communication system is proving to be a successful mode of basic communication for children with autism. However, there seems to be little research on the context in which children use the PECS, specifically whether they can use the system to make spontaneous requests. It is important that children can make spontaneous requests because it will enable them to demonstrate the skill flexibly and without having to rely on external factors. The benefit of spontaneous requesting will be considered further in section 1.8.2 as to

understand fully why spontaneous requesting is important it is first necessary to seek clarification on what 'spontaneity' is.

1.8.1. Definition of Spontaneity

There does not seem to be a consensus amongst researchers on the definition of the term 'spontaneity', with researchers' views varying greatly over the antecedent conditions that they associate with a spontaneous response (Chiang & Carter, 2008; Ostryn et al., 2009; Reichle & Sigafoos, 1991b; Reichle et al., 1991). Clarification of the term 'spontaneity' will be achieved by consideration of Skinner's (1957) analysis of Verbal Behaviour and the continuum model of spontaneity (Carter, 2003a, 2002; Carter & Hotchkis, 2002; Chiang & Carter, 2008).

1.8.1.1. Spontaneity and Verbal Behaviour

Skinner (1957) proposed that the antecedent conditions, as well as the consequences, are important in determining the function of a verbal behaviour. Skinner proposed that all verbal behaviour is under the control of certain antecedent conditions and will only occur in the presence of those antecedents and not in their absence. Skinner defined the mand as a verbal operant that is under the control of states of deprivation or aversive stimulation. For example, children are more likely to mand a sweet if they have experienced a period of sweet deprivation, and are less likely to emit the mand if they have just eaten many sweets and are satiated. Michael (1982, 1993, 2000) has since clarified the nature of the types of events that exert functional control over manding. Michael used the term Establishing Operation (EO) and defines this as: *'any change in the environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behaviour that has been followed by that reinforcement'* (1982, p150). An example of an EO is depriving an individual of food: firstly, it alters the effectiveness of reinforcers by increasing the reinforcing effectiveness of food; secondly, it alters the frequency of behaviours associated with the reinforcing events by evoking behaviours that have a history of leading to food consumption (Michael, 1993).

Michael (1993) distinguished between two types of EO: the Unconditioned EO (UEO) and the Conditioned EO (CEO). Michael defined UEO as being unlearned

and depending for its effectiveness on the evolutionary history of the species (e.g., food deprivation). CEOs involve the presentation of stimuli that were previously motivationally neutral but through teaching have become paired with another EO or with a form of reinforcement or punishment. Applied researchers have manipulated the CEO by utilizing a behaviour chain interruption strategy (BCIS) (see review by Carter & Grunsell, 2001). In the BCIS a situation is contrived whereby a well rehearsed routine is interrupted by removal or non-occurrence of an object. The routine cannot be completed unless a request for that object occurs, which subsequently increases the effectiveness of the missing item as a reinforcer, thereby motivating the individual to request the missing item. For instance, when an individual is about to brush his teeth a partner may hide the toothpaste, such that the learner must emit a request for the toothpaste before the routine can continue.

As noted in section 1.3.1, Skinner (1957) claimed that manding, as with all verbal operants, is also under the control of the presence of a listener, and so this stimulus (the listener) serves as a discriminative stimulus (S^D). Michael (2000) differentiates between the EO and S^D, by noting that the EO is associated with the effectiveness of the reinforcement, while the S^D is a stimulus that is associated with differential availability of a reinforcer (e.g., the response is repeatedly reinforced in the presence of that stimulus and not in its absence). This differential reinforcement causes stimulus control to occur such that the behaviour will only be emitted in the presence of the S^D (Michael, 1993). According to Michael, in the absence of the S^D the unavailable reinforcer would have been just as effective if it had been obtained, such that the EO may exist when the S^D is not present. A mand is typically under the stimulus control of the presence of a listener, because only when a listener is present can the request be honoured and the behaviour reinforced (McDevitt & Fantino, 1993; Michael, 2000).

The mand is, therefore, said to be under the control of the EO and the presence of the listener. Skinner (1957) discussed that a verbal operant may be under sources of multiple control and if so should be considered ‘impure’. Bondy et al. (2004) expanded on the notion of impure verbal operants, noting that if a mand is under the stimulus control of sources associated with the intraverbal (e.g., verbal prompts) it would be considered a mand-intraverbal, and if it were controlled by

sources associated with the tact (e.g., the presence of the item) it would be considered a mand-tact (see Table 1.2).

Table 1.2. Summary of Skinner's Verbal Operants

Verbal Operant		Antecedent Conditions	Behaviour	Consequence	Example
Pure Mand		Establishing Operation (EO)	Verbal Behaviour (VB)	Receipt of a specified reinforcer	EO > "I want biscuit" > receive biscuit
Impure Mand	Mand-Tact	EO plus specific aspect of environment	VB	Receipt of a specified reinforcer that is visible in the environment	EO + biscuit in view > "I want biscuit" > receive biscuit
	Mand-Intraverbal	EO plus verbal behaviour of another person	VB	Receipt of a specified reinforcer plus educational reinforcer	EO + hear "what do you want?" > "biscuit" > receive biscuit and praise
	Mand-Echoic	EO plus verbal behaviour of another person	VB that is identical to speakers VB	Receipt of a specified reinforcer plus educational reinforcer	EO + hear "biscuit" > "biscuit" > receive biscuit and praise

Note. The presence of the listener has not been included in the table as it applies to all verbal operants.

1.8.1.2. Continuum Model of Spontaneity

Some researchers contend that spontaneity in communication should not be seen as an all-or-none phenomenon, but instead conceptualized on a continuum (Carter, 2002, 2003a,b; Carter & Hotchkis, 2002; Charlop, Schreibman & Thibodeau, 1985; Chiang & Carter, 2008). Charlop and colleagues (1985) were the first to discuss a continuum approach, and then Halle (1987, cited in Carter & Hotchkis, 2002) offered the first detailed model (see Figure 1.2). According to the continuum model, spontaneity is the degree that an observer can discern controlling stimuli (Carter & Hotchkis, 2002). An individual's response may be controlled by a range of

stimuli and the more discernable the controlling act, the less spontaneous the response is considered to be. In Halle's model the first three levels (from left to right) are considered to be the most discernable controlling stimuli, referring to prompts from another person, moving from the most intrusive prompts (physical guidance) to the least intrusive (questions e.g., "What do you want?"). The presence of objects or events refers to the next level on the continuum, followed by the presence of the listener (e.g., the listener is already present and attending to the speaker, so the speaker does not have to seek the listener's attention). The final level of the continuum model represents the highest level of spontaneity, which is associated with interoceptive (e.g., hunger/thirst) and contextual stimuli.

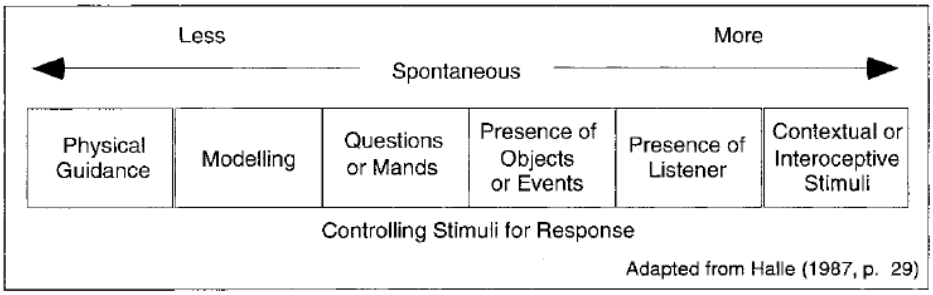

Figure 1.2. Halle's continuum model of spontaneity (extracted from Carter & Hotchkis, 2002, p 175)

The continuum model has been used in relation to communication in general; however, there are some problems with this model when the different verbal operants described by Skinner (1957) are considered. 'Tacts', for instance, will only occur in the presence of the referent and so there will always be a discernable stimulus when this verbal operant is observed; it would therefore seem mistaken to consider this communicative behaviour as not fully spontaneous and so the continuum model seems to be more applicable to requesting ('manding') skills specifically. With this in mind, the continuum model is in line with Skinner's notion that a fully spontaneous request is associated with interoceptive cues and will occur without the requested item in sight. The continuum model also adds to the understanding of spontaneity by discussing the influence of contextual cues.

Carter and colleagues (Carter, 2003a; Carter & Hotchkis, 2002) propose that an individual should be able to generate communicative acts across the whole of the spontaneity continuum, and that higher levels of spontaneity are not always desirable, so a competent communicator will demonstrate varying levels of spontaneity

depending on the context. For instance, on some occasions it may be appropriate to ask for something that is not visible, while on other occasions it may be more appropriate to only request items that are in view. Thus, while Skinner's framework focuses upon requesting behaviour resulting from the need of the individual (e.g., does the individual request food when he is hungry?), the continuum model considers whether the behaviour is contextually appropriate (e.g., does the individual request food at an appropriate time?). It is of course important that both factors are taken into account; requests that appear totally unrelated to contextual cues may be considered deviant in some situations (e.g., a child requesting an ice cream during the school assembly), but there will be times when an individual should be able to make requests irrespective of whether it is contextually appropriate at that time (e.g., an individual requesting food when he is starving). Thus, it may be more accurate to consider requesting behaviour on two dimensions rather than on a single continuum, with both the need of the individual and the appropriateness of the context taken in to account.

A further difference between Skinner's framework and the continuum model is related to the stimuli that could evoke a fully spontaneous response. Carter and colleagues (Carter, 2002, 2003a,b; Carter & Hotchkis, 2002; Chiang & Carter, 2008) contend that even the most spontaneous requests will be associated with naturally occurring contextual stimuli. Carter and Hotchkis (2002) note that a context is considered natural when the behaviour occurs in an appropriate place, with an appropriate person and at an appropriate time of day. Therefore, it would seem that the contextual cues could act as a CEO that increases the effectiveness of a reinforcer (e.g., a child requests a spoon when given a yoghurt but nothing to eat it with). However, it seems that the contextual cues may also serve as S^D. The cues that could serve as a S^D could be a place, person or time of day that the child has learnt to associate with access to a desired food or activity, and so the child only requests the food or activity when those contextual cues are present. These contextual cues can be considered as a S^D because they signal the increased availability of particular reinforcers rather than increasing the effectiveness of the reinforcer (e.g., a sweet shop will signal an increase in the availability of sweets, but the effectiveness of sweets as a reinforcer will be the same if the sweets were received when the child was in the sweet shop or in the classroom).

Therefore, while Skinner's framework describes a fully spontaneous request as being under the control of the presence of the listener and the EO alone, the continuum model also suggests that the request may be under additional S^D that serve as contextual cues. Despite the differences in the two frameworks, both contend that a request should not be considered as fully spontaneous if it occurs when the requested item is in sight. Reichle and Sigafoos (1991b) stated that probably the most widely used definition of spontaneity refers to any communicative behaviours that occur without prompts or instructional cues from another person (including vocal, gestural, or physical prompts), and this appears to remain true today (Chiang, 2009), such that researchers who examine spontaneous requesting in children with autism tend not to take account of the presence of the desired item.

1.8.2. Why is Spontaneous Requesting Important?

Fully spontaneous requests emerge early in typical development. The research from Bates et al. (1979) showed that in typical development an infant's earliest requests occur without prompts from another person, and Bruner et al. (1982) found that requests for items/events that are not visible begin to emerge in typically developing children from as early as 14 months of age. Requests for items out of sight may emerge around this time because, as noted in section 1.3.2, it is when children begin to demonstrate referential communication (Bates et al., 1979), which would enable them to effectively request objects that are not in sight as the listener will not require contextual cues to correctly infer what is being requested.

There is, however, a lack of research on communicative spontaneity in typically developing children (Carter & Hotchkis, 2002). Specifically there is paucity of data on when typically developing children begin to emit requests for items that are not visible and, once children have become proficient at requesting, what proportion of their requests are for items out of sight. Carter and Hotchkis (2002) contend that the dearth of normative data on the variables that occasion the requests of typically developing children means that it is difficult to determine what constitutes 'normal' levels of spontaneous requesting.

Despite the lack of research it is apparent that from early on typically developing children will emit requests without prompts from another person and for items that are not in sight. Ostryn and colleagues (2008) argued that spontaneity is

important for communication competence (the ability to functionally communicate in any setting and/or for any reason). Requests that occur without prompts from another person are important as they allow an individual to instigate and terminate an interaction when he chooses (Reichle & Sigafoos, 1991b): this means the individual does not have to rely on partners to anticipate communication, thereby giving him a greater ability to control his environment (Carter & Grunsell, 2001; Carter & Hotchkins, 2002; Reichle & Sigafoos, 1991b), and it reduces the demand on the communicative partner to anticipate the individual's needs (Carter & Grunsell, 2001). Requests that occur without the item in sight will also give the individual more control over his environment because they allow him to emit requests based on internal cues (Carter & Grunsell, 2001; Carter & Hotchkis, 2002; Skinner, 1957): this means, for example, that when the individual is hungry or thirsty he can request food or drink irrespective of whether the item is in sight. Spontaneous requesting skills are thus functional because they enable individuals to demonstrate the skill flexibly and without having to rely on external factors.

1.8.3. Current Research on the 'Spontaneous' use of the PECS

Frost and Bondy (2002) set out in the training manual that the PECS aims to develop 'spontaneous' communication, but they define spontaneity with regard to prompts from another person (physical and verbal) and not in relation to visual cues. A search of the literature was conducted to examine the current evidence on the spontaneous use of the PECS[5]. Studies were included if they specifically examined 'spontaneous' outcomes (these studies are shown in Table 1.3) or they examined whether the PECS was used to request out of sight items (these studies are shown in Table 1.4).

Only a small number of studies have specifically examined the 'spontaneous' use of the PECS (e.g., Adkins & Axelrod, 2001; Carr & Felce, 2007b; Ganz & Simpson, 2004; Heneker & MacLaren-Page, 2003; Kravits et al., 2002; Malandraki & Okalidou, 2007; Schwartz, Garfinkle & Bauer, 1998; Tincani et al., 2006) (see Table

[5] Empirical studies on the PECS that had results relating to spontaneity were identified through computerized searches using Google Scholar. The descriptors used were "PECS" or "Picture Exchange Communication System" and also, to narrow the search, "spontaneous" or "spontaneity" or "pure mands" or "referent/item/object not in sight". In addition, once articles had been identified through the computerised search, a manual search of the reference lists in the articles was conducted.

1.3.). All these studies reported that spontaneous outcomes occurred following PECS training. However, of these studies, most researchers either failed to clarify how they defined 'spontaneity' (Adkins & Axelrod, 2001; Malandraki & Okalidou, 2007) or defined spontaneity according to prompts from another person and did not take account of the presence of the requested item (Carr & Felce, 2007b; Ganz & Simpson, 2004; Kravits et al., 2002; Schwartz et al., 1998; Tincani et al., 2006). A few studies report spontaneous outcomes in regard to instances of speech that emerged following the PECS training (e.g., Carr & Felce, 2007a; Charlop-Christy et al., 2002; Yoder & Stone, 2006), but these researchers also only take account of prompts from an adult. It should be noted that some researchers report the 'independent' use of the PECS (e.g., Tincani, 2004); however, this term is not synonymous with spontaneity, as researchers define 'independent' use as behaviour that occurs without prompts from another person so, again, the presence of the requested item is not taken into account.

Only the study by Heneker and MacLaren-Page (2003) defined spontaneity in relation to the presence of the requested item (the outcomes of this study will be considered shortly). There were a further few studies identified which considered whether individuals use the PECS without the requested item being present, although the researchers of these studies did not specifically refer to this as 'spontaneous' communication (Chambers & Rehfeldt, 2003; Ganz & Simpson, 2004; Marckel et al., 2006). Thus, four studies were found that took into account the presence of the requested item when reporting PECS use; these are shown in Table 1.4. The criteria used to compare the four studies were: (a) whether the researchers directly manipulated the presence of the requested items; (b) whether the researchers manipulated participants' need for out of sight items (e.g., capturing/contriving the EO); and (c) whether the researchers conducted correspondence checks on requests for out of sight items (the importance of which will be discussed shortly).

Table.1.3. Summary of the PECS studies reporting 'spontaneous' outcomes.

Authors	Participants	Diagnosis	Ages	Research Design	Outcomes Examined		Definition of 'Spontaneity'
					'Spontaneous' PECS Use	'Spontaneous' Speech	
Adkins and Axelrod (2001)	1	Pervasive Developmental Disorder	7 years	Single-subject (alternating treatment)	X [a]	_	None given
Carr and Felce (2007a)	10	Autism	3-7 years	Comparative group design	_	X [a]	Without prompts from another person
Carr and Felce (2007b)	41	Autism	3-7 years	Comparative group design	X [a]	_	Without prompts from another person
Charlop-Christy et al. (2002)	3	Autism	3-12 years	Single-subject (multiple baseline)	_	X [a]	Without prompts from another person
Ganz and Simpson (2004)	3	Autism	3-7 years	Single-subject (changing criterion)	X [a]	_	Without prompts from another person
Heneker and MacLaren-Page (2003)	Two groups, numbers not specified	Autism	6-11 years	Pre-experimental	X [a]	_	Used Halle 's (1987) continuum model of spontaneity
Kravits et al., (2002)	1	Autism	6 years	Single-subject (multiple baseline)	X [a]	X [a]	Without prompts from another person
Malandraki and Okalidou (2007)	1	Autism	10 years	Case Study	X [a]	_	None given
Schwartz et al. (1998)	31	16 autism/PDD-NOS	3-6 years	Pre-experimental	X [a]	X [a]	Without prompts from another person
Tincani et al. (2006)	3	Autism	9-11 years	Single-subject (multiple baseline)	X [a]	_	Without prompts from another person
Yoder and Stone (2006a)	36	Autism/ PDD	21-54 months	Comparative group design (RCT)	_	X [a]	Without prompts from another person

Note. 'X' indicates behaviour examined. Dashes indicate behaviour not examined. [a] Positive outcomes reported

Table 1.4. Summary of the PECS studies reporting requests for out of sight item

Authors	Participants	Diagnosis	Ages	Research Design	Level of PECS	Dependent Variables	Did participants emit PECS Requests for Out of Sight Items?	Presence of Requested Items Directly Manipulated	What was the EO?	Correspondence Checks
Chambers and Rehfeldt (2003)	4	*'Severe Developmental Disabilities'*	19-40 years	Single-subject (alternating treatment)	Phases I to III taught	Use of PECS vs. manual signing	✓ Participants more likely to request out of sight items with the PECS compared to signing.	✓ 'Preferred' items removed from view to see if participant would request them.	Participants taught to request their 'preferred' items when visible. Then 'Preferred' items placed out of view.	×
Ganz and Simpson (2004)	3	Autism	3-7 years	Single-subject (changing criterion)	Phases I to IV taught	Use of PECS and Speech	✓ 1 participant began requesting out of sight items using PECS during phase III of training	×	Participants taught to request their 'preferred' items when visible. Then communication observed when 'preferred' items out of view.	×
Heneker and MacLaren-Page (2003)	Two groups, numbers not specified	Autism	6-11 years	Pre-experimental	PECS taught, level reached by participants not specified	Use of PECS	✓ Most requests occurred in presence of the requested item.	×	Not manipulated	×
Marckel et al. (2006)	2	Autism	4-5 years	Single-subject (multiple baseline)	Criteria for participants was *'Independent use of the PECS stimuli to make requests'* (level not specifically assessed)	Use of PECS (improvised requests using descriptors when specific symbols unavailable)	✓ Participants used the PECS to make improvised requests for out of sight items; this was not formally assessed.	×	Participants' taught to request their 'preferred' items when visible. Then communication observed when 'preferred' items out of view.	×

In the study by Heneker and MacLaren-Page (2003), children who had been trained in the PECS were observed in a number of different contexts (e.g., free play, snack time, structured teaching). The researchers used Halle's (1987) continuum model of spontaneity to assess outcomes. The researchers commented that the older participants requested out of sight items during free play sessions (the frequency of these requests was not reported). The researchers concluded, however, that the presence of the requested object or event was the main level of stimulus to which participants were responding. The results of this study should be treated with caution as the research design was weak, the researchers simply carried out an on-line observation of participants during a school day with there being no experimental control.

Chambers and Rehfeldt (2003) taught four adults with developmental disabilities requests using the PECS and manual sign. One of the dependent measures was a comparison of the number of requests emitted when the reinforcing items were not in sight. Participants were found to be more likely to request items when the items were out of sight using the PECS than manual signs. The researchers concluded that the pictorial symbols themselves most likely provided a visual prompt that increased the likelihood of participants making requests for items out of sight with the PECS compared to manual signing, although this was not formally tested. This study was carried out with adults with developmental delay, which limits whether the findings can be generalised to children with autism (who are the focus of the present literature review); however, the authors remarks may provide an indication that the direct presentation of the PECS folder and pictures could influence the use of the PECS for children with autism (this will be considered further in section 1.8.4.2.).

Ganz and Simpson (2004) examined the PECS use in three children with autism, and reported that following the PECS training one participant began requesting items that were not in his visual field. Marckel et al. (2006) taught two children with autism who used the PECS to use descriptor symbols (for functions, colours and shapes) to request desired items when the specific corresponding picture was unavailable. For instance, the children were taught to request a cookie by placing a symbol for 'eat' and a symbol for 'circle' on a sentence strip. The therapist and parents involved in the study were reported to have commented that the children used

the newly learnt skill to request out of sight items; however, this skill was not formally observed.

In addition to the limitations already discussed, the results of the studies shown in Table 3 are further limited because, firstly, only the study by Chambers and Rehfeldt (2003) directly manipulated the presence of the requested items, and this study was carried out with adults with developmental delay, not children with autism, who are the focus of the current literature review. Secondly, Heneker and MacLaren-Page (2003) observed children during a 'typical' school day and so did not attempt to contrive an EO, and in the other studies the EO involved the removal of participants' 'preferred' items from view (only in the study by Chambers and Rehfeldt (2003) was this done directly). It is possible that the EO in these studies may not have been effective at increasing the reinforcing value of the missing items, and if so the studies would not have tested participants' ability to emit spontaneous requests under optimum conditions.

Furthermore, the studies are limited as none of the researchers conducted correspondence checks. A correspondence check involves having the individual select from an array of items after he has made a request, to assess the correspondence between the item requested and the subsequent item selection (Sigafoos et al., 2007). It has been found that individuals with developmental delay may emit requests that do not correspond to what they desire, and that they may accept any object they are given irrespective of whether the item corresponded to the request they had made (Sigafoos et al., 2007; Yamamoto & Mochizuki, 1988). For this reason it is important to conduct correspondence checks as they will ensure that participants are requesting an item that is not in view as opposed to making an incorrect request for an item in sight.

There is evidently a paucity of evidence examining whether children with autism use the PECS to emit spontaneous requests. Ostryn et al. (2008) conducted a review of the literature on the PECS and concluded that more research is needed to examine whether the system is used spontaneously. The researchers specified that future research is needed which: (a) uses an operational definition of spontaneity; (b) records instances of pictorial requests that occur when the item is in and out of sight; and, (c) demonstrates whether these requests are for items found in the child's natural environment.

1.8.4. What Factors May Impede Spontaneous PECS Use?

1.8.4.1. Teaching Conditions of the PECS

During the PECS training the items that the child is taught to request tend to be visible. This enables communication to be initiated by the child (e.g., when the child reaches for the desired item he can be prompted to exchange a pictorial symbol). In the PECS manual Frost and Bondy (2002) suggest that, once children are using the PECS to request items in view, they should be taught to request items out of sight (p145 & 278). However, in the authors opinion the researchers' suggestions on how to do this are brief and rather nebulous, and also the suggestions are not included in the structured teaching procedures so it is possible that this step has been overlooked as yet. If the PECS is taught only when the requested item is in sight there is reason to suspect that children will only use the system on future occasions when the same conditions are in place.

As noted earlier, individuals with severe disabilities often fail to generalise acquired behaviours to new people, settings, tasks or materials (Carter & Grunsell, 2001; Reichle & Sigafoos, 1991b). In line with this, several investigators have discussed that lack of spontaneity may be attributed to the procedures used to teach AAC systems, proposing that children with developmental disabilities may tend only to emit communication responses under the same conditions in which the communication was taught (Carr & Kologinsky, 1983; Carter, 2002; Chiang & Carter, 2008; Hall & Sundberg, 1987; Reichle & Sigafoos, 1991c; Sundberg & Michael, 2001).

Skinner (1957) said that a request that is learnt in the presence of a specific stimulus may not occur in the future unless that stimulus is present. This occurs due to stimulus control; if certain stimuli are always present during training (e.g., verbal cues, presence of the referent) these stimuli may come to be associated with reinforcement of the taught behaviour and come to serve as S^D. In support of this Carr and Kologinsky (1983) taught six children with autism to respond using sign language when shown a specific item and asked "What is it?". If the children emitted a correct sign they received the corresponding reinforcer, so the children learnt to emit a multiply controlled operant (a tact-mand-intraverbal). The researchers found that without further training the children did not use the newly learnt signs to emit pure

mands (e.g., when the item was not in sight and the question was not asked). Further, Partington, Sundberg, Newhouse and Spengler (1994) showed that a 6-year old girl with autism who learnt to emit tacts when asked "What is that?"(a tact-intraverbal) failed to emit tacts when the prompt was not given.

This suggests that, in the PECS, if requesting behaviour is taught only when the referent is in view, the behaviour may be unlikely to occur when the item is not present without additional training.

1.8.4.2. The Reinforcing Practises of the Community

The reinforcing practices of the community may affect levels of spontaneity as it is these reinforcing practises that determine a child's future use of an AAC system. According to Skinner (1957) if a child's requests do not receive immediate reinforcement the frequency of his requests may decline until the behaviour is completely extinguished. Carter (2003b) examined the circumstances under which different AAC systems were used and the consequences of communication. He found that the more spontaneous the communicative act, the less likely that it would result in delivery of the requested item or activity. According to Carter this lack of responsiveness may be because spontaneous acts are less likely to be anticipated by the communicative partner, which means that the act could be missed and so not responded to, or the act may be refused because the timing was not appropriate (e.g., a request for food outside normal meal times). Carter found that outright denial of requests appeared to be relatively infrequent; however, there were instances when spontaneous requests were followed by a delay because requested items were not immediately available. This suggests that, in the PECS, lack of spontaneity may occur because spontaneous responses are less likely to be immediately reinforced and subsequently the behaviour could become extinguished.

Carter (2002) proposed that a lack of spontaneity may arise because of learned helplessness (Seligman, 1975), which occurs when outcomes are perceived to be independent of an individual's actions. The individual learns that he has no control over consequences, and so there is a lack of motivation to initiate behaviour. Carter (2002) contends that learned helplessness may be particularly evident in children with severe communication difficulties, as they are likely to be highly dependent on assistance from others and their caregivers may be more likely to anticipate all the

child's needs, such that the child does not have the opportunities to learn how to control his own environment.

Reinforcement associated with the PECS materials themselves may also impact on spontaneity. Carter (2003b) demonstrated that the materials for aided AAC systems (not specifically PECS) were largely inaccessible to the user, and that use of the systems was dependent on teacher presentation of the materials. In the PECS, if children's requests are more likely to be reinforced after the pictures and folder have been directly presented in front of them, these conditions may come to be associated with increased availability of the reinforcer and so the presentation of the materials may come to serve as a S^D. It is important that these conditions do not become a S^D as individuals who are proficient in the PECS will need to actively move to a PECS folder and select pictures from inside the folder (Frost & Bondy, 2002), i.e., the folder or pictures will not always be directly visible. At the time of writing the current paper, no studies on the PECS that investigated this issue were found.

1.8.5. How can spontaneity be promoted?

If children are unable to use the PECS to emit requests for items not in sight it would be necessary to teach this skill to them directly.

1.8.5.1. Teaching Pure Mands

The PECS is taught when the requested items are in sight as this encourages the child to initiate the interaction. If the item was not in sight the interaction would have to be initiated by a verbal prompt (e.g., the child is asked "What do you want?" or hears a modelled response, for instance, "biscuit"), but then the child would be learning to emit a mand-intraverbal or mand-echoic respectively. An alternative strategy could be the use of the BCIS; Carter and Grunsell (2001) concluded, in a review of the literature of the BCIS, that it is an effective strategy to teach individuals with severe disabilities to emit pure mands. However, the BCIS can only be used to teach children to request items that form part of a routine and not a favourite food/toy/activity. It is these highly preferred items/activities that children are first taught to request during the PECS training. Children's ability to emit spontaneous requests for these items would give them the greatest degree of control over their environment, as these items will form part of their natural environment and be what

they are most motivated by. The BCIS would only be a useful method for teaching children to emit pure mands if individuals are able to generalise this skill to emit pure mands for items that have not been specifically taught. In 2001, when Carter and Grunsell conducted their review, there was no evidence to show whether the ability to emit pure mands generalised to items that did not form part of a routine. A current search of the literature indicated that this gap in research is still evident to date.

It appears that it would be difficult to teach children to request a favourite food or toy without those items being in sight. In addition, there are advantages to initially teaching children to emit mand-tacts. Most notably, that it encourages children to initiate interactions by reaching for the desired item. Also, children's desire for an item may increase when they see the item (Skinner, 1957), and so having preferred items visible may increase the opportunities to teach requesting skills. Furthermore, initially teaching mand-tacts may provide the opportunity to begin to train two verbal operants at the same time. Arntzen and Almas (2002) propose that, while additional training may be required to teach children to emit pure mands or pure tacts, overall the training needed to help children acquire both verbal operants will be less than if the mand and tact were taught separately.

Therefore, it would seem that the present protocol for PECS, in which the referent is in sight, is the most advantageous method; however, once children are reliably emitting requests for items that are in view, procedures may need to be put in place to promote spontaneity.

1.8.5.2. Transfer of Stimulus Control

Bloh (2008) contends that transfer of stimulus control occurs when behaviour initially evoked by one stimulus comes under the control of a different stimulus. Carter and colleagues have said that transferring stimulus control along the spontaneity continuum, from more intrusive to less intrusive stimuli, could facilitate the development of spontaneity (Carter, 2002; Carter & Grunsell, 2001; Carter & Hotchkis, 2002). There is much literature on behaviour analysis that shows how to transfer stimulus control through: (a) fading procedures, which involve systematically reducing the amount or magnitude of the assistance provided; and (b) time delay procedures, which involve introducing a designated pause before delivery of an

instructional prompt (e.g., Barbera and Kubina, 2005; Bloh, 2008; Reichle & Sigafoos, 1991b; Walker, 2008).

Only a few studies have described methods to bring the mand under the primary control of the EO and a listener (Carr & Kologinsky, 1983; Carr & Durand, 1985; Sweeney-Kerwin et al, 2007). Carr and Kologinsky (1983) trained children with autism to request out of sight items using sign language. The researchers aimed to identify a procedure that would facilitate spontaneous requesting by bringing signing under the control of broadly defined stimuli (e.g., adult attention) rather than narrowly defined stimuli (e.g., the presence of the object or verbal prompting). To promote transfer the researchers used a combination of prompting, fading, and differential reinforcement. In the training sessions the teacher approached the child and presented an imitative prompt for one of the reinforcer items, thereby teaching the child to emit an echoic-mand. When the children imitated the sign they received a small piece of the corresponding reinforcer which had previously been out of sight. The imitative prompt was gradually faded to transfer stimulus control from imitative prompts to the mere presence of an attending adult. This intervention led to an increase in the children's rate of spontaneous signing.

Carr and Durand (1985) taught four children with developmental delay to request attention or help from adults as an alternative to their challenging behaviour; the EO was manipulated by varying task difficulty to establish the effectiveness of adult attention or help as reinforcers. The researchers initially taught these skills using an echoic prompt which was then systematically faded. This method proved successful at bringing the mands under the primary control of the EO and the listener.

Sweeney-Kerwin et al. (2007) provided the first study to use rolling time delay and prompt fading procedures to free the mand from control of the presence of the item (mand-tact) and so bring the mand under the control of the EO and listener alone (pure mand). The researchers first assessed whether two participants with autism (aged 3 and 7 years) were able to emit pure mands during observation sessions where the targeted items (which had previously been identified as the participants' preferred items) were out of sight. After a lengthy assessment period it was revealed that the children were only able to emit mands (in the form of speech and gestures) for visible items. Subsequently, experimental sessions were conducted where the targeted item

was initially presented to the child and then a two-minute time delay occurred where the item was placed out of view. If the participant manded the item within the two-minutes, but at least 15 seconds after the item had been removed from view, the response was recorded as a pure mand. If a mand had not been emitted within the two-minute interval then the item was displayed again as a prompt for the mand. This procedure continued for a three-hour session. The study found that within the first teaching session participants began to emit pure mands, suggesting only a few prompts were needed to produce EO-controlled mands. The study used a multiple baseline design across behaviours, such that once the child emitted pure mands for the first targeted item, a second item was then subjected to the independent variable and so on. Prior to each experimental session a 30-minute observation was conducted without the item in sight to examine when the pure mands emerged. It was found that participants begun to emit pure mands for specific targeted item once teaching for the item had begun, suggesting that the transfer from mand-tacts to pure mands had occurred as a consequence of the stimulus-transfer procedures. The researchers also found that, once pure mands began occurring, the transfer from mand-tacts to pure mands rapidly occurred for the other items. The results should be treated with caution, however, as the researchers did not use correspondence checks to ensure the participants were requesting items out of sight.

As discussed in section 1.8.4.1, in the PECS manual Frost and Bondy (2002) do briefly discuss the need to create opportunities for the child to make requests when the items are not present (e.g., putting an item away immediately after the child has requested and received it, to see if he will request the item again). However, it is unclear how effective these suggestions would be at promoting spontaneity as, at the time of writing this literature review, the author was unable to find any research on the PECS that looked at stimulus-transfer procedures.

1.8.5.3. The Reinforcing Practises of the Community

The more frequently a behaviour is emitted and reinforced, the more likely it is that it will be maintained (Michael, 2000; Reichle & Sigafoos, 1991c; Skinner, 1957). In line with this, Frost and Bondy state that during the PECS training it is important that the child is given as many opportunities as possible to make requests. Carter (2003b) contends that during training communicative partners need to

anticipate possible requests and attempt to ensure relevant items are available, to ensure the consistent reinforcement of emergent spontaneous communicative behaviour. Furthermore, it is important that the likelihood that a child's pictorial requests are reinforced is not associated with visual prompts, such as the presence of the item or the close proximity of the PECS folder/pictures.

Michael (2000) proposed that a behaviour can be extinguished if the reinforcement is equally available in the presence of a behaviour as it is in its absence. This suggests that if a desired item is given to a child when he uses means other than making a pictorial request (e.g., generalised requests such as pointing or displaying challenging behaviour) then his pictorial requests may be extinguished. Drash and Tudor (1993) found that parents of children with verbal delay unintentionally yet systematically reinforced generalised mands (e.g., reaching towards an object, pointing). It is, therefore, important that when children can make requests using the PECS, adults encourage children to use this skill by not responding to other, less appropriate behaviours that serve the same function.

1.9. Conclusion and Directions for Future Research

Children with autism have poor communication skills and it is fundamental that these skills are targeted during early intervention programmes. The PECS is evidently an effective means of communication for children with autism but there are still some areas where further investigation is needed. In particular, there is little research on the PECS examining whether children make requests that are fully spontaneous. The present literature review has shown that both Skinner's analysis of verbal behaviour and the continuum model (Carter, 2003a, 2002; Carter & Hotchkis, 2002; Chiang & Carter, 2008) provide useful frameworks for considering the notion of spontaneity. According to Skinner's framework a spontaneous request can be considered as a 'pure mand' that is solely under the control of the presence of the listener (S^D) and the EO (either conditioned or unconditioned). The continuum model of spontaneity highlights the importance of also taking into account the context in which a request is emitted, and suggests that, in addition to the listener and EO, a fully spontaneous request would be associated with contextual cues. Both models, however, contend that a request should not be considered as fully spontaneous if it occurs when the requested item is in sight.

This literature review has shown that there are a number of reasons to suspect that some children who learn to use the PECS may only do so when the item is in sight and so may not be able to make requests that are considered as fully spontaneous, because of the teaching conditions that are adopted and because of the reinforcing practises of the community. Therefore, further research is needed on the PECS that examines whether children with autism use the system to emit spontaneous requests. If it was found that a child's pictorial requests were not fully spontaneous then this literature review has provided a number of ways that spontaneity could be promoted, by adopting procedures for transfer of stimulus control and by ensuring appropriate reinforcement of a child's communications. Further research on the antecedent conditions that control a child's use of the PECS and procedures to promote spontaneity could improve the ability to develop the language skills of children with autism.

Chapter 2. Empirical Paper.

The Journal of Applied Behavior Analysis (JABA) has been used as a guide for determining the style of the paper.

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

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Doctor of Educational Psychology

DO CHILDREN WITH AUTISM USE THE PICTURE EXCHANGE COMMNUNICATION SYSTEM (PECS) TO MAKE SPONTANEOUS REQUESTS?

By Amy Farrer

2.1. Abstract

The Picture Exchange Communication System (PECS) is an augmentative communication system often used for children with autism; however, few studies have specifically examined whether children with autism use the system to make 'spontaneous' requests. Of the studies that have reported instances of 'spontaneity', most fail to make use of Skinner's (1957) analysis of verbal behaviour when defining spontaneity by not taking into account the presence of the requested item. The current study addresses this issue using a single case study design with two children with autism who had both mastered phase III of the PECS. An assessment procedure was developed to determine whether the children would use the system to emit spontaneous requests (e.g., without verbal and physical prompts and without the item being in sight). Results demonstrated that one of the participants failed to use the PECS to emit requests for items out of sight and so he received a teaching phase, which used rolling time delay and prompt fade procedures. This appeared to be effective in freeing the child's requests from the stimulus control of the presence of the item and thereby promoting spontaneity. The study also examined whether the direct presentation of the PECS pictures and/or folder affected the children's use of the PECS as this may impede levels of spontaneity. It was found that the children's use of the PECS at home was not dependent on the direct presentation of the PECS materials; however, the children were also observed in school and it seemed that their use of the PECS in this context was associated with the teacher's presentation of the PECS materials.

2.2. Introduction

Deficits relating to spontaneous communication are frequently reported in children with autism (American Psychiatric Association [APA], 2000; Carter, 2002; Carter, 2003b; Carter & Hotchkis, 2002; Carr & Kologinsky, 1983; Chiang & Carter, 2008; Reichle & Sigafoos, 1991b; Tager-Flusberg, Paul & Lord, 2005). However, there currently exists a lack of agreement over the term 'spontaneity' and so researchers may be basing their judgements on different patterns of behaviour (Chiang & Carter, 2008; Ostryn, Wolfe & Rusch, 2009; Reichle & Sigafoos, 1991b; Reichle, Sigafoos & Remington, 1991). Skinner's (1957) analysis of verbal behaviour can serve as a useful framework to understand the notion of spontaneity. Requests were defined by Skinner as 'mands' which are *'reinforced by a characteristic consequence and* [are] *therefore under the functional control of relevant conditions of deprivation or aversive stimulation'* (1957, p35-36). Michael (1982, 1993, 2000) has since clarified the nature of the types of events that exert functional control over manding. Michael used the term Establishing Operation (EO) and defined this as: *'any change in the environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behaviour that has been followed by that reinforcement'* (1982, p150). For instance, food deprivation is an EO that increases the value of food as reinforcement and subsequently increases the likelihood of behaviours occurring that have been successful in the past at acquiring food. The mand is said to be under the control of the EO and also the presence of the listener, such that it will only occur when those conditions are present.

Skinner (1957) proposed that a verbal operant may be under sources of multiple control and if so should be considered 'impure'. Bondy, Tincani and Frost (2004) expanded on this by proposing that, if a mand is under the stimulus control of prompts from another person or the presence of the requested item, it should be considered 'impure'. This suggests that requests can only be considered as spontaneous if they occur without verbal or physical prompts and without the item in sight. It is important that individuals can emit requests under these conditions as this will give them a greater degree of control over their environment (Carter & Grunsell, 2001; Carter & Hotchkis, 2002; Ostryn et al., 2008; Reichle & Sigafoos, 1991b), enabling them to demonstrate the skill flexibly and without having to rely on external

factors. For instance, individuals will be able to request food when they are hungry and not have to wait until another person asks them if they want anything, nor have to wait until a food item is in sight to ask for it.

Some researchers contend that spontaneity should be conceptualized on a continuum (Carter, 2002, 2003a,b; Carter & Hotchkis, 2002; Charlop, Schreibman & Thibodeau, 1985; Chiang & Carter, 2008). According to this model the least spontaneous requests occur following verbal prompts, moving to requests that occur when the referent is in sight, to the most spontaneous requests that are controlled by internal cues (e.g., hunger). Carter and colleagues propose that an individual should be able to demonstrate varying levels of spontaneity depending on the context (Carter, 2002, 2003a,b; Carter & Hotchkis, 2002), such that individuals emit requests that are contextually appropriate (e.g., the individual is aware of when it is appropriate to emit fully spontaneous requests and of when it is more appropriate to wait to be asked or request items only that are in sight).

Therefore, individuals should be able to emit requests under a range of different antecedents conditions depending on the circumstance; however, it is critical that individuals are able to emit fully spontaneous requests when they need to. For this reason it is important that spontaneous communication is seen as a desirable goal in Alternative or Augmentative Communication (AAC) programs. The Picture Exchange Communication System (PECS) is a pictorial-based, aided AAC system that was developed by Bondy and Frost (reported in Bondy & Frost, 1994, and Frost & Bondy, 1994). In the PECS children are taught to requests objects or activities by exchanging a corresponding pictorial symbol. The PECS has become a popular communication strategy for children with autism and other communication disorders and is now in widespread use in the UK (Howlin, Gordon, Pasco, Wade, & Charman, 2007; Preston & Carter, 2009).

A potential concern of the PECS is that it may teach users to emit requests only when the desired item is visible. This is due to the fact that throughout the phases of the training, the items the individual is taught to request tend to be visible. Several investigators proclaim that children with developmental disabilities may tend only to emit communication responses under exactly the same conditions in which the communication was taught (Carr & Kologinsky, 1983; Carter, 2002; Chiang & Carter,

2008; Hall & Sundberg, 1987; Reichle & Sigafoos, 1991c; Sundberg & Michael, 2001). This could mean that if the PECS is taught only when the referent is present, requesting behaviour may be brought under the multiple control of the EO and the presence of the item, and this could therefore impede spontaneous use.

Research has shown that the PECS is proving to be a promising mode of communication for individuals with autism (see reviews by Preston & Carter, 2009 and Sulzer-Azaroff , Hoffman, Horton, Bondy & Frost, 2009); however, a search of the literature on the PECS found that only a small number of studies have specifically reported instances of 'spontaneous' requesting with the PECS (Adkins & Axelrod, 2001; Carr & Felce, 2007b; Ganz & Simpson, 2004; Heneker & MacLaren-Page, 2003; Kravits, Kamps, Kemmerer & Potucek, 2002; Malandraki & Okalidou, 2007; Schwartz, Garfinkle & Bauer, 1998; Tincani, Crozier & Alazetta, 2006). Of these studies, researchers tend to refer to prompts from another person when defining spontaneity and only Heneker and MacLaren-Page (2003) make reference to the visibility of the requested item. Heneker and MacLaren-Page (2003) examined the use of the PECS in a group of children with autism and found that the majority of requests occurred when the referent was visible, although they also note that some children did request out of sight items. The results of this study should be treated with caution, however, as the design lacked experimental control. There are a further few studies that have reported that participants used the PECS without the requested item being present (Chambers & Rehfeldt, 2003; Ganz & Simpson, 2004; Marckel, Neef & Ferreri, 2006). However, only Chambers and Rehfeldt formally tested the behaviour by directly manipulating the presence of the requested items, and this study was conducted with participants who were adults with developmental delay, so there is evidently a dearth of research examining the spontaneous use of the PECS in children with autism.

To examine whether children use the PECS to request items out of sight an assessment procedure needs to be devised that pays careful attention to the EOs. The EO can be captured by simply waiting until the EO is strong (e.g., depriving the child of food for some time to ensure he is hungry) (Skinner, 1957; Sundberg, 1993), but there are of course ethical implications in doing this. One could wait for naturally occurring periods of deprivation but this would provide few convenient and replicable opportunities to assess whether a child is able to emit spontaneous requests. The EO

could be contrived using the Behaviour Chain Interruption Strategy (BCIS) (see review by Carter & Grunsell, 2001), but this approach could only be used to examine whether children emit spontaneous requests for items that form part of a routine. The items that children are first taught to request in the PECS include their favourite food/drink/toy and these items are unlikely to form part of a routine. Children's ability to emit spontaneous requests for these items would give them the greatest degree of control as they will already form part of their natural environment and be most motivating.

An alterative way of examining whether children are able to emit spontaneous requests could be to create contextual cues that evoke certain behaviours. Carter and Hotchkis (2002) note that even the most spontaneous requests will be associated with contextual stimuli, for instance, occurring in an appropriate place, with an appropriate person and at an appropriate time of day. A contextual stimulus could be considered a Discriminative Stimulus (S^D). The S^D is a stimulus that is associated with differential reinforcement (e.g., the response is repeatedly reinforced in the presence of that stimulus and not in its absence) (Michael, 2000). This differential reinforcement causes stimulus control to occur such that the behaviour will only be emitted in the presence of the S^D. If children learn that access to a preferred food/activity is more likely in a certain place (e.g., shop/restaurant/kitchen) or with a certain person, they will be more likely to request the reinforcers when those contextual cues are present. A request that occurs in this context would not be considered a 'pure mand' (associated with the EO and listener only), but an assessment procedure that utilizes these contextual stimuli could demonstrate if the child was able to emit requests without additional stimuli being present (e.g., presence of item). In addition, a condition which utilizes new contextual cues could also be used to factor out the effect of previous reinforcement. Carter (2003b) found that the more spontaneous the communicative act the less likely that it would result in delivery of the requested item or activity, and so a child may not emit spontaneous requests because in the past these requests had not been reinforced and so the behaviour had been eliminated.

If children are unable to emit spontaneous requests using the PECS then procedures are needed to free their responses from the stimulus control of the sight of the item. There is much literature in the area of behaviour analysis that shows how to transfer stimulus control through: (a) fading procedures, which involve systematically

reducing the amount or magnitude of the assistance provided; and (b) time delay procedures, which involve introducing a designated pause before delivery of an instructional prompt (e.g., see Barbera & Kubina, 2005; Bloh, 2008; Reichle & Sigafoos, 1991b). Only a small number of studies have described methods to bring the mand under the primary control of the EO and a listener (e.g., Carr & Kologinsky, 1983; Carr & Durrand, 1985; Sweeney-Kerwin, Carbone, O'Brien, Zecchin & Janecky, 2007). The study by Sweeney-Kerwin et al. (2007), which had two participants (aged 3 and 7 years) with autism who used sign language, was the first to demonstrate procedures to transfer control of the mand from the presence of the item to the EO and listener alone. The researchers demonstrated that rolling time delay and prompt fading procedures could be used to free participants' gestural responses from sources of multiple control. At the time of writing this study the author was unable to find any research that looked at stimulus-transfer procedures for the PECS.

A child's use of the PECS may be influenced by the visibility of the PECS materials. Carter (2003b) found that the use of aided AAC systems was predominantly associated with a low level of access to the materials by the user, and that users tended to use the systems only after teacher presentation of the materials. In PECS, if a child's pictorial requests are more likely to be reinforced after the pictures and folder are directly presented in front of him, these conditions may come to be associated with increased availability of the reinforcer. These conditions may then serve as a S^D and, if so, the response would not strictly be considered a pure mand. It is important that these conditions do not become a S^D as individuals who are proficient in the PECS will need to actively move to their PECS folder and select pictures from inside the folder (Frost & Bondy, 2002), since the folder or pictures will not always be directly visible.

Therefore, the first part of this study was carried out at participants' homes to establish whether children with autism, who were able to use the PECS up to at least phase 3, used the system to make spontaneous requests and, if not, to both to train them to do so and to assess the impact of that training. This was achieved using an assessment procedure that utilized contextual cues. *Spontaneous* requests were defined as requests that occurred without verbal or physical prompts and without the items being in sight, and it was hypothesised that the children in the study may be unable to make spontaneous requests. If the children were unable to emit spontaneous

requests, a teaching phase was conducted which adopted stimulus transfer procedures, and it was hypothesised that these procedures would free the child's requests from the stimulus control of the presence of the item and so promote spontaneity. The effect of the direct presentation of the PECS pictures and/or folder on the children's requests was also examined, as it was hypothesised that the children may be more likely to use the PECS when the materials had been placed directly in front of them. In the final part of the study participants were observed in school during a 'typical' morning to examine the conditions that the PECS was used in, in that setting.

2.3. Method

Design and Overview

A single case experimental design (Barlow & Hersen, 1984) was used. The first part of the study was carried out at each of the participant's home and it involved three phases (Assessment phase; Teaching phase; and, Maintenance and Generalisation phase). The Assessment phase was carried out to establish whether the participants used the PECS to make requests for out of sight items. The assessment comprised of a reinforcer assessment to determine the children's four most 'preferred' items, and then three 30-minute observation sessions (Type A) carried out across two weeks (at least a day apart). In the latter half of each observation session the children were presented with their 'preferred' items. The purpose of the observations was to allow the children to make an association between the contextual cues present in the sessions and access to their 'preferred' items, and then to examine whether the children would begin to emit requests for their preferred items before these items had been placed in view. If the children did not emit requests for out of sight items then the teaching phase began. The Teaching phase was conducted for two weeks in 30-minute sessions three times a week. Stimulus transfer procedures were adopted to free the child's requests from the stimulus control of the presence of the item. A Maintenance and Generalisation phase was then conducted, which involved three 40-minute observation sessions (Type B and C) carried out across three weeks (at least a week apart). The purpose of these observations was to examine whether the child was able to use the PECS to request items out of view following the teaching phase, and to also examine what effect the direct presentation of the PECS pictures (observation Type B) and folder (observation Type C) had on the child's requests. In the second

part of the study, participants were observed at school to examine under what conditions they used the PECS in that setting.

Participants

Participants were selected for this study using the following criteria: that they (a) had a diagnosis of autism, (b) were between 3 and 7 years of age; (c) had little or no functional speech (i.e. not exceeding single words/word approximations); (d) were at least at phase 3 of PECS[6]; (e) had no evidence of sensory impairment; and that (f) parents consented to the research being conducted in their homes. Two participants meeting these criteria were identified by staff at the special school which they attended[7]. Approval from the Ethical Committee was obtained from the University of Southampton and from the authority where the study was carried out.

Participant 1 was called Robert[8]. He was 6 years 2 months old, he was diagnosed with autism at three years of age and he attended a day special school for children with a Statement of Special Educational Needs. Robert was reported to have recently reached phase 4 of the PECS by a speech and language therapist attached to his school and he used the system at school and home. At the time of this study Robert had no intelligible speech and used a few signs.

Participant 2 was called Katie. She was 5 years 11 months old, she had been diagnosed with autism at two years of age and she attended a day special school for children with a Statement of Special Educational Needs. Katie was reported to currently be at phase 3 of the PECS by a speech and language therapist attached to the

[6] In the meta-analysis conducted by Sulzer-Azaroff et al (2009), the majority of studies taught PECS only up to phase III. Phase III is when participants will be able to use PECS as a medium of functional communication. Therefore, it is at this stage when spontaneous communication should emerge. The later phases of PECS continue to have the item in sight during structured teaching sessions, so it is thought that the latter stages are no more likely than the earlier stages to promote spontaneous communication.

[7] Names of suitable participants were gathered through discussion with practitioners working with early years and school age children (including early years teacher counsellors, ASD advisory teachers, educational psychologists, speech and language therapists, special school staff) in the researcher's placement area. From these discussions a total of four children were raised who met criteria and parental consent was obtained for two of these.

[8] Names have been changed for anonymity.

school and she used the system at school and home. At the time of this study Katie had no intelligible speech and used a few signs.

Table 2.1 provides a summary of the children's characteristics and also includes results from measures that were carried out with both children before the assessment phase began. The measures included: Expressive Vocabulary Test, Second Edition (EVT-2, Williams, K, 2007); Peabody Picture Vocabulary Test, Fourth Edition (PPVT™-4, Dunn, L. & Dunn, D, 2007) and Vineland Adaptive Behavior Scales, Second Edition (Vineland-II, Sparrow, Balla, & Cicchetti, 2005). The results of these measures showed that the two participants were similar in their levels of expressive and receptive language and in their adaptive behaviour skills. Both children had no speech and, although their receptive language was better than their expressive language, their receptive language was also considered to be significantly delayed. They also both demonstrated significant delays in their adaptive behaviour skills (e.g., the ability to function in everyday life).

Table 2.1. Summary of the participants' characteristics

Participant	Robert	Katie
Age	6;2	5;11
Gender	M	F
Expressive Language	No intelligible speech . EVT- no score	No intelligible speech . EVT- no score
Receptive Language	PPVT: Percentile <0.1 Age Equivalent= 2 years Receptive (PPVT) > Expressive (EVT) (p=0.01)	PPVT: Percentile <0.1 Age Equivalent = Less than 2 years. Receptive (PPVT) > Expressive (EVT) (p=0.01)
Adaptive Behaviour	Vineland: percentile= 0.5 Adaptive Level= Low (mild deficit)	Vineland: percentile= 0.1 Adaptive Level= Low (moderate deficit)

2.3.1. PART 1

Settings and Stimulus Materials

All the sessions (observation and teaching) were held at the children's homes[9]. Sessions involved access to a variety of available materials that the children typically had access to when at home (e.g., books, puzzles, TV) and these items were visible and the children could play with them without contingent requests. The only items where access was restricted were the four 'preferred' items (see assessment procedure below). The children had access to their PECS folders throughout the observation and teaching sessions. These were standard folders (approximately 18.5 X 15.5cm in size) which had several pages within them (all made of thick, durable, polypropylene). The front of the folder and the pages within the folder had Velcro strips across them on which the laminated pictorial symbols could be stuck (the pictures were approximately 2.5cm in size) (see Figure 2.1). On the front of the folders there were pictures corresponding to the children's 'preferred' items and on the pages within the folders there were pictures corresponding to vocabulary that the children had used in the past (these will be referred to as pictures for 'non-targeted' items). The children's PECS folders were kept in the same location across sessions. A stopwatch was used to ensure accuracy of reinforcer access time and all observation sessions were videotaped. An observation schedule was used during observation sessions to record each communication initiated by the child on a number of different descriptives (e.g., method, function); this was derived from that used by Heneker and MacLaren-Page (2003) (see Appendix 1). A response form was used during teaching sessions to record the number of pictorial exchanges and the level of cueing (see Appendix 2).

Figure 2.1. PECS Folder and symbols (Pyramid Educational Consultants)

[9] As the sessions were conducted in the child's home, the persons present during the observations varied; persons other than the researcher and child's caregiver who were present during the sessions included siblings and family friends.

Dependent Measure and Interobserver Agreement

The primary dependent measure was the frequency of spontaneous pictorial requests (requests per minute). In observation and teaching sessions all pictorial exchanges that the child emitted were recorded. The level of cueing for the pictorial exchanges was determined with respect to the conditions that were present within 20 seconds[10] prior to the exchange taking place (e.g., a verbal prompt or visual prompt). A request was defined as 'spontaneous' if it was emitted without verbal or physical prompt and without the item being in sight. One in four of the children's pictorial requests were assessed as correct or incorrect according to a correspondence check that was carried out (see assessment phase). In teaching sessions, when a pictorial exchange was physically prompted, the level of prompt was noted (e.g., taken to PECS folder, hand-over-hand).

During observation sessions, in addition to the pictorial exchanges, other communications that the child initiated were also recorded. In keeping with Frost and Bondy (2002) a functional communicative act was defined as a behaviour which is *"directed to another person who in turn provide(d) related direct or social rewards"* (p8). In the observation sessions, each time the child initiated an interaction by emitting a functional communicative act according to this definition it was recorded. After the child had initiated an interaction, subsequent initiations were not recorded until 30 seconds had elapsed.

The researcher was the primary data recorder. For observation sessions, a secondary data recorder coded interactions from video footage for 34% of the sessions. The secondary data recorder used the observation schedule and recorded the time at which the child initiated an interaction. If the time was within 20 seconds of the time of an interaction recorded by the primary data recorder it was judged to be in reference to the same interaction. Agreement or disagreement was then determined for each interaction. A disagreement was deemed to have occurred when one of the data recorders did not record the occurrence of a communicative act which the other data recorder had recorded (if this occurred, disagreement was recorded for each of the descriptives) or if the data recorder's codings did not match that of the other data

[10] A 20 second interval was chosen as this gave the child sufficient time to go to their PECS folder, take off a picture and exchange it with a communicative partner after a prompt had been delivered.

recorder on any of the descriptives. The observer agreement was calculated by dividing agreements by agreements plus disagreements and multiplying by 100. For pictorial exchanges the observer agreement for Robert was 100% reliability and for Katie it was 96.7%. For total communications, the observer agreement for Robert was 93.5% reliability and for Katie it was 88.1%.

Assessment Phase

Reinforcer and PECS Assessment. The child was visited at home and a reinforcer assessment was completed using empirically validated procedures (Deleon & Iwata, 1997; Frost & Bondy, 2002) (see Appendix 3). The children's four most highly 'preferred' items were identified; Robert's were chocolate buttons, twiglets, toy darts and skittles, and Katie's were chocolate buttons, sweets, raisins and crisps. A PECS assessment was then carried out using procedures outlined by Frost and Bondy (2002) (see Appendix 3). This assessment demonstrated that the children were proficient at least up to phase III of the PECS and were able to discriminate between the pictures corresponding to their 'preferred' items. Robert achieved 90%[11] accuracy and Katie achieved 95% accuracy. In addition Robert requested his 'preferred' items by placing an 'I want' symbol on the left of the strip and a picture corresponding to his 'preferred' items to the right the strip, after which he would exchange the strip with the communicative partner; according to the PECS protocol this was indicative of him being at phase IV.

Observation Sessions (Type A). Three 30-minute observation sessions were carried out at least 1 day apart across two weeks. Table 2.2 shows how these sessions were divided into two parts in which the presence of the 'preferred' items was manipulated; they will be called Type A Observations. Sessions were carried out at a time when deprivation levels were believed to be high for snack reinforcers (either in the hour before lunch or in the hour after the children arrived home from school). In addition, the children were not allowed access to their 'preferred' items for at least two hours prior to the session taking place. Pictures corresponding to the children's four most preferred items were stuck to the front of the PECS folder and pictures for non-targeted items were stuck to pages inside the folder.

[11] 90% accuracy was used as this is the criterion used by Frost and Bondy (2002) to determine at which phase of PECS a child is proficient.

Table 2.2. Description of Type A observation (visibility of 'preferred' items manipulated)

Time (minutes)	Description
0 to 15	The 'preferred' items were out of view. The children did not see the items be placed out of view and, unless they requested the items, were not shown the items until the 15 minutes had elapsed. The corresponding pictures were on the front of the PECS folder and the PECS folder was in sight.
15 to 30	The corresponding pictures remained on the front of the PECS folder and the PECS folder in sight. The items were brought in to the room by the caregiver/researcher and placed in the child's view but out of their reach.

During the whole observation session the children were able to emit pictorial requests for their 'preferred' items, as well as for non-targeted items represented within their folder, irrespective of whether the items were in view. Each time the children made a pictorial request for a preferred item or any other item they were allowed to eat a small portion if edible or were given 90 seconds[12] access to the item, then the item was placed back where it had been situated (e.g., either out of sight or in sight but out of reach). The picture was returned to the folder after every exchange. Each time a child initiated a communicative act with a communicative partner that did not involve the PECS (e.g., vocally, physically) the partner was asked to interact with the child for no longer than 30 seconds. If the children tried to request their 'preferred' items by means other than PECS the listener responded to the child's interaction but pretended not to understand the request and so did not give the child the item. All persons present during the observations were asked to not initiate any interactions with the children, either verbally or non-verbally.

Correspondence checks were conducted on one in every four of the children's PECS requests. These were carried out according to the procedure described by Frost and Bondy (2002). After the children had made a pictorial exchange they were shown an array of six items including their four 'preferred' items and encouraged to make a selection. If the child took an item that did not correspond to the picture he had given the communicative partner the exchange was recorded as incorrect. This procedure

[12] 90-seconds access to the item was chosen because this allowed enough time for the activity to be set up and the child to have several turns with the activity (e.g. darts or skittles) without becoming satiated (e.g. still demonstrating a desire for longer access to the activity).

was aimed at ensuring that the children were exchanging the picture that corresponded to the item they wanted.

Teaching Phase

The 'preferred' items were kept out of sight during the teaching sessions. A rolling time delay procedure was used. The child was physically prompted by the researcher, who was positioned behind the child; this is in line with the prompting strategy used in the PECS protocol (see Frost & Bondy, 2002). The child was prompted to go to the PECS folder, which was in a fixed location, take off a picture corresponding to a 'preferred item' and exchange it with the communicative partner (parent). The communicative partner then gave the child access to the item for 90 seconds or if edible allowed the child to consume a small portion; the items were then placed out of view again. A two-minute delay followed before the researcher physically prompted the child to make another pictorial exchange. The researcher adopted a least-to-most prompting strategy as suggested by Frost and Bondy (2002). For instance, she would take the child to the PECS folder and if the child did not make an independent request within five seconds then she would adopt a hand-over-hand prompt to encourage the child to select a picture. If the child made a request independently within the two-minute interval either for a 'preferred' item or for a 'non-targeted' item then the request was honoured and the time interval was reset, such that the researcher did not prompt the child to make an exchange until a further two minutes had elapsed.

During the first week of teaching the picture corresponding to just one of the 'preferred' items was stuck to the front page in the PECS folder. Each session began with a different preferred item stuck to the page. During the second week of teaching all four pictures corresponding to the 'preferred' items were stuck to the front page in the PECS folder. When the child demonstrated a desire for more access to the food/activity (i.e. through sounds or gestures) after the item was removed from view, on the subsequent trial the researcher prompted the child to exchange the same picture as before. If the child had not demonstrated desire for more of the food/activity, then on the subsequent trial the researcher prompted the child to exchange a different picture with the communicative partner. When the child was prompted to exchange a

different picture, the order in which the pictures were prompted was rotated, such that the picture corresponding to each of the 'preferred' items was prompted in turn.

After a request had been prompted, if the child did not take the preferred item then the item was not used again during the session. This was to increase the likelihood that the child was prompted to request items that he desired. In addition, correspondence checks were carried out on one in four of the child's pictorial exchanges for both prompted and unprompted exchanges. On the correspondence check, if the child went to take an item that did not correspond to the picture he had exchanged, an error correction procedure was carried out in line with that described by Frost and Bondy (2002) (see Appendix 3). The researcher would block the child's access to the item and she would then tap the picture corresponding to that item and prompt the child to exchange that picture. Once the child had exchanged the correct picture the child was praised but not given the item. A brief pause followed and then the correspondence check was conducted again. On prompted trials the correspondence checks were used to determine if the child desired the item he had been prompted to request, and if not, the checks enabled the researcher to establish what the child did desire at that time and then to encourage a request for that item to be made.

Maintenance and Generalisation Phase.

Three observation sessions were carried out across three weeks (at least a week apart) to examine if the teaching had been successful and to also examine what influence the visibility of the pictures and folders had on the children's use of the PECS. These observations were conducted in the same manner as Type A observations with the exception that they were 40 minutes in duration and additional antecedent variables were manipulated. Two observations were carried out where the visibility of the pictures was manipulated; these will be called Type B Observations (see Table 2.3). One observation was carried out where the visibility of the PECS folder was manipulated; this will be called a Type C observation (see Table 2.4).

Table .2.3. Description of Type B observations (visibility of PECS pictures manipulated)

Time (minutes)	Description
0 to 15	The PECS folder was in view and the 'preferred' items were out of sight. The pictures corresponding to the 'preferred' items were *inside* the folder.
15 to 30	The PECS folder was in view and the 'preferred' items were out of sight. The pictures corresponding to the 'preferred' items were on the *front* of the folder.
30 to 40	The PECS folder was in view and the pictures corresponding to the 'preferred' items were on the front of the folder. The child's 'preferred' items were visible and out of reach.

Table .2.4. Description of Type C observations (visibility of PECS folder manipulated)

Time (minutes)	Description
0 to 15	The pictures corresponding to the 'preferred' items were on the front of the PECS folder and the 'preferred' items were not visible. The researcher and caregiver were in a different room to the PECS folder such that the folder was not directly visible and the child would have to travel to the folder and bring back a picture to exchange it with a communicative partner.
15 to 30	The pictures corresponding to the 'preferred' items were on the front of the PECS folder and the 'preferred' items were not visible. The child, researcher and caregiver were in the *same* room as the folder.
30 to 40	The PECS folder was in view and the pictures corresponding to the 'preferred' items were on the front of the folder. The child's 'preferred' items were visible and out of reach.

2.3.2. Part 2

School –Based Observations

The children were observed in school to examine what antecedent conditions were associated with their use of the PECS in this context. A three hour on-line observation (9.30am to 12.30am) was carried out, watching each child during a

'typical' morning at school. Each child had his/her own PECS folder which was hung on the wall of the classroom and contained the pictures the child had used in the past (the pictures available were not manipulated). The contexts in which the children were observed and all instances when they used the PECS were recorded. Activities were defined as 'structured' or 'unstructured'. Unstructured activities were those where the children had more freedom to follow their own agenda and where adult attention was more variable, as this provided children with more opportunities to initiate interactions. An observation schedule was used to record all the children's pictorial exchanges (see Appendix 4). The school observation was videoed for 22% of the total time to allow inter-observer agreement to be calculated. The observer agreement was 100% reliability for Robert and 96.3% reliability for Katie.

2.4. Results and Discussion

2.4.1. Part 1[13]

Robert

The frequency of the pictorial requests emitted by Robert during the assessment phase is shown in Figure 2.2. Robert only used PECS to emit spontaneous requests on two occasions. The average number of requests for items in sight was 4.3 per observation session but for spontaneous requests it was just 0.7 per session. The child requested all four of his 'preferred' items when the items were in sight but only requested one of his 'preferred' items when the items were out of sight. This suggests that Robert's ability to emit spontaneous requests was not comparable to his ability to emit requests for items in sight so it was decided that the teaching phase would be appropriate for him. The results provide a preliminary indication that children with autism, who use the PECS up to at least phase 3, may not use the system to make spontaneous requests.

[13] Any PECS requests that were preceded by a verbal or physical prompt were not included in the results section. Across all sessions there was only one instance of this for Robert and three for Katie.

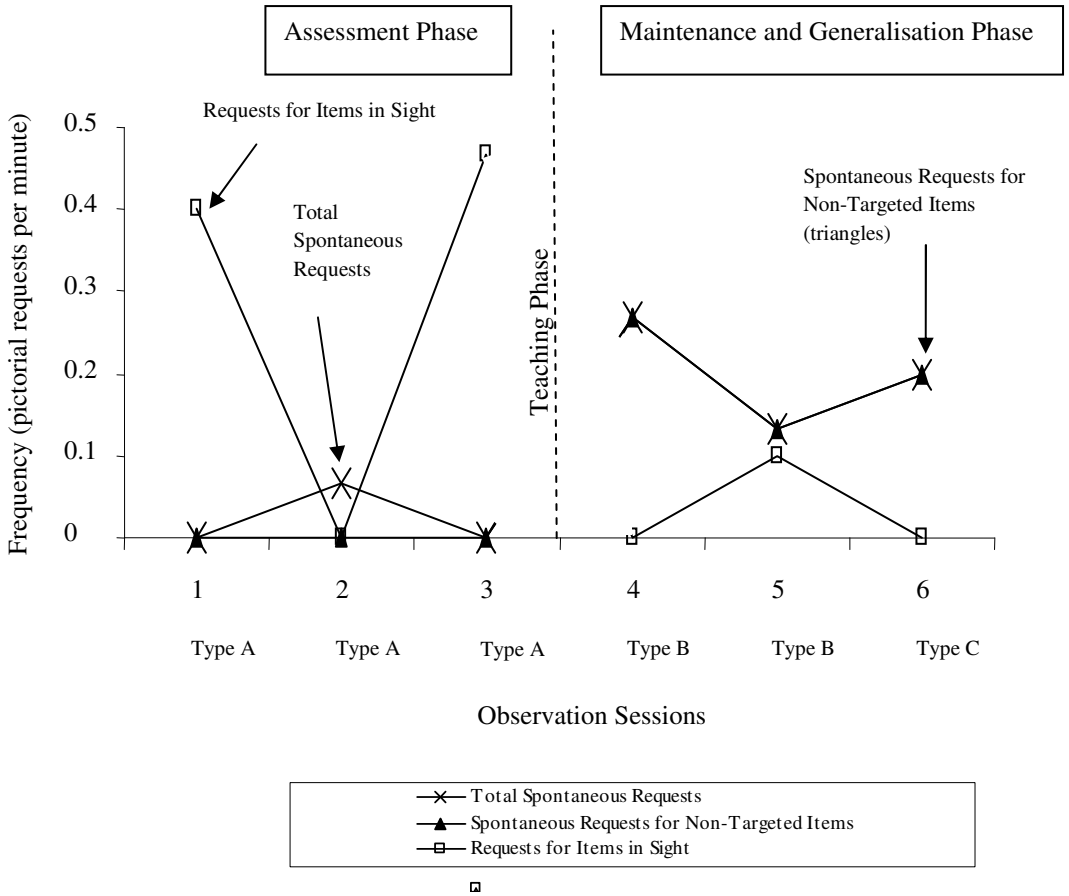

Figure 2.2. Graph of the frequency of Robert's pictorial requests before and after the teaching phase.

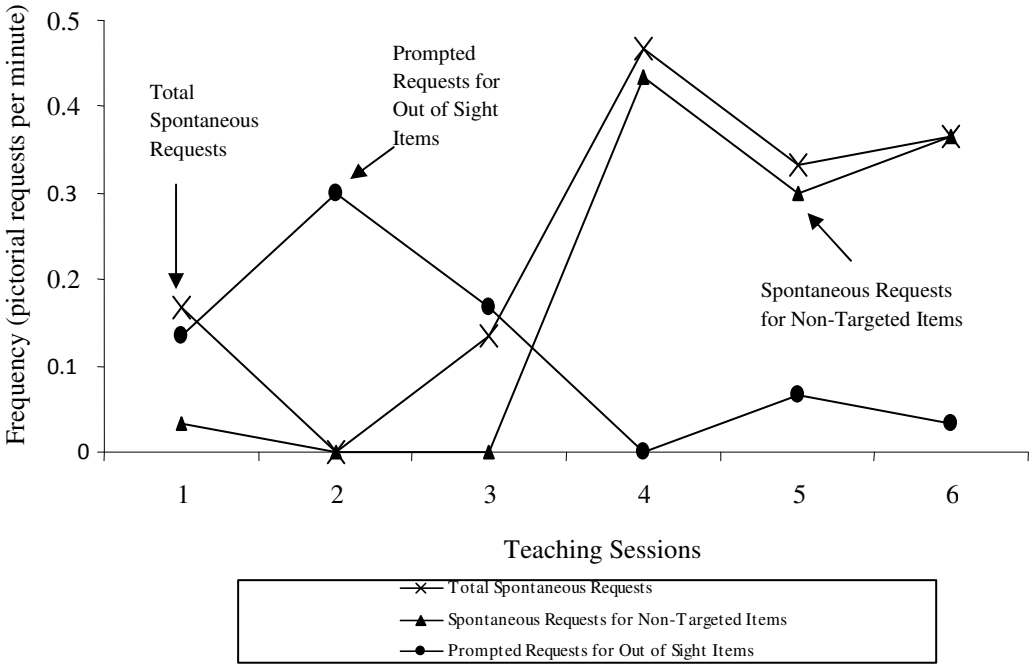

Figure.2.3. Graph of the frequency of Robert's pictorial requests during the teaching phase.

Figure 2.3 shows the frequency of spontaneous requests emitted by Robert during the teaching phase. Robert began emitting spontaneous requests during session 1. However in sessions 1 and 2 Robert did not emit any spontaneous requests before prompted exchanges had taken place at least three times. The child began to emit spontaneous requests before any prompts had been delivered during session 3 and this occurred in all sessions onwards. The frequency of spontaneous requests emitted by Robert was higher in week two than in week one, with the average number of spontaneous requests per session during week one being 3 (range of 0 to 5) and in week two being 12 (range of 10 to 14). As the frequency of Robert's spontaneous requests increased, the frequency of required prompts decreased. The average number of prompted requests per session during week one was 6 (range of 4 to 9) and in week two was 1 (range of 0 to 2). The teaching phase appeared to lead to generalisation of the skill to 'non-targeted' items. Robert was only prompted to request his 'preferred' items but during week one Robert spontaneously requested a 'non-targeted' item once. Then in week two the average number of spontaneous requests Robert emitted for 'non-targeted' items was 11 per session (range= 9 to 13) and the average number of different 'non-targeted' items requested was 4.3 per session (range= 3 to 6).

The frequency data for Robert's spontaneous pictorial requests after the teaching phase (during the maintenance and generalisation phase) are shown in Figure 2.2[14]. The results show that the frequency of spontaneous requests emitted by Robert increased after the teaching phase. The average number of spontaneous requests emitted[15] in the assessment phase was 0.67 per observation session (range= 0 to 2) and in the maintenance and generalisation phase was 6 per session (range= 4 to 8).

[14] The observation sessions conducted in the assessment phase were Type A and in the maintenance and generalisation phase were Type B and Type C, thus the duration in which the 'preferred' items were out of view differed according to the type of observation that was conducted. It was important that the duration that the child's 'preferred' items were out of sight was held constant when looking at frequency data. Otherwise the child may become satiated if the duration was longer, thereby reducing the frequency of his requests, and if this occurred it may not provided an accurate representation of the impact of the teaching phase. For this reason spontaneous requests were only included in the frequency data if they were emitted within the first 30 minutes of the observation. This period of time was chosen because firstly all the child's spontaneous requests following the teaching condition were for 'non-targeted' items and so in all the observations Robert could have spontaneously requested these non-targeted items for at least 30 minutes from the start of the session. Secondly, the visibility of the PECS materials did not influence Robert's use of the PECS.

[15] In line with footnote 9, only requests emitted within the first 30 minutes of the observation sessions were included.

Furthermore, the correspondence checks on Robert's spontaneous pictorial exchanges showed that across all the observation and teaching sessions Robert scored 100% correctly, indicating that Robert was indeed requesting items out of view as opposed to making incorrect requests for items in sight. These results support the findings of Sweeney-Kerwin et al. (2007) that rolling time delay and prompt fading procedures can effectively free a child's requests from the stimulus control of the presence of the item and thereby promote spontaneity.

In the assessment phase Robert did not emit any pictorial requests for 'non-targeted' items. In comparison, in the maintenance and generalisation phase all but one of the requests Robert emitted were for 'non-targeted' items that were out of sight and with the corresponding picture inside the PECS folder. The number of different 'non-targeted' items requested spontaneously increased from 0 per session in the assessment phase to up to 3 different items in the maintenance and generalisation phase. These 'non-targeted' items had not been identified in the preference assessment as items that Robert 'preferred'. However, it was evident that they were items that Robert liked, as the correspondence checks showed that Robert would select the non-targeted item even when offered his 'preferred' items, and also Robert would eat the item if edible or engage with the item appropriately (e.g., playing with a toy) after he had requested it. These results are contrary to the findings of Sweeney et al. (2007) who found no evidence for response generalisation. The difference in results may be because Robert used the PECS while participants in the study by Sweeney et al. used manual signs. In the current study, once Robert had been prompted to go to his PECS folder, he could see the pictures corresponding to the 'preferred' items but also see pictures corresponding to 'non-targeted' items. It would seem that the pictures themselves may have provided a visual prompt that encouraged Robert to request 'non-targeted' items.

Robert only emitted one request for a 'preferred' item in the maintenance and generalisation phase, irrespective of whether the items were in sight. It is possible that in the assessment phase Robert had been able to emit spontaneous requests but he had not been motivated to request his 'preferred' items. However, in the assessment phase the frequency of Robert's requests for 'preferred' items when they were in view was high, suggesting he was indeed motivated by the items. Thus, it may be that once Robert began requesting 'non-targeted' items these newly introduced items competed

with the value of the 'preferred' items. In support of this, Sweeney-Kerwin et al. (2007) found that during training the introduction of each new item led to a decrease in spontaneous requesting for the previous items taught. Thus, the value of the 'non-targeted' items may have competed with the value of the 'preferred' items, accounting for the decrease in requests for these items following teaching.

The maintenance and generalisation phase demonstrated that Robert's use of the PECS was not dependent on the direct visibility of the pictures or folder. During the Type B Observations (observation 4 and 5) 92.3% of Robert's requests were emitted when the pictures were inside the folder and so not directly visible, and during the Type C observations (observation 6) 44% of Robert's requests were emitted when the PECS folder was in a different room and so not directly visible.

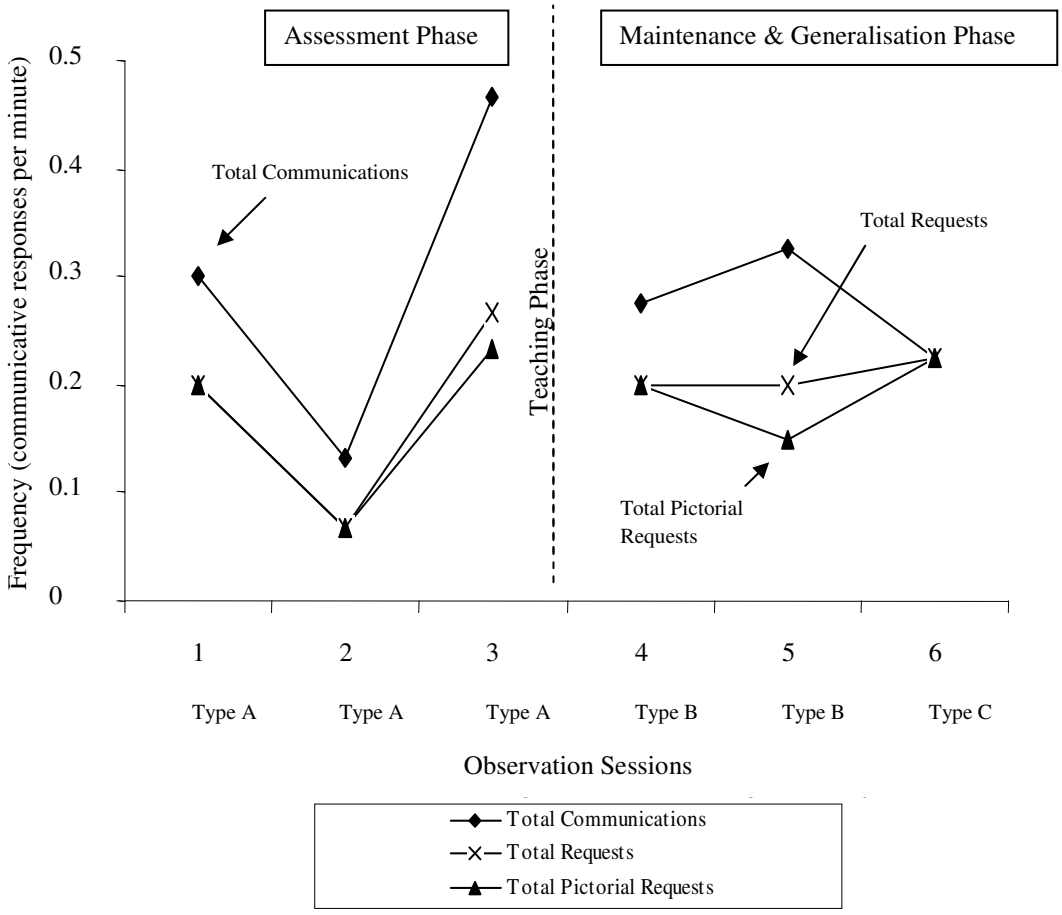

Figure 2.4. Frequency of communicative exchanges initiated by Robert during all observation sessions.

The frequency of all the communications initiated by Robert across all the observation sessions is shown in Figure 2.4. The majority of Robert's

communications were requests (68.3%) and of these the majority were emitted using the PECS (92.7%). The requests without the PECS tended to be generalised (e.g., pulling a person to indicate what he desired) with one instance of a specific request that was emitted by signing (for drink). Other communications that the child engaged in were to obtain attention (e.g., touching/hugging the person)[16]. The results show that Robert used the PECS as his primary mode of communication and that it enabled him to emit specific requests. Specific requests are more effective than generalised requests at enabling the individual to make his needs and wants known to others, as specific sounds or gestures are used in reference to particular stimuli and so these requests are unambiguous and can be interpreted by anyone (Reichle, 1991; Reichle & Sigafoos, 1991a).

Katie

Figure 6 provides the frequency data from the observation sessions conducted with Katie. During the assessment phase Katie began requesting her 'preferred' items when they were out of sight during the second observation. By the end of the third observation it was evident that the teaching phase was not needed for Katie as she was requesting 'preferred' items irrespective of whether they were in view (this is discussed below). Therefore, following the second observation, the maintenance and generalisation phase began, whereby the visibility of the pictures and folder were also manipulated: the third and fourth observations were Type B Observations, and the fifth observation was a Type C Observation[17].

[16] The attention-seeking behaviours could be considered a type of request (e.g. request for attention); however, they will be differentiated from the other requests which were all emitted to obtain a tangible item.

[17] Because the duration in which the 'preferred' items were out of view varied according to the type of observation, spontaneous requests were only included in the frequency data if they were emitted within the first 15 minutes of the session. This period of time was chosen as, firstly, all but one of Katie's spontaneous requests were for her 'preferred' items, which were out of view for at least the first 15 minutes of every observation session. Secondly, Katie's use of the PECS was not dependent on the direct visibility of the PECS materials.

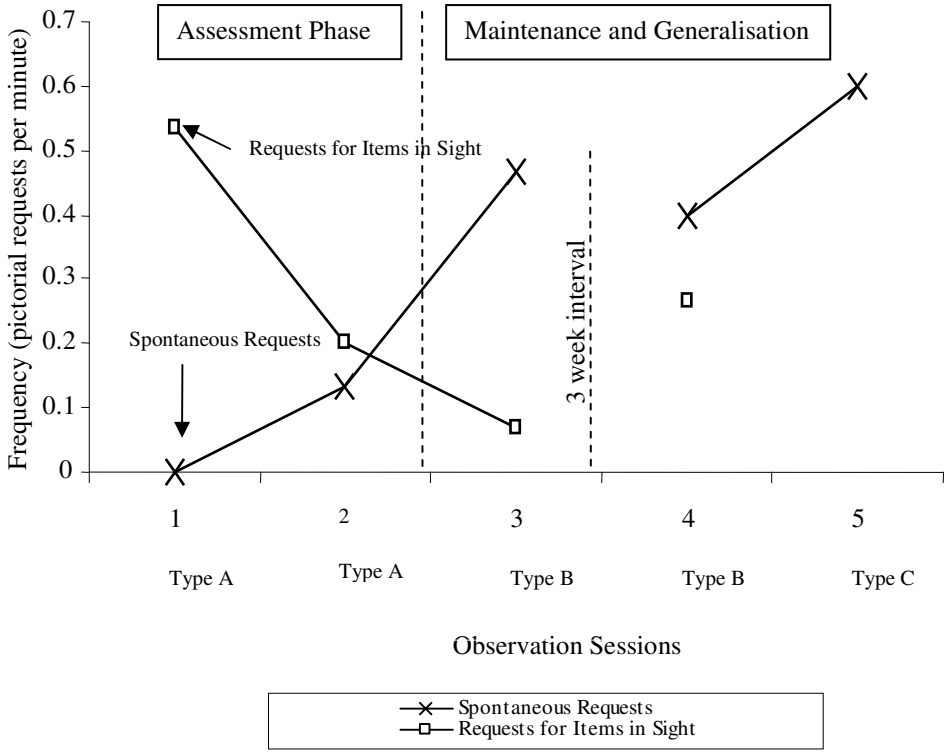

Figure.2.5. Frequency of Katie's pictorial requests during observation sessions[18].

Figure 2.5 shows that across the observation sessions there was a general increase in the frequency of spontaneous pictorial requests emitted by Katie. During the first three observations the frequency of Katie's spontaneous requests increased as the frequency of her requests for items in view decreased. This pattern of results may have been caused by satiation; Katie may have become satiated after consuming a certain number of food items and if so she would no longer request her 'preferred' items even when the items were presented before her (this was not investigated directly). During the third observation the frequency of Katie's spontaneous requests was comparable to the frequency of her requests for items in view during the first observation. Also, during the first three observations Katie requested the same 'preferred' items when the items were out of sight as she did when the items were in sight. These results suggested that Katie did not need the teaching phase. The frequency of Katie's requests continued to increase across all the observation sessions. Furthermore, Katie scored 91.1% correctly on the correspondence checks,

[18] The fifth observation was discontinued after 30 minutes as Katie left the room so it was not possible to examine her pictorial requests for items in view.

suggesting she was indeed requesting items out of sight as opposed to making incorrect requests for items in view.

In a slight alteration to the proposed method, observation 4 was carried out three weeks after observation 3 to examine maintenance of skill over a longer period of time. Figure 6 shows that the frequency of Katie's spontaneous requests in observation 4 was only slightly below that in observation 3 and substantially higher than that during observation 1 and observation 2. These results show that the frequency of Katie's spontaneous requests had been maintained which suggested that she had remembered the contextual cues. The frequency data also suggests that the continuous reinforcement of Katie's requests increased the likelihood of her requesting items that were out of view; the slight dip that is evident in observation 4 supports this view, as the variables manipulated in observation 3 and 4 were held constant but reinforcement would have been less likely to have occurred during the three week interval. This suggests that children's ability to emit spontaneous requests using the PECS will be dependent on the requests being reinforced by the people they are communicating with.

Like Robert, Katie's use of the PECS was not dependent on the direct visibility of the pictures or folder. In the maintenance and generalisation phase during Type B observations 84.6% of Katie's requests were emitted when the pictures were inside the folder and so not directly visible, and during the Type C observation 64.3% of Katie's requests were emitted when the PECS folder was in a different room and so not directly visible.

It was decided to conduct a further observation (session 6) at the home of Katie's respite carer to examine generalisation; this session was a Type A Observation but differed according to the physical setting and persons present (the researcher and respite carers). During this observation the frequency of Katie's spontaneous pictorial requests was zero and the frequency of her requests for items in view was 2.47 per minute (N=37). This suggests that the child's motivation for the preferred items was very high on the occasion that she was observed, but the association she had made between the researcher and access to her preferred items was dependent on other contextual cues being present. It seems that the presence of the researcher alone was not sufficient to evoke spontaneous requests and that other contextual cues were

needed (e.g., the child's mother/ being at home). This supports the research that has shown that individuals with severe disabilities often fail to generalise behaviours to new people, settings, tasks or materials (Carter & Grunsell, 2001; Reichle & Sigafoos, 1991b). It also supports the view of Carter and colleagues (Carter, 2002, 2003a,b; Carter & Hotchkis, 2002; Chiang & Carter, 2008) who contend that even the most spontaneous requests will be associated with contextual stimuli. The results suggest that, while a child may demonstrate spontaneous requests in one setting, the response may only be evoked when very specific contextual cues are in place and additional training may be needed before the child is able to generalise the skill to other environments.

Figure 2.6 shows that the majority of Katie's communications over the six observation sessions were requests (91.7%) and of these the majority were emitted using the PECS (79.3%). Therefore, like Robert, Katie used the PECS as her primary means of specific communication. All the requests the child emitted using PECS were for her 'preferred' items, with the exception of one request that was emitted for 'drink'. The requests that were emitted without the PECS were all generalised (e.g., pulling a person to indicate what the child desired). The other communications that the child engaged in were to obtain attention (e.g., touching/hugging the person)[19].

[19] As noted for Robert, the attention-seeking behaviours could be considered a type of request (e.g. request for attention); however, they will be differentiated from the other requests which were all emitted to obtain a tangible.

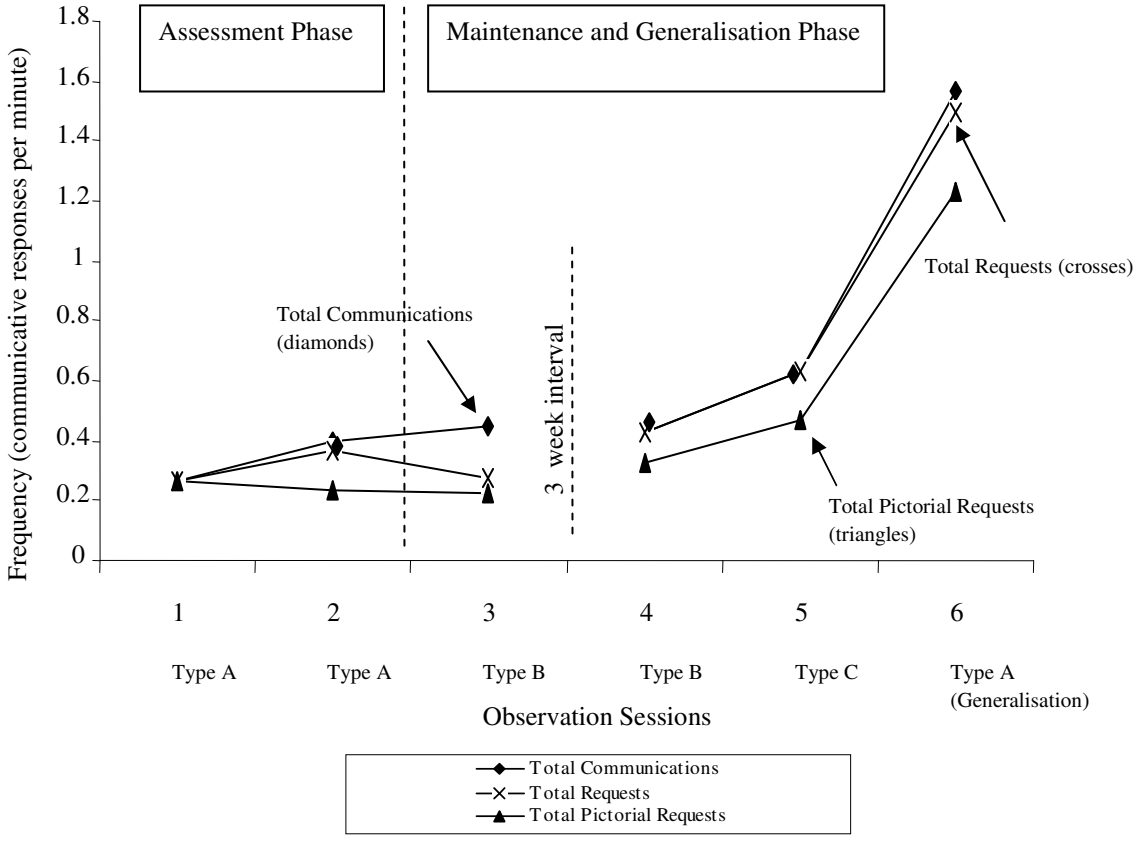

Figure .2.6. Frequency of communicative exchanges initiated by Katie during all observation sessions.

2.4.2. Part 2

The school observations were carried out once it had been established that Robert and Katie were able to emit spontaneous requests using the PECS in their homes and that their requests were not dependent on the direct visibility of the pictures or folder. Robert was observed in five different contexts and he did not emit any PECS exchanges during the entire observation (see Table 2.5). During the observation Robert's PECS folder was either unavailable (for 55.6% of the observation Robert was involved in activities outside of the classroom where he did not have access to his PECS folder) or his PECS folder was on the wall of the classroom.

Table.2.5. Contexts when Robert was observed during school observation

Context		Access to PECS folder	Total pictorial exchanges
Unstructured (70 minutes, 39% of total time)	Freeplay (11 minutes, 6.1% of total time)	Yes	0
	Splash (20 minutes, 11.1% of total time)	No	0
	Sensory Room (40 minutes, 22.2% of total time)	No	0
Structured (110 minutes, 61% of total time)	Teaching/instruction(e.g., getting ready for splash/lunch) (60 minutes, 33.3% of total time)	Yes	0
	Snack time (11 minutes, 6.1% of total time)	Yes	0
	Lunch Time (40 minutes, 22.2% of total time)	No	0

Katie was observed in four different contexts and her use of PECS is shown in Table 2.6. During the observation all of Katie's pictorial requests were actioned. The majority of Katie's requests were emitted during structured times, specifically during snack time (64.3% of pictorial requests). Of Katie's requests, 50% were emitted in the presence of the referent and 28.6% were emitted following a verbal prompt. There were also two instances of spontaneous requests. In line with the continuum model of spontaneity (Carter, 2002, 2003a b; Carter & Hotchkis, 2002; Charlop et al., 1985; Chiang & Carter, 2008) this suggested that Katie was able to emit requests across the range of the spontaneity continuum; this will be considered further during the general discussion.

The observation that Katie used the PECS in school while Robert did not may have been due to the availability of the PECS materials. On no occasion were the PECS materials directly presented before Robert and they were often unavailable. Of the pictorial requests emitted by Katie 85.7% (12/14) occurred when the teacher placed the PECS folder on a table directly in front of her. These results could suggest that at school the children's use of the PECS was at least partly dependent on the direct presentation of the PECS materials; this will also be discussed further in the general discussion.

Table.2.6. Contexts in which Katie was observed during school observation

Context		Access to PECS folder	Total pictorial exchanges	Level of Cueing			
				Spontaneous Requests	Presence of the item	Verbal Prompt (e.g., question)	Physical Prompt
Unstructured (65 minutes, 36.1% of total time)	Freeplay (31 minutes, 17.2% of total time)	Yes	5	1	1	3	0
	Splash (34 minutes, 18.9% of total time)	No	0				
Structured (115 minutes, 63.9% of total time)	Teaching/instruction (e.g., changing for splash/getting ready for lunch (63 minutes, 35% of total time)	Yes	0				
	Snack Time (22 minutes, 12.2% of total time)	Yes	9	1	6	1	1
	Lunch Time (31 minutes, 17.2% of total time)	No	0				
Total			***14***	***2***	***7***	***4***	***1***

2.5. General Discussion

The present study was intended to be a pilot that tested a particular hypothesis and obtained preliminary information about the spontaneous use of the PECS. Part one of the study was conducted at the children's homes and it involved three phases (Assessment; Teaching; Maintenance & Generalisation). In the assessment phase a procedure was used that utilized contextual cues. Contextual cues were created by having observation sessions in which the children's 'preferred' items were presented in front of them after a period of time had elapsed. The purpose of this was to allow the children to make an association between the contextual cues present in the

sessions and access to their 'preferred' items, and then to examine whether the children would begin to emit requests for their preferred items before these items had been placed in view. Evidence that these contextual cues were created was the observation that Katie began requesting her 'preferred' items when they were out of sight during the second observation session and onwards. The assessment phase, therefore, seemed to provide a time efficient means of establishing whether the participants used the PECS to emit spontaneous requests (e.g., without verbal or physical prompt and without the item being in sight).

The assessment phase differentiated between Katie, who could make spontaneous requests, and Robert, who could not. These findings were supported by parental reports; before phase 1 began the parent of Katie reported that she did use the PECS to request out of sight items, while the parent of Robert reported that he did not. This suggests that the procedure could be used to screen whether children need additional teaching to encourage them to emit spontaneous requests. The fact that Robert, who was considered to be further ahead in the PECS according to the typical protocol, emitted requests that were contingent on him having seen the item supports the notion that the PECS training procedures may fail to teach some children to emit requests for items out of sight. In this study one out of two participants did not use the PECS to spontaneously request, if the findings of the study are generalised to the general population of children with autism who use the PECS it may suggest that around 50% may not use the system to spontaneously request; however, this statement should be treated with caution given the small number of participants used in the study and replication of the findings is needed.

The maintenance and generalisation phase showed that the frequency of Robert's spontaneous pictorial requests increased after the teaching phase. In addition, after the first week of teaching Robert's parent reported that he was beginning to emit pictorial requests for out of sight items outside of the teaching sessions. These findings provide preliminary evidence that the stimulus transfer procedures adopted in the teaching phase promoted the spontaneity of Robert's requests by freeing them from the presence of the item, and that Robert was able to generalise the skill he had learnt to other settings.

The results of the maintenance and generalisation phase also showed that the use of the PECS by both children was not dependent on the pictures or folder being directly visible in the home context. The second part of the study, however, which involved a school-based observation of both children, suggested that the children's use of the PECS was influenced by the direct visibility of the materials in that setting. At school the majority of Katie's pictorial requests occurred when the materials had been directly presented in front of her. In contrast, on no occasion were the materials placed before Robert, with the materials either being inaccessible or hung on the classroom wall, and this may explain why Robert did not use the PECS during the entire observation. These findings support those of Carter (2003b), who showed that users of AAC systems tended to use the systems only after a teacher had presented the materials in front of them. In the school context, if children are encouraged to use the PECS only when the materials have been presented directly before them, it could mean that the conditions become associated with increased availability of the items that the child can request. Subsequently, the teacher's presentation of the PECS materials could come to serve as S^D to the children's requests and this may reduce levels of spontaneity.

Although this study has focused on children's ability to use the PECS to make fully spontaneous requests, individuals must also have an awareness of when it is appropriate to do so and when it is more appropriate to wait for verbal prompts (e.g., being asked "What do you want?") or visual prompts (e.g., seeing what choices are available). Carter and colleagues (Carter, 2003a; Carter & Hotchkis, 2002) have proposed that it is important that individuals can communicate across the whole spontaneity continuum as higher levels of spontaneity are not always desirable. The school-based observation suggested that Katie did use the PECS to emit requests across the spontaneity continuum, as she emitted requests following verbal prompts, with the referent in sight and also spontaneously.

The conclusions that can be drawn from this study are limited by a number of factors. Firstly, the issue of the small number of participants. It will be important to replicate the current study with a larger sample to factor out possible confounding factors. Large Random Controlled Trials (RCT), however, are difficult to employ, in terms of recruiting potential participants and being highly demanding in terms of time and cost. A multiple-baseline design (MBL) may be more effective and could be used

to verify the effectiveness of the assessment and teaching phases. It is possible that Robert may have needed longer to become aware of the contextual cues in the assessment phase, such that an increase in his spontaneous requesting might have been observed if the assessment phase had simply continued over a longer period of time; a MBL design across participants could be used to rule this out.

The EO in the observation sessions involved withholding the children's 'preferred' items at a time when they would normally have access to such items. It is possible that these conditions may not have increased the value of the reinforcers and so not have increased the likelihood of the children requesting them. If so, when the children did not emit spontaneous requests it might have been because they were not motivated to do so, rather than being unable to emit spontaneous requests. However, both children came to emit requests for items out of view with no visual or verbal prompts during the observation sessions, suggesting that the EO was effective.

Despite the limitations, the present study adds to the body of research examining the effectiveness of the PECS by demonstrating that researchers should take into account the presence of the item when examining 'spontaneity'. The study provides preliminary evidence that some children with autism who use the PECS may not use the system to emit spontaneous requests, so it is important for practitioners to assess whether children demonstrate this skill in a variety of contexts. If children are not emitting spontaneous requests once they have become proficient up to phase III, then practitioners may need to teach children this skill directly; the present study provides the first preliminary evidence that transfer of stimulus control procedures could be effective at achieving this. The study has also shown that it will be important that schools promote the spontaneous use of the PECS by ensuring that children's use of the system does not become dependent on the PECS materials being first presented to them by a teacher.

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Appendix 1. Observation Schedule (Part 1)

NB: When 'other' recorded specify who/what/how. If more than one number applies tick all.

All Communications				**PECS Only**
Time	**Method of child's communication**	**Function of child's communication**	**Type of communication (Requests only)**	**Level of cueing (i.e. what made the child engage in the behaviour. Determined by the conditions that were present within 20 seconds prior to the exchange)**
	(1) Gestural (e.g., pointing/signing) (2) PECS (3) Vocal (e.g., speech/vocalisation) (4) Physical (e.g., leading adult/moving persons hand)	(1) Requesting (2) Greeting (3) Commenting (4) Labelling (5) Anticipating (6) To gain attention (7) Unclear (8) Other	(1) Generalised (e.g., not specifically linked to its referent/not understood by others) (2.)Specific (e.g., specifically linked to its referent/understood by others)	(1) Presence of listener (2) Presence of object/event (3) Verbal prompt (question or modelled response) (4) Physical Prompt

Appendix 2. Response Form for Teaching Condition

Name: **Date:**

Date	Trial No.	Discrimination Level (e.g., picture chosen)	Spontaneous? Y/N	Level of Prompt				Correspondence Check (pass/ fail)
				Taken to PECS folder	Pick up (hand-over-hand)	Taken to communicative partner	Release	

Appendix.3. Procedures for the PECS

Reinforcer Assessment

The reinforcer assessment was a two-step procedure. Step 1 involved obtaining an idea of what the child liked and disliked by asking the parent to complete the Vocabulary Selection Worksheet devised by Frost and Bondy (2002). Step 2 involved a stimulus preference assessment using a multiple-stimulus format (Deleon & Iwata, 1997*)* to determine each child's four most 'preferred' items. The procedure adopted was the same as that used by Charlop-Christy, Carpenter, Le, LeBlanc and Kellet (2002). The researcher sat at a table opposite the child and had in front of her a tray of items, including four of the preferred and four non-preferred items that were identified by the child's caregiver. The child was allowed to select an item and interact with it for 30 seconds, or allowed to consume a small portion, if edible. The item was then returned to the tray or, if edible, replaced with another of the same item. An item was considered preferred if the child reached for it within 5 seconds, and an item was considered highly preferred if it was selected more than three times. Once an item was identified as highly preferred it was removed from the array and replaced with another item.

PECS Assessment (Frost & Bondy, 2002)

The PECS assessment involved two probes that were conducted in the child's home. A probe was conducted in one 10 trial block. The pictorial symbols for the child's four 'preferred' items were displayed on the front of the PECS folder which was placed in front of the child. The four 'preferred' items were placed in view of the child but out of his reach. A trial was recorded as correct if the child exchanged a pictorial symbol without prompting. Also, on one in every four requests a correspondence check was adopted. If the child did not pass the correspondence check then the trial was marked as incorrect. Once a child had correctly requested one of his preferred items on at least 4 occasions it was removed, and the item and corresponding pictorial symbol were changed for a non-preferred item. This ensured the child would request each of his preferred items during the probes. A score of 90% or higher was indicative of the child having mastered PECS up to at least phase 3 and being able to discriminate between the pictorial symbols corresponding to their

preferred items. If either child had not been at this stage then further training would have been needed but this was not the case.

Error Correction Procedure (Frost & Bondy, 2002, p139)

During a correspondence check, if the child reached for an item that did not correspond to the pictorial symbol that he exchanged, the communicative partner would block the child's access to the item. The communicative partner then: (1) showed/tapped the target picture; (2) held her hand open near the picture or physically prompted the child if necessary; (3) praised the child when he gave target picture but did not give the requested item; and (4) briefly distracted the child e.g., "Do this". The communicative partner then enticed the child with the preferred items to encourage the child to make a request.

Appendix 4. Observation Schedule (Part 2)

Time	Communicative Partner (i.e. listener/ who responded)	Context	Function of Child's communication	Manner in which adult's attention gained by child	'Listeners' response	Level of cueing (i.e. what made the child engage in the behaviour. Determined by the conditions that were present within 20 seconds prior to the exchange)
			(1) Requesting (2) Greeting (3) Commenting (4) Labelling (5) Anticipating (6) To gain attention (7) Unclear (8) Other	(1) Already gained (2) Not gained (3) Child moved to adult (4) Gestural prompt (5) Vocalisation (6) Other	(1) None (2) Actioned (3) Verbal response (3. i) Question (3.ii) Comment (3.iii) explained 'not' possible (3.iv) Other (4) Physical response (5) Other	(1) Presence of listener (2) Presence of object/event (3) Verbal prompt (question or modelled response) (4) Physical Prompt

Appendix 5. Parental Consent Forms (Part 1).

UNIVERSITY OF Southampton

Do children use the Picture Exchange Communication System (PECS) to make spontaneous requests?

Letter of consent for research participation

Dear Parent/Guardian,

I am a trainee educational psychologist at the University of Southampton, and I am involved in a project to evaluate how effective the Picture Exchange Communication System (PECS) is for children (Bondy & Frost, 1994). In PECS children are taught to exchange pictures to request items. PECS has become a popular communication strategy for children with autism and other communication disorders, and the present study will examine if children use PECS to make spontaneous requests (i.e. without adult prompt and without the item being in sight).

Free-play sessions will be observed to sample the child's communicative interactions over a range of situations. Children will then receive an intervention condition to promote spontaneous requesting. The intervention will last for 2 weeks and involve 30-minute sessions conducted three times a week; this teaching will involve free play sessions in which the child is encouraged to make pictorial requests for items that are not in sight. Some free-play sessions will be video taped to ensure reliability of results. Caregivers will need to consent to their child taking part and to allow training to occur at their home.

I will write a report based on the results which will not include yours or your child's name or any other identifying characteristics. Written feedback on the research findings will be sent to you in September 2010. Personal information will not be released to or viewed by anyone other than the researchers involved in this project. Once video taped footage has been analysed it will be deleted.

If you agree to take part in this project I would be grateful if you could return the consent form (attached) and send it back to us in the freepost envelope. The participation of you and your child is voluntary and you/or they may withdraw consent at any time.

If you have any questions relating to this study please do not hesitate to contact me at School of Psychology, University of Southampton (telephone no: 023 8059 2609). You may also contact my supervisor, Professor Bob Remington (Deputy Head of School—Research and Enterprise) at School of Psychology, University of Southampton (telephone no: 023 8059 2626). If you have questions about your rights as a participant in this research you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. (telephone no: 023 8059 5578).

Yours sincerely,

[Name of Researcher]

Appendix 6. Parental Consent Forms (Part 2)

UNIVERSITY OF Southampton

Video recording agreement

I am currently researching how children use the Picture Exchange Communication system (PECS). As part of this research I would like to video a few teaching sessions at [Name of School]. Your child will not be the focus for this video work but may appear in the background of the recording. The video will be viewed by myself and staff within the University of Southampton.

If you would not like your child to appear on the video please complete the slip below and return it to school.

All data will be dealt with in accordance with the Data Protection Act and the University of Southampton policy. Information will remain anonymous with names omitted from video recordings and data analysis. The data will only be used for the purpose of this research. Once data has been analysed from the video recorders the tapes will be erased. The data from the videos will be kept on a password protected computer.

If you have any questions relating to this study please do not hesitate to contact me on my work mobile (no: 07766991502). You may also contact my supervisor, Professor Bob Remington (Deputy Head of School—Research and Enterprise) at School of Psychology, University of Southampton (telephone no: 023 8059 2626). If you have questions about your rights in this research you may contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ. (telephone no: 023 8059 5578).

Many Thanks

[Name of Researcher]

UNIVERSITY OF Southampton

I would not like my child to be recorded on video for the purpose of the research project being conducted by [Name of Researcher].

…… Parent/Guardian

Print Name

…… Parent/Guardian

Signature

…… Date