

GENERALISATION OF THE PICTURE EXCHANGE
COMMUNICATION SYSTEM (PECS) ACROSS
TRANSFER FACILATED AND NON-FACILITATED
SETTINGS

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Table of Contents

Dedication	iii
Abstract	iv
Glossary	v
Introduction	1
Method	10
Results	.....	25
Discussion	.....	34
References	.....	44
Appendix	.....	49

List of Figures and Tables

Figure 1: PECS acquisition	.....	26
Figure 2: Transfer of PECS	.....	30
Figure 3: Transfer of verbal requesting	.....	32
Table 1: PECS requests post training	.....	31
Table 2: Non-verbal requests	.....	33

Dedication

For the children and clients who inspire and intrigue me on a daily basis, I thank you.

To the children who served as participants in this study, and their families, my greatest appreciation for their time, effort and trust. I hope you learnt as much from this study as I did.

To my husband, my immense gratitude for your on-going support and to my parents for keeping me focused, this research would never have been completed without your encouragement and practical assistance, and I will be forever grateful for all your help.

Finally to my supervisor, I thank you sincerely for your endless patience, words of wisdom and guidance that enabled me to produce this work.

Abstract

The purpose of this study was to investigate the extent to which PECS would generalise from the training setting to other familiar settings as a function of properties of the settings. It was predicted that PECS would generalise better to the setting where PECS use facilitated was by having the same communicative partners and items available. Three preschool children all with a diagnosis of Autism Spectrum Disorder (ASD) were trained to use the Picture Exchange Communication System (PECS) to a minimum proficiency level of Phase 3. The experiment employed an ABA single case design with multiple target measures, replicated across participants, acknowledging that observations in the first baseline would be zero. Transfer of PECS across settings varied for each participant. One participant generalised PECS to the facilitated environment more than the non-facilitated environment as predicted. Another participant transferred PECS better to the non-facilitated environment compared to the facilitated environment contrary to the research prediction. The final participant did not generalise PECS to either environment, switching to functional verbal communication instead.

Glossary

Echoic

An echoic is a type of verbal operant. Its antecedent is an auditory stimulus, usually verbal and the response is verbal, sharing a similarity with the stimulus. Echoics are typically maintained by social reinforcement. For example, an adult points to a plane in the sky and says to a child *'look, moon'*. The child responds *'moon'* and the adult provides reinforcement by saying *'that's right, it's the moon'*.

Echoic-Tact

An echoic-tact is a mixed verbal operant where the antecedent is both visual and auditory. For example, a person points to a picture in a book of a cat and says to a child *'cat'*. The child repeats *'cat'*.

Echolalia

Echolalia is similar to echoic behaviour in that its antecedent is auditory and the behaviour is verbal. However with echolalia the speech may be a single word, phrase, sentence or more and may be repeated several times or continuously. Echolalia may happen in the absence of other people. For example, a child with autism may watch a video and then repeat large chunks of the dialogue to them-self throughout the rest of the day. Reinforcement of echolalia is usually considered to be self-stimulatory or intrinsic, rather than being a response provided by another person. Therefore echolalia is not a verbal operant, as it is not performed to generate a response from another person in the environment.

Intraverbal

An Intraverbal is a verbal operant where the verbal behaviour is a response to a verbal stimulus, resulting in social or educational reinforcement. It is similar to echoic behaviour, but the response does not match the antecedent in form. Answering questions or completing sentences are examples of intraverbal behaviour.

Intraverbal-Echoic-Tact

An intraverbal-echoic-tact is another form of a mixed operant. This occurs when the antecedent is visual, and a verbal instruction is given which contains the response that will be made. An example would be when people are saying goodbye. The mother says to her child 'say bye to Nana'. The child says 'bye Nana'. This example would be an intraverbal tact if the mother asked her child 'what do you say'. It would be an echoic-tact if the child saw and heard the people saying goodbye, and then repeated 'bye'.

Intraverbal-Tact

An intraverbal-tact is a mixed verbal operant. The antecedent differs by having a subject in view that the person is asked a question about. For example, a new book is on the table and the child is asked 'what's this?' In a pure tact the book would be on the table, but no question would be asked and the child would comment 'new book'. In a pure intraverbal the book would not be in sight and the child would be asked 'guess what I got you today'.

Mand

A mand is a verbal operant generated by a state of deprivation or the presence of an aversive stimulus. It is reinforced by tangible responses that are specified by the verbal behaviour.

Mands are generally requests. For example, a child is given a meal they don't like. They demand '*take it away*' and their parent removes the dish.

Mand-Tact

A mand-tact is another type of mixed verbal operant. The behaviour is generated from deprivation and seeing something in the environment that would meet their need. For example, a child is thirsty and sees a bottle of coke on the bench. The child says '*want coke*'. In this situation their behaviour would be a pure mand if they were thirsty but the coke wasn't in sight. For their behaviour to be a pure tact they wouldn't be thirsty, but would just see the coke and say '*there's coke*'.

Tact

A tact is a verbal operant generated by a nonverbal event or objects in the environment, and is maintained by social reinforcement. Comments are usually tacts. An example would be, where a person looks out the window and comments '*it's rainy outside*' and the communicative partner provides reinforcement by saying, '*you better wear your jacket today so you don't get wet*'.

Verbal Operants

Verbal operants are a form of verbal behaviour that is performed by a person to produce an effect from their environment.

Introduction

Autism Spectrum Disorder (ASD) is a congenital disorder of pervasive developmental delay. Children with this disorder have key neurobiological features including a limited range of interests, repetitive behaviours, significant impairment of social relatedness and abilities, and a major deficit in language and communication (American Psychiatric Association, 1994). Studies of the epidemiology of autism by Fombonne (2005), place the occurrence of autistic disorder at 0.13% of the population, with all disorders of pervasive developmental delay at 0.6%, and affecting more boys than girls at a ratio of 4:1.

In autistic disorder, deficits occur in all areas of language and communication, but most obviously in semantics and pragmatics, i.e., the meaning and use of language respectively (Ogletree & Harn, 2001). According to Peeters and Gillberg (1999), about fifty percent of children with autism do not develop functional language and as adults they are functionally mute. These deficits may severely impact the functional use of language to communicate with the person with autism and their communication to others. Based on the work of B.F. Skinner, Frost and Bondy (2002) have defined functional communication to be “behaviour directed to another person who in turn provides related direct or social rewards”.

Gaining a means to communicate allows a person to participate in social interactions and have more control over life events, and can have a tremendous impact on their quality of life (Goldstein, 2002). When children are unable to communicate effectively, they may engage in inappropriate or maladaptive behaviours such as self-injury, tantrums, crying, screaming and aggression towards others, destruction of property and self-stimulatory behaviours (Mirenda, 2001; Stoner, Beck, Bock, Hickey, Kosuwan, & Thompson, 2006).

Because communication is so essential to human life and because when it is compromised it has such serious effects on human development and quality of life, many

approaches have been taken and interventions developed with the purpose of reducing functional communication deficits in individuals with autism (Durand & Merges, 2001). Among these, Augmentative and Alternative Communication (AAC) interventions involve the use of signs or symbols to either support and supplement, or replace, verbal language. Systems include sign language, electronic systems and symbol systems (Schwartz, Garfinkle, & Bauer, 1998). The objective of AAC interventions is for the user to become competent at communicating both in their present environment and, in the future, in new environments and situations (Beukelman & Mirenda, 1998), however, it is seldom enough just to provide a communication device without providing systematic training in its implementation (Sigafoos, 2005). Nor is it sufficient for an individual to merely learn how to use some AAC system. If the acquired communication skill is to have beneficial effects across their quality of life and developmental trajectory, the skill has to endure over time and have generality across social situations – i.e., it must transfer and generalise (Carré, Le Grice, Blampied, & Walker, 2009; Stokes and Baer, 1977; Yoder & Lieberman, 2010).

The Picture Exchange Communication System (PECS) is an augmentative communication system that enables children with limited functional language to communicate effectively. PECS has rapidly become popular since its development by Andy Bondy and Lori Frost, with its widespread adoption somewhat preceding the empirically controlled studies required to substantiate its efficacy and effectiveness (Charlop-Christy, Carpenter, Le, Le Blanc & Kellet, 2002).

Using both developmental theories and behavioural principles, especially those of reinforcement and prompting techniques, the objective of PECS is to teach spontaneous use of communication within a social context by using pictures and symbols (Bondy & Frost, 2001; Magiati & Howlin, 2003). PECS is trained and explicitly intended for use in social situations where the individual with communicative difficulties has a communicative partner

with either no or a lesser degree of communicative deficit. As typically implemented, the child with deficits is trained to use PECS in the home and classroom situation where the communicative partner is a parent, teacher or teacher aide, or somebody else who can be responsive to the child's communicative attempts and responses.

Commonly implemented with children with ASD, numerous studies have reported PECS to be an effective intervention for communication within this population because it requires a communicative act based on social interaction (Sigafoos, 2005). PECS is significantly different to other AAC interventions as it is based on the spontaneous initiation of language by the person who is learning to communicate, rather than imitation of sounds or signs modelled by a therapist which can lead to prompt dependency and failure to develop the initiation of communication. (Schwartz et al., 1998; Bondy & Frost, 2001). Initial speech by typically developing children is in the form of labelling/naming (tacts), which is maintained by social reinforcers, and requesting (mands), which is maintained by its specific consequence (Bondy and Frost, 1994; Skinner, 1957), [see the Glossary for definitions of tacts and mands].

However, because of the social impairment in children with autism, they are taught to mand first as it results in tangible reinforcement. Once manding is established in the communicative repertoire, other verbal operants, including tacts, may be established. PECS is a non-vocal communication system in which the presentation of a picture symbol by the person initiating the communication to a communicative partner functions as a verbal operant, maintained by the consequence mediated by the communicative partner (thus meeting the definition of verbal behaviour; Skinner (1957)). Since this requires the learning and performance of a new skill set on the part of the learner (and to some extent the communicative partner) PECS has a comprehensive teaching protocol involving six phases. It starts with how to communicate using pictures in a way that is meaningful to the child, and

goes through to the use of multiple picture sentences and on to a variety of communicative functions such as answering questions and commenting (Bondy & Frost, 2001; Frost & Bondy, 2002).

Phase 1 teaches the presentation of a single picture by the student and its exchange for a desired item to and from the communicative partner. Phase 2 expands on Phase 1 by systematically teaching the student to make the same exchange over distance, in order to retrieve the picture and reach the communicative partner. Phase 3 introduces discrimination between multiple pictures typically housed in a folder, some of which may be trained and some untrained distractors. Phase 4 provides the student with a sentence strip, which is a presentation device for holding and ordering pictures, and teaches them to build a basic sentence using an '*I want*' card. Phase 5 teaches the student to respond to the question from a communicative partner '*what do you want?*' using their pictures and sentence strip. Phase 6 expands on Phase 5 by teaching students to respond to questions where the answers are intra-verbals or intraverbals-tacts rather than mands (see Glossary), resulting in reinforcement that is social rather than tangible.

One of the reasons for the popularity of PECS is that it does not require any of the prerequisite skills often needed in other AAC systems, before implementation such as eye contact, imitation, labelling or ability to match (Bondy & Frost, 2004). For example: Bondy and Frost (2001) observed that when a therapist attempts to teach speech through its imitation, children may spend many months learning the skill of imitation before speaking their first words. Furthermore, they noted that many children do not develop speech during a reasonable time period, and the acquisition of speech imitation does not necessarily generalize to actual communication (Bondy & Frost, 2001).

Another reason for its popularity is that PECS is readily understood by the general public, so potential communicative partners are more frequently available (Mirenda &

Erickson, 2000), and can respond or be taught to respond to PECS request-initiations with relative ease. This is different to sign language which requires other people within the child's environment to be trained in sign language so as to both recognize that they are being communicated with and to understand the communication. Furthermore, many individuals with autism have trouble with fine motor co-ordination, limiting their ability to point accurately or manually sign as required in other AAC interventions (Schwartz et al., 1998). Ease of responding by communicative partners in PECS notwithstanding, features of the communicative partner response, such as immediacy and social responsiveness may play a role in the both the initial acquisition of PECS skills by the child and subsequent transfer and generalisation (Carré, et al., 2009). This follows from our knowledge of the effect of immediacy of reinforcement on acquisition, where delayed reinforcement is known to reduce learning and performance (Cooper, Herron & Heward, 2007). The same principle predicts that contexts where communicative partners are primed to be responsive and do, in practice respond rapidly and effectively to PECS requests are likely to sustain more transfer and generalisation than those contexts where communicative partner responses are less immediate or competent.

PECS training is also claimed to occur in a relatively short amount of time (Bondy & Frost, 1993). This claim has been substantiated by other studies (Charlop-Christy et al., 2002; Ganz & Simpson, 2004; Schwartz et al., 1998) with Cummings, Carr and Le Blanc (2012), stating that “as long as trainers employ a sufficient density of trials, PECS can be taught in a relatively effective manner” (p. 33). Even so, it remains an empirical question as to whether or not any specific child will master PECS at all, the PECS phase level they attain, and the extent to which they transfer PECS use beyond the training environment.

Bondy and Frost (1994) have argued from the initiation of PECS that use of PECS will promote emergence of spontaneous vocal speech, and have other benefits such as reduction in

challenging behaviour. Charlop-Christy et al. (2002), showed the use of PECS to also reduce challenging behaviours and increase spontaneous speech. A meta-analysis of single subject studies by Hart and Binda (2010) found support from two other studies for the decrease in problem behaviours with the use of PECS, but warned that this effect needs more evidence before it can be stated conclusively. A review of 16 single-participant studies by Tincani and Devis (2011) showed that fewer studies have documented speech, but those that have show that more than half of the participants have made some gains in speech, ranging from mild to substantial improvements.

Whilst PECS has many advantages, it does not have a great deal of empirical evidence behind it. Much of the initial research was limited to anecdotal reports and program evaluation data from its creators (Mirenda, 2001). PECS is recognised as an effective intervention for communication within the autistic population (Sigafos, 2005) but the amount of published research, whilst promising, is still small (Stoner et al., 2006).

In particular, the research on transfer and generalisation is minimal, yet generalization must be a major attribute of any communication intervention for it to be considered functional. As explained by Stokes and Baer (1977), it is important that generalization be recognized as an active process that does not occur automatically just because a change in behaviour is achieved under intervention. To truly assess generality, the trained behaviour must be observed in an untrained setting. Therefore a communication system cannot be considered functional if its use does not generalise to settings that differ from the training environment on multiple dimensions simultaneously (Yoder & Lieberman, 2010), nor is it functional unless it endures in the repertoire. Bondy and Frost (1994, 2001, 2002) contend that the PECS protocol actively facilitates generalization throughout the training process by such processes as: using a variety of reinforcers, practising with different communicative

partners, practising in different environments, and removing all prompts that may be cueing the child to initiate communication.

Whilst some studies have demonstrated the efficacy of PECS, they have not assessed generalization of PECS to other contexts or its maintenance over time (Charlop-Christy et al., 2002; Ganz and Simpson, 2004). The small amount of research that has examined generalization is mostly confined to generalisation within, rather than across, environments/instructional contexts and is inconclusive at best (Carré, et al., 2009; Mirenda, 2001; Schwartz et al., 1998; Stoner et al, 2006).

Data on the generalisation of PECS from its place of training to other environments is limited. In a review of research on Autism and augmentative communication systems, Mirenda (2001) found data on generalisation of any augmentative communication system to be anecdotal and with little assessment of its social validity. Some other studies, which have been small in scale, have commented on generalisation but not formally assessed its occurrence (Ganz & Simpson, 2004; Kravits, Kamps, Kemmerer & Potucek, 2002).

Research by Schwartz et al. (1998), reported generalisation of PECS to occur, from trained settings to untrained settings within the school environment over the period of a year with children who had varying communicative disabilities. In 2006, Stoner et al. reported success of generalisation of PECS across environments when three nonverbal adults with mental retardation successfully used the PECS they had mastered in their group home, in two fast food restaurants. Another study with adults who had severe mental retardation ,found that requests made by PECS generalised to a novel setting with a new communicative partner for two of their three participants (Ziomek & Rehfeldt, 2008). However, these requests were learnt through training to complete a task with a set establishing operation, rather than being spontaneous requests for intrinsically motivating items. A recent study that was set up to specifically examine generalisation of the use of PECS within the classroom and across to the

home environment, for young school age children with either Autism or developmental delay, did not find a functionally significant increase in the use of PECS to occur within the untrained classroom or in the home setting (Carré et al., 2009).

Research by Yoder and Lieberman (2010), looked at whether the actual behaviour of making a picture exchange to communicate generalised. Nineteen children with ASD were given PECS training. The post treatment investigation was carried out in a different setting with different materials and activities by examiners who had not been a part of the PECS training and had a different style of interaction. The participants did not have to discriminate pictures in this study as only a single symbol was ever available for exchange. The researchers found that the act of exchanging a picture as a request did generalise across setting, communicative partners and activities.

In reaching a conclusion about the evidence about transfer and generalisation of PECS, a review of 34 published PECS studies, acknowledged that more research is needed in the extent to which training and generalisation opportunities, both formal and informal, relate to the acquisition of communication skills (Sulzer-Azaroff, Hoffman, Horton, Bondy & Frost, 2009).

As noted above, a major consideration for the success of generalisation has to be the training of staff, parents and caregivers who will be the student's main communicative partners. A pilot study of the introduction of PECS training in schools by Magiati & Howlin (2003) found most parents to be positive about the use of PECS at home, but some had difficulties in transferring its use from school. However, the study incurred difficulties with data collection and measures over the study were obtained inconsistently. The authors concluded that for generalisation from the school setting to home to occur, there would have to be a close liaison between these environments. It was also noted by Stoner et al. (2006)

that the success of PECS in their study would have been questionable if implemented by the participants' support staff rather than the researchers.

A study by Howlin, Gordon, Pasco, Wade and Charman (2007) found that PECS usage and rates of initiation increased significantly immediately after staff had been given PECS training but these gains were not maintained after training stopped, raising important issues about the contingencies shaping and maintaining staff performance in educational settings. This demonstrates the major role that trainers and communicative partners have in the long term efficacy of PECS. Carré et al. (2009) also discussed the need to train the communicative partners and emphasised the importance of their role, especially during the initial training stages.

Given the extensive use of PECS for children with ASD and other communicative deficits, research is required to substantiate the occurrence of generalisation with this system. As PECS is widely used with children with Autism, it would be beneficial for such a study to have members of this population serve as participants. The purpose of this study, therefore, is to investigate the generalisation of PECS from the training setting to different settings, with different communicative partners, and with different activities and items available that the participants would normally experience. It is predicted that rates of requests using PECS will transfer better to a setting where generalisation is facilitated by having the same items and communicative partners as in the training environment available (called a transfer-facilitated setting), than to a setting where the communicative partners and items are different to those in the training sessions.

Method

Participants

Three preschool children all with a diagnosis of Autism Spectrum Disorder (ASD) were trained to use the Picture Exchange Communication System (PECS) to a minimum proficiency level of Phase 3. The participants were selected from referrals made by local speech therapists and a behaviour therapist after an advertisement of the study was sent to professionals who specialised in working with children who have ASD.

The five criteria for participation in the study were that the child; was aged five years or younger; had no current form of functional communication such as speech or sign language; had a diagnosis of ASD from a healthcare professional; would be observable in two environments other than the home; and would be available for the full length of the study. It was also a requirement of the study that parents must be prepared to support the use of PECS as prescribed and keep a record of PECS use once a week.

Suzy:¹ Aged 4 years, 8 months at the beginning of her baseline observations, Suzy was diagnosed as having ASD at the age of 2 years, 9 months by a paediatrician. Suzy presented with echolalia and had two words she would use appropriately. One was the name of her sister, and the other an approximation of raspberry, which she would use to request juice.

Suzy would occasionally babble to herself at a pre-speech level. When she wanted something she would often hover around her parents and wait for them to notice her and offer her choices of activities, drinks or snacks. Suzy's receptive abilities were greater than her expressive abilities and she could follow simple one step instructions given to her by her parents. She had some rituals that she maintained rigidly around order and use of materials.

¹The given name of each participant in this study is a pseudonym.

Ben: Aged five years, 0 months at the start of his observations, Ben had been diagnosed as having ASD by a paediatrician at the age of 3 years, 4 months. Ben's verbal attempts to communicate were limited to one sound and a one word approximation of 'upple' for up and pull. Ben was proactive in getting his needs met by physically guiding his parents towards what he wanted and moving their hands to the right item. This would frequently lead to frustration as it would be clear to his parents that Ben wanted something, but it was not always specifically clear what that was, especially if an item had been moved, been finished or was broken or missing. On occasion, when Ben was ready for his evening meal, he would bring his parents a plate to show he wanted to be fed.

Lila: Aged 4 years, 7 months at the commencement of her initial baseline observations. Lila was given a diagnosis of ASD at the age of 2 years, 6 months by a paediatrician. She had also suffered from meningitis as a toddler. Lila was grossly apathetic and would happily sit for long periods of time in one place mouthing the items around her, to the point where her mother and teacher aide would often pick her up and physically move her to other places and activities. When provided with something new to do, she would usually engage in it happily. Lila had little interest in food and an extremely small variety of foods that she would eat. She relied on being offered different toys, activities and food items rather than seeking them out.

Lila would frequently engage in stereotyped speech, repeating large chunks of songs and videos, and had infrequently echoed words another person said in her vicinity that were irrelevant in meaning to her but she appeared to like the sound of. Her stereotyped speech was often continuous and would increase in volume when under pressure to respond to other people.

Lila at her most active would spend large amounts of time in front of the mirror or television repeating songs from children's videos and TV jingles along with the choreographed movements and dances that went with them. When her repetitive activities

were interrupted before she was ready, or if she was expected to do something to communicate or interact, Lila would curl up on all fours and either go silent, or cry or increase the volume of her repetitive speech. At her most upset she would leave the room and find a corner to curl up in.

Settings

Baseline observations of communication were made at home and in two other familiar settings for each participant prior to training. One of the two settings outside of the home was selected for PECS transfer to be facilitated. The facilitated setting would have communicative partners from the home setting present, and some preferred items such as toys, snacks and activities that were available at home would also be available at that location. Transfer to the third setting would not be facilitated to the same degree as the second setting. Training was provided for items available at that location, but items that would not usually be in that setting were not made available there, and the communicative partners were different to those at home.

For Suzy her Nana's house served as the facilitated environment and her mother and sibling would accompany her there. The preschool she attended five mornings a week was used as the non-facilitated environment. At pre-school a teacher's aide was assigned to Suzy for two hours each day. Ben's facilitated setting was also his Nana's house where he would visit with his mother, sibling and occasionally his father. His non-facilitated location was the day care centre he attended five days a week. At day care, Ben received assistance from a teacher's aide for nine hours a week. For Lila the play centre she attended twice a week was the facilitated environment as it was run by parents and her mother and grandmother attended with her. The kindergarten she attended four mornings a week where she was supervised by a teacher's aide at all times was the non-facilitated environment.

PECS training took place at home until at least the discrimination phase (Phase 3) was mastered. Training took place primarily in the family room of each home with the participant's primary caregivers taking an active role as communicative partners during teaching. Training would also move around the house, based on different activities and would often involve working in the kitchen and outside in the garden. As part of Phase 2, the participants were trained to travel throughout their home to access their PECS and find communication partners. The communication of participants was then observed again over a four week period at home and in the other two settings.

Assessments

As well meeting the criteria for the study, the following assessments were conducted prior to PECS training occurring.

Critical Communication Skills Checklist. This checklist is provided in the PECS manual (Frost & Bondy, 2002) as a guideline for assessing the need of an individual for an augmentative or alternative communication system, and to determine if PECS would be functional for the intended user. It was administered to ensure that participants had no other form of functional communication, or previous PECS experience and that PECS was an appropriate intervention for the participant.

None of the participants had a functional means of communication. Suzy could follow simple single step verbal instructions given by her parents, usually accompanied with gestures. She could verbally ask for her turn when she saw items of interest but did not do so consistently. Suzy was unable to ask for help and her solution to being presented with something she didn't like, was to withdraw herself.

Unable to communicate effectively with speech, Ben would try to move people and objects in order to get his needs met. His ability to follow simple verbal instruction was

inconsistent and he seldom responded to directions made visually or by gesture. Lila would become distressed when her needs weren't being met but she showed very little initiation of communication in any form and relied strongly on her mother to offer her food, drink and activities throughout the day. Lila was largely unresponsive to instructions either verbal or visual and would run and hide if attempts to communicate with her were too persistent.

Peabody Picture Vocabulary Test – Third Edition. The Peabody Picture Vocabulary Test – Third Edition (PPVT-III; Dunn & Dunn, 1997) is a standardised test that provides age equivalent scores for vocabulary from age 30 months to 18 years. This test was administered to gauge the participants' level of receptive language. Suzy's test results yielded an age equivalent of less than one year, nine months, with her standard score equivalent falling in the extremely low range. Both Ben and Lila did not understand the instructions they were given, so a reliable measure from this test could not be ascertained for either of them.

Vineland Adaptive Behavior Scales – Second Edition. Providing a measure of adaptive behaviour across domains such as communication and daily living skills, the Vineland Adaptive Behavior Scales-Second Edition (VABS-II; Sparrow, Cicchetti, & Balla, 2005) was administered to give a measure of the overall level of functioning for each participant. Suzy's adaptive behaviour composite score of 67 defines her general adaptive functioning as low, scoring higher than only one percent of similarly aged individuals in the test's norm sample. With the bands of error at the 95 percent level of confidence, her true adaptive behaviour score is likely to be between 62 and 72, with the latter score reaching within the moderately low range.

Ben's adaptive behaviour composite score was 62. With a 95 percent confidence level, his true score is likely to be within the range of 57 to 67, classifying his general level of

adaptive functioning as low. He also scored higher than only one percent of his age related peers in the norm sample. In the maladaptive behaviour test, Ben's results were elevated and his tendency to internalise emotional distress was measured as being at a clinically significant level. Lila's adaptive behaviour composite score was 50 and with a 95 percent level of confidence, her true score is likely to be between 45 and 55, placing well within the low functioning range.

Scoring higher than only one percent of the similarly aged individuals in the norm sample, Lila's score was also considerably lower than that of the other two participants in this study. In the communication, socialisation and daily living skill sub-domains, Lila's age equivalents were all less than that of a one year old. Her maladaptive behaviour and tendency to internalise emotional distress were both at a clinically significant level.

Childhood Autism Rating Scale. The Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 2002) was conducted to confirm the criteria of ASD being present and to provide an indication of the severity of the disorder. With scores ranging on a continuum between 15 and 30 as non-autistic, 30 to 37 as mild to moderately autistic, and 38 to 60 as severely Autistic, Suzy's raw score of 38 placed her just within the severely autistic range. With a score of 42, Ben was also placed in the severely autistic range. Lila's assessment yielded a score of 50.5 placing her well into the severely autistic range. These results were consistent with how the participants presented on a day to day basis, and mirrored the profiles generated by the VABS-II.

Materials

Suzy and Ben were provided with an A5 size, two ring binder, and Lila with an A4 size, 2-ring binder. The binders were orientated so that the spine served as the top. On the

front, three strips of Velcro hooks, spaced evenly ran vertically down the cover. Suzy also had a sentence strip made of coloured paper measuring 20 centimetres long and six centimetres cm wide. This was laminated with a strip of Velcro centred horizontally across it parallel to the bottom of the folder cover. Inside the binders laminated sheets of coloured paper were inserted with Velcro attached in the same way as on the front cover.

At the beginning of training the pictures and symbols used were all 8cm square. By the end of training Suzy's cards were 5cm square, Ben's cards were 6cm square and Lila's cards remained at the original size. The cards were made using photos, and pictures from Boardmaker CD-Rom (Mayer-Johnson, 2001) and Pics for PECS CD-Rom (Pyramid Educational Products, Inc, 2008), colour printed onto 200gsm white card and laminated with a Velcro loop dot on the back.

The pictures for each child were determined by parent report using the PECS Vocabulary Selection Worksheet, observation of interests and formal reinforcer assessment as outlined in Bondy and Frost (1994). A list of the pictures used by each child is attached in Appendix C.

Design

As the participants had no previous experience of PECS it was not possible to conduct a true multiple baseline experiment. The experiment employed an ABA single case design with multiple target measures, replicated across participants, acknowledging that observations in the first baseline would be zero. A single case design was chosen as it is sensitive to individual differences with the participant serving as their own control, and it is a reliable method by which to assess the effect of an intervention.

Procedure

Ethics approval for this study was granted by the University of Canterbury Human Ethics Committee. The training of participants using PECS strictly followed the procedures and phases set in the 2002 PECS Training Manual 2nd Edition by Frost and Bondy.

Parent Meeting. Before observations and training could start, the researcher met with the parents of each prospective participant to explain the research, outlining the procedure to be followed and the requirements of the study (Parent information form, refer Appendix A, consent form, refer Appendix B). More information about PECS was provided and the importance of parental involvement emphasised. The Vocabulary Selection Worksheet and the Critical Communication Skills Checklist were filled out using parent information. A check would be made to ensure the participant met all of the criteria and then signed permission slips for study participation in each location were obtained.

Baseline Observations. The participant was then observed twice in each of their observation settings and their current methods and levels of communication were recorded over a two week period. Verbalisations made by the participant that were not communicative were recorded as babble, words or echoic speech. Sounds such as giggling or humming were not recorded.

Verbal operants were recorded based on classifications made by Skinner (1957). Pure tacts were recorded as comments. Both pure mands and mand-tacts were recorded as requests. Intraverbals such as spontaneous answers to questions or reciprocated greetings were recorded as responses. Intraverbal mands and intraverbal mand-tacts in response to questions such as “what do you want?” were recorded as word on request, as were intraverbal

echoic mand-tact responses made when the participant was told what to say in order to make a request. Echoic and echoic-tacts were recorded as repeats word as a response.

Possible communicative behaviour such as gestures, hovering, dragging by the hand and staring were recorded as clear or unclear non-verbal operants. Finally verbal operants using PECS were recorded as being made independently or with a prompt, and also by correctness. During the pre-intervention baseline observations, Suzy was observed for twenty minutes at a time whilst Ben and Lila were observed for half an hour each time.

After each observation at home a reinforcer assessment was conducted. The participant was presented with favourite toys, foods and activities, and their response was used to categorise the item as highly preferred, preferred, neutral or non-preferred. Items of preference were also established in the community settings through the observations. After the last baseline observation at home the PPVT-III was administered. When all baseline observations were complete the CARS and the VABS-II were also administered.

Parent Training. In preparation for the introduction of Phase 1 PECS training, the parents of each participant were trained as communicative partners using role play. They were taught to entice the student to communicate using a desired item, and to immediately reinforce the picture exchange with the tangible reinforcer requested and social reinforcement.

Training Phase 1. As per Frost and Bondy's (2002) training manual the purpose of this phase was to teach the student how to communicate. With potential reinforcers identified during baseline observations, Phase 1 started for each participant in their home with the researcher acting as the physical prompter and their parent(s) as the communicative partner.

A picture of a preferred item would be placed in front of the participant and the communicative partner sitting opposite and within arm's reach of the participant, would entice the student with that item. Both the communicative partner and the prompter would wait for the participant to reach for the desired item. At this point the prompter sitting immediately behind the participant would immediately physically assist the participant to pick up the picture and release it into the communicative partner's hand which would open to receive the card once the participant reached for the item.

Instantly, within half a second of receiving the card the communicative partner would provide the reinforcer being requested, label it and give social praise. The participant would then be able to eat food items or have approximately twenty seconds to play with the item before the communicative partner would calmly take the toy back. During this time the trainers would set up for the next trial.

The communicative partner would then start to entice the participant again and a new trial would start. As the participant gained experience in making the picture exchange, the physical prompter would use backwards chaining to reduce the intrusiveness of the physical prompts over successive trials. For example, the prompter would prompt the participant to pick up the card and move it to the partner's hand but no longer prompt the release. When this part of the exchange was learnt then the prompter would start to fade assistance to reach towards the trainer, and eventually fade assistance from picking up the card.

As this phase of training is designed to be errorless, few mistakes would occur. However, if an error was made in making the exchange, then the trial would restart and the prompter would provide more physical assistance at the point where the error occurred on the last trial.

If satiation of the preferred item occurred then the communicative partner would switch to another preferred item and the picture provided would be changed to match the new

reinforcer. Training would usually last for up to half an hour at a time, and end before the participant could tire of all the reinforcers prepared. Parents of the participants were encouraged to practice at the phase their child was up to, whenever a suitable opportunity occurred such as at meal, snack or play times.

Training Phase 2. In the distance and persistence phase, the objective is to teach the participant to travel to their communication folder and to their communicative partner in order to make a picture exchange. The participant was provided with a ring binder used for storing their pictures. The picture for the preferred item available was placed on the front cover. Sitting as in Phase 1, the physical prompter would wait for the participant to show interest in the item available and then physically prompt the participant to remove the picture from the folder and exchange it with the communicative partner. This assistance was then faded over successive trials until the participant could complete the exchange independently.

Distance was then gradually introduced between the participant and the communicative partner. The communicative partner would then hold their hand closer to their body when the picture exchange was being made so that the participant would have to reach further in order to complete the exchange. Gradually the communicative partner would inch further away until the participant would have to stand and walk over to them in order to make the picture exchange.

This process continued until the participant would independently cross the room in order to make an exchange. At this point the communicative partner would start to move their body so their hand was not readily available. The physical prompter would physically assist the participant to reach for the communicative partner's hand, open it and place the card inside it. This prompt was faded also using backwards chaining. Next the distance between the participant and their communication folder would be gradually and systematically

increased from being in front of the participant to being far away enough that they had to stand and walk in order to get the picture before making the exchange.

Next the communication folder would be gradually moved off to one side so that the participant would have to move in one direction to get the picture and then change direction to reach the communicative partner. During this process the prompter was available in order to physically assist the participant if they needed any guidance as the distance increased. Training was practised in different rooms of the house, and the communicative partner would move into an adjoining room after enticing the participant so that the participant had to travel through the house in order to make the exchange. A place to store the communication folder in the main room of the house was then determined.

Training Phase 3. The goal of this phase was to teach discrimination between pictures and started when the participant had mastered requesting using pictures for five to ten different items. The communicative partner and the participant sat opposite each other with the communication folder between them. For the purpose of generalisation both the parents and the researcher took turns at being the communicative partner.

The communicative partner would place two pictures on the folder, one of a highly preferred item and a distracter picture of a non-preferred item, and then entice the participant with the two items. The participant would then select a picture and make an exchange receiving the requested item. If the participant selected the correct picture then praise or encouragement was given as soon as they touched it, serving as conditional reinforcement for the requested item.

When the picture of the non-preferred item was selected no verbal reinforcement was given, the participant was allowed to complete the exchange and was given the non-preferred item in return. When the participant reacted negatively to receiving the distracter item, the

four step error correction procedure was implemented. The participant was first shown the correct card and secondly, prompted to give that card to the communicative partner who would then respond with praise but not give the item. Thirdly the communicative partner would then pause or switch to another activity unrelated to PECS briefly. Finally the participant would then be enticed again with both items by the communicative partner and reinforced with the preferred item upon making the correct selection. After each successful trial the pictures on the cover would be re-arranged so that the participant would learn to select the card based on its picture, not its location.

The second part of Phase 3 was to teach the participant to discriminate between two preferred items using correspondence checks. A picture of each preferred item was put on the cover of the communication folder, and the participant shown the two items. When they selected and gave their card to the communicative partner, both items would be presented to the participant and they were told to take it. As soon as the participant reached for the item they requested they were praised and allowed to take the item. If the participant went to take the other preferred item, it was presumed it was the item they really wanted, and that their request was wrong. Access to this item was not given and the four step error correction procedure was followed.

When the participant became proficient at discriminating between the two pictures then a third preferred picture was added until they could discriminate reliably between at least ten pictures of preferred items. Pictures of newly identified reinforcers would continue to be added at the Phase 2 level. Both Ben and Suzy had the size of their picture size reduced during Phase 3 due to their strength in discrimination and the number of pictures they now had in their folders. They were also taught to look through the pages in their folders to find the picture of the item they wanted instead of relying on the desired picture being on the front cover.

Phase 4. Suzy's acquisition of PECS was rapid and her imitation of language during training so strong that she started to make some requests verbally without using PECS. Hence, it was decided that it was in her best interests to go to Phase 4 of PECS training and teach her to use a multi-word phrase when requesting by providing her with a sentence strip. This was attached to the front of her communication folder. In a slight deviation from the PECS protocol instead of having a single card representing I want, two cards were used. One was an "I" card containing a picture of Suzy, and the second a "want" card using the Boardmaker symbol for want.

When Suzy wanted an item the communicative partner would wait for her to select the card and then prompt her to put it on the sentence strip, remove the sentence strip and exchange it. When the sentence strip was received the communicative partner would quickly turn the strip to face Suzy and read her request aloud whilst pointing to each word respectively, and then give her the desired item. The "I" and the "want" pictures were then moved to the front cover with the other pictures and Suzy would select and position them on the sentence strip in order before adding her request.

Finally, Suzy was prompted to point to the pictures on the sentence strip in order, after handing it to the communicative partner who would read it back to her. This prompt was systematically faded using backwards chaining.

Post Treatment Baseline Observations. After training was completed, the researcher met again with the staff and extended family that were present in the participants' two other pre-treatment observed settings, to train them in being communicative partners. The participants then took their communication folder with them when they went out. Post treatment baseline observations were then made for half an hour, twice a week, for four weeks at the participant's home and in their two previously observed locations. The

participant's level of communication was recorded using the same data sheet as in the pre-treatment observations.

Inter-Rater Reliability

All observations and training sessions were digitally recorded on video so that they could be rated by other people to ensure that the data collected was objective, consistent and reliable as possible. Due to time constraints and major disruptions occurring during the period of study, it was regrettably not possible to obtain measures by another rater before completion of this research.

Results

The pre intervention observations of Suzy were a third shorter in duration than her post intervention observations. Pre and post intervention baselines for Ben and Lila were approximately thirty minutes long. So that these observations could be compared fairly, all pre and post intervention scores were averaged into a rate per minute, and then multiplied by thirty to yield a rate per half hour measure. This method of conversion was also used to provide an average number of requests per half hour for the intervention sessions as these all varied in duration. Data for each session including duration, prompting, phase, and distance is provided for each participant in Appendix D.

Acquisition

The acquisition of PECS is shown in Figure 1 for each participant as a rate per 30 minutes of independent requesting and prompted requests, cumulatively across training sessions and phases. Of the three participants Ben showed the most rapid acquisition of PECS to Phase 3b, with a high rate of independent requesting achieved over a relatively small number of training sessions, once better reinforcers were accurately identified. Suzy's acquisition of PECS was to Phase 4 and showed a steady increase of independent requesting over sessions, across all phases. Lila took the most training sessions to master Phase 3b. Once better reinforcement was also identified for her during her phase 1 training, her rate of independent requesting also showed a steady rate of acquisition.

Of the three participants Ben progressed through Phase 1 the fastest. He had two sessions with no independent responding followed by a three-session training break spent on reinforcement assessment. With better reinforcers identified, Ben mastered Phase 1 and started Phase 2 during his third training session.

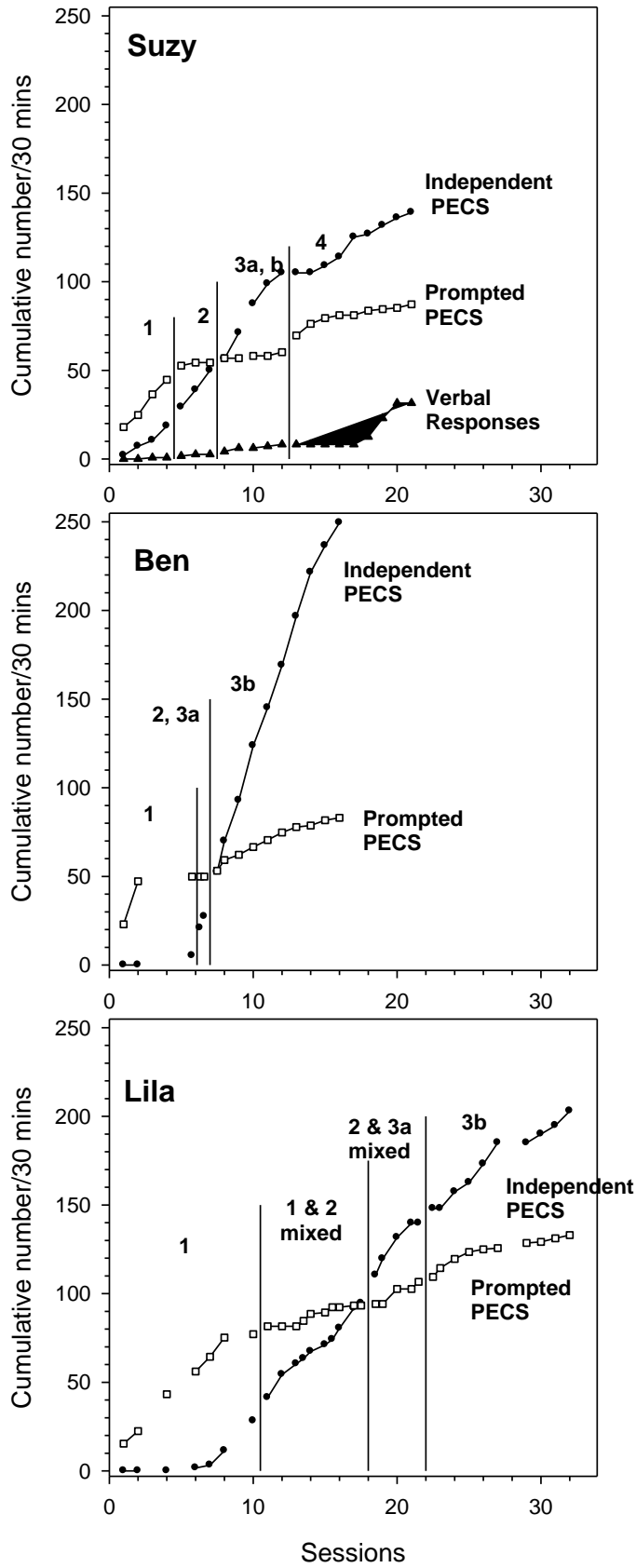


Figure 1. PECS acquisition displayed cumulatively across sessions and phases, for both independent PECS use, prompted PECS use and verbal requests (for Suzy alone).

Lila also had two breaks within her training at level one for reinforcement assessment each of which lasted for one session at a time. The break in her data at session nine was due to the electronic recording of this session being corrupted and impossible to view. Like Suzy, Lila required a consistent level of prompting during this phase but she had double the number of training sessions for this level, and it took longer for her to make any requests without prompting. The number of requests prompted in the first two training sessions was similar for Lila and Suzy, but Suzy made steady progress in the number of her independent requests using PECS from her first training session, which correlated with her rate of prompted requests.

Lila's mastery of each phase was much less distinct than Ben and Suzy's. She would often have to go back a step at the beginning of each session and work up to the level she had been working on at the end of previous session. Once Lila started Phase 2 she continued to train at Phase 1 occasionally for a further six sessions.

Both Suzy and Ben mastered Phase 2 relatively rapidly, with Ben completing Phase 2 training within a single session and Suzy within three training sessions. During Suzy's Phase 2 training, her percentage of independent requests increased steadily with each session whilst the rate of prompted requests plateaued as illustrated in Figure 1. Lila's rate of prompted requests also plateaued whilst acquiring Phase 2 which she mastered over 11 sessions. During this time her rate of independent PECS requests steadily increased and, as for Suzy, also overtook her cumulative rate of prompted requests as she started Phase 3a. Ben's acquisition of Phase 3a occurred within the same training session in which he mastered Phases 1 and 2.

All three participants showed an ability to discriminate between pictures they were familiar with, without requiring much in the way of explicit training. The degree to which each participant could discriminate pictures varied. Ben showed discrimination with five pictures initially. When presented with his pictures in a folder he learnt to flip through the

pages within a session and within four sessions he was discriminating among 12 pictures. By his fourteenth training session Ben could discriminate all of the 30 pictures in his folder.

Suzy spent two sessions at Phase 3a. She showed discrimination when she sorted through 20 pictures independently to find the one that she wanted during her eighth training session. Presented with a folder the next session, Suzy searched through the folder independently and discriminated among 25 pictures. By the end of her training Suzy was discriminating between 64 pictures without error.

As for Suzy and Ben, Lila also progressed through Phase 3a rapidly when compared to the number of sessions spent on other phases. Lila showed initial discrimination between three pictures, quickly moved to five and then six pictures. The largest number of pictures she learnt to discriminate from was nine on a single page, but she did not acquire the ability to flip through her folder and discriminate between pictures on different pages during this study. Lila mastered Phase 3a within a period of five sessions, making it the fastest phase for her to acquire.

Ben had a high rate of requesting during Phase 3b, which he stayed in for nine sessions whilst new pictures were developed and introduced to ensure that he had enough variety of items he could request across settings when doing post training observations. During two of these training sessions his rate of requesting was just over one request per minute. Suzy spent less time training at Phase 3b than Ben, because she already had a wide variety of pictures to request from when she reached this phase. Figure 1 illustrates this difference when the rate of prompted requests using PECS increases at a low but steady rate for Ben during this phase, but remains fairly static for Suzy. Lila stayed in Phase 3b for a similar amount of time to Ben, training at this level for 10 sessions whilst consolidating her skills as her rate of prompted PECS's requests was still high when compared to her rate of independent PECS's requests. As shown in Figure 1, the difference between these two rates of requesting

continued to grow steadily during this phase as Lila's independent requests increased at a greater rate than her prompted requests. Data for one of Lila's training sessions during this phase is missing due to corruption of the electronic file.

Suzy was the only participant to be trained to Phase 4. As can be seen in Figure 1, when training started at this level there was an initial increase in prompted requests as she learnt the new format for requesting and her rate of independent requesting slowed during her first two Phase 4 training sessions at this level. Suzy's rate of prompted PECS requests then plateaued again as she progressed through training and her independent PECS requests resumed at a steady pace. Whilst Suzy's rate of independent PECS requesting in Phase 4 did resume, it was at a lower rate than her independent requests in earlier phases. As shown in Appendix B, Suzy soon began to verbalise when making PECS's requests. As her graph in Figure 1 illustrates, she also started to slowly make some unprompted verbal requests independent of her PECS requests during her training sessions. These verbal requests started to increase in rate during her last three training sessions at Phase 4.

Transfer of PECS

As illustrated in Figure 2, Ben was the only participant to generalise his acquisition of PECS to other settings as predicted, i.e., more transfer of PECS to the facilitated setting than to the un-facilitated setting. As shown in Table 1, Ben's average rate of responding in his facilitated setting was slightly higher than that of his home setting. Ben also transferred his use of PECS to his non-facilitated setting at a lower but still functional rate.

Comparison of Figure 1 and Figure 2 shows that Suzy's transfer of PECS to other settings and maintenance of use at home dropped significantly compared to her independent use during training sessions.

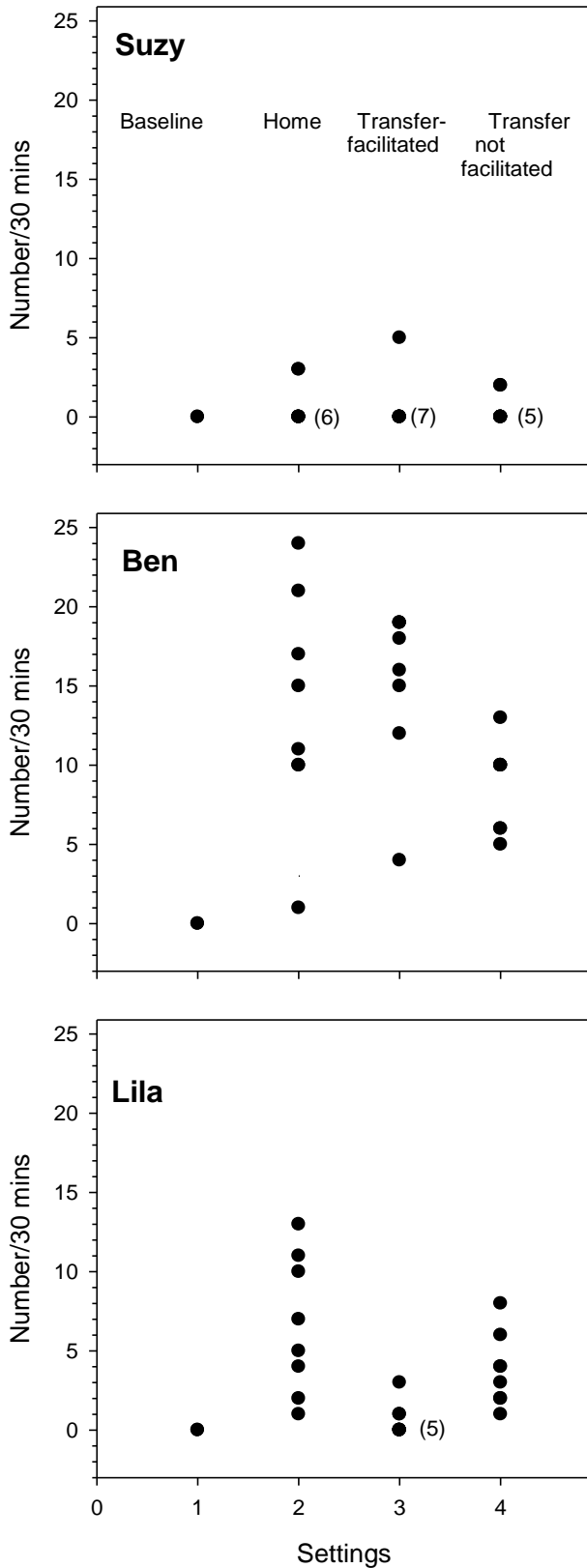


Figure 2. Transfer of PECS requests displayed from baseline, per observation across settings. 1 = baseline, 2 = training setting, 3 = transfer facilitated setting, 4 = non-facilitated transfer setting. Numbers in brackets denote number of sessions with zero requests recorded.

Table 1

Range and Mean of Participants Independent Requests Post Training by Setting

Participant	Setting		
	Home	Facilitated	Non-Facilitated
Suzy PECS Requests			
Range	0-3	0-5	0-2
Mean	0.75	0.63	0.57
Ben PECS Requests			
Range	1-24	4-19	5-13
Mean	13.63	15.25	8.75
Lila PECS Requests			
Range	1-13	0-3	1-8
Mean	6.63	0.63	3.75
Suzy Verbal Requests			
Range	5-38	6-79	0-19
Mean	16.50	32.13	7.40

Lila's use of PECS continued at home after training but as indicated in Table 1, her range of requests made during observation was a lot smaller than those of the other participants. Figure 2 shows that Lila's transfer of PECS requests to her non-facilitated setting was greater than in her facilitated setting, where her PECS requests were marginal. Pre and post training observation data is provided for each participant in Appendix E.

Transfer of Other Behaviour

Figure 3 illustrates Suzy's change in verbal requesting pre and post training across settings. It shows that during post training observations Suzy made verbal requests in all three settings. The number of requests she made in this format was at an even greater rate in the facilitated setting compared to the home setting, as shown in Table 1. Suzy also transferred her use of verbal requests to her non-facilitated setting, and like Ben, this too was at a lower but still functionally significant rate for her.

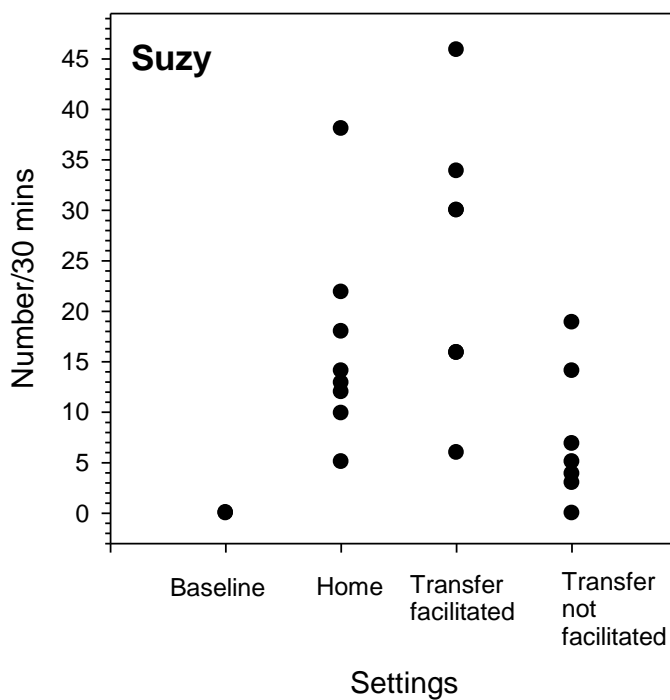


Figure 3. Transfer of verbal requesting from baseline across settings per observation for Suzy.

Other forms of requesting were not recorded during training sessions. However, a comparison of Ben's other forms of requesting during pre and post intervention observations showed a marked decrease in Ben's maladaptive non-verbal means of communication.

Across settings Ben averaged a rate of 8.5 clear non-verbal requests pre intervention. As shown in Table 2, nonverbal requests remained relatively similar pre and post intervention in the non-facilitated setting, but across all settings this average had decreased to 3.75 non-verbal requests per half hour.

Table 2

Average Non-verbal Requests by Ben

Phase	Home	Facilitated	Non-Facilitated	Combined
Pre Intervention	5.00	14.00	6.50	8.50
Post Intervention	2.63	2.63	6.00	3.75

Discussion

The purpose of this study was to investigate the extent to which PECS would generalise from the training setting to other familiar settings as a function of properties of the settings. It was predicted that PECS would generalise better to the setting where PECS use facilitated was by having the same communicative partners and items available. For generalisation to be assessed PECS use first had to be acquired. All three participants acquired PECS to a minimum level of Phase 3b. Transfer of PECS across settings varied for each participant. One participant generalised PECS to the facilitated environment more than the non-facilitated environment as predicted. Another participant transferred PECS better to the non-facilitated environment compared to the facilitated environment contrary to the research prediction. The final participant did not generalise PECS to either environment, switching to functional verbal communication instead.

Acquisition of PECS

As has been shown in other studies, there was considerable individual reliability in the rate and extent of PECS acquisition. Two of the participants acquired PECS to Phase 3b, and the other participant acquired PECS to Phase 4, all without requiring any other skills to be taught first, consistent with the claims of its creators (Bondy & Frost, 2004). Also consistent with the claims of Bondy and Frost (2001), PECS was acquired relatively fast by the first two participants which is in line with the results of previous studies (Charlop-Christy et al., 2002; Cummings et al., 2012; Ganz & Simpson, 2004; Schwartz et al., 1998). The third participant (Lila) acquired PECS more slowly than the others. It took her double the amount of time to learn relative to Ben's acquisition performance, yet Lila still mastered Phase 3 in less than eight weeks. In agreement with Cummings et al. (2012) trial density played a key factor in

the speed of acquisition. Trial density increases as a function of the amount of trials conducted within a given time frame. Suzy took considerably fewer trials to acquire PECS than the other participants, and mastered another phase (Phase 4) of PECS. However, the amount of time she took to make these gains was halfway between that of Lila and Ben because the items and activities Suzy liked took a longer amount of time to complete, so there were fewer trials per session. Therefore, if Suzy had been able to fit more trials in a session it may not have taken her so long to acquire mastery. Ben took more trials to master Phase 3, but he did so in a shorter amount of time because his rate of trials was so high in each session, that he had greater trial density.

In addition to sufficient trial density, the importance of having items that were highly reinforcing cannot be overlooked as a key variable in the rate of PECS acquisition. Ben showed interest in play items during pre-treatment observations and reinforcement assessments, but these items were not valued highly enough by him for them to be motivating when a communicative demand was placed him. As his progress in the first two training sessions was slow and he was hard to engage, his training was put on hold until better reinforcement could be identified. Once the play items were abandoned for physical games, Ben's interest and engagement increased dramatically, as did his rate of acquisition.

In Lila's case she was often apathetic and would happily engage in repetitive self-stimulatory behaviours for long periods of time. This made it hard to find items of a high enough reinforcement value as they would have to be able to compete with the level of intrinsic reinforcement she received from her self-stimulatory behaviours. Lila would also frequently become upset when people tried to engage with her whilst she was engaging in self-stimulatory behaviour. This is one reason why her training sessions took so long, as it would take time for her to acclimate to another person being present and engage in training

Lila had a high rate of prompted trials and was the only participant to make incorrect responses when she started Phase 3 training. Sessions would sometimes start with prompted trials to build momentum, using items known to be the most reinforcing, to encourage Lila to engage. However, on some occasions Lila would make an exchange with her mother without looking at the picture, knowing an exchange was expected but there was nothing available at the time that she wanted to engage with more than her self-stimulatory behaviours. This resulted in incorrect responses and resistance to the error correction procedure. If pushed to participate for too long, Lila would then disengage and remove herself from the training setting.

In her 24th training session Lila was provided with a 'stop' card that it became apparent that negative reinforcement for escaping from imposed activities and being able to control stimuli in her environment was a lot more reinforcing for Lila than positive reinforcement. When her least favourite video was played, Lila's ability to travel to her book, discriminate amongst the 30 plus other pictures for the 'stop' card, locate a communicative partner and perform the exchange became remarkably swift and independent. This confirmed that Lila understood and had learnt the use and practice of PECS, but it wasn't an establishing operation that could be ethically used on a continuous basis in order to get a greater density of trials.

Transfer and Generalisation of PECS

Ben's generalisation of PECS was as predicted, in that his use in his transfer facilitated setting was comparable with that in his training setting, whilst his generalisation to the non-facilitated setting was at a much lower rate. Ben's post-intervention observations of PECS requests in the facilitated transfer setting was slightly higher than his non-verbal attempts to request pre-intervention in the same setting. This indicates that PECS was a functional means

of communication for Ben, given that he was in the same environment, with the same communicative partners, and the same items available, and he was getting his needs met at a similar rate. It also demonstrates that he successfully generalised and transferred his use of PECS to the facilitated setting. Ben's transference of PECS to the non-facilitated settings was not at the same rate as to the facilitated setting. However, he was making a functionally significant number of requests in that environment which was also slightly higher relative to his pre-intervention non-verbal rate for that setting. It could therefore be argued that Ben transferred and generalised his use of PECS to this environment too, but there was naturally not as much motivation and reinforcement for him to communicate within this setting when compared to the training and facilitated transfer environments.

As demonstrated in Figure 1, Suzy acquired PECS to mastery at Phase 4. Figure 2 shows that not only did she not generalise her use of PECS to either setting, she stopped using the system all together. Therefore the results from Suzy's observations do not allow us to draw conclusions about the transference and generalisation of PECS. Of note though, when looking at Suzy's use of verbal requests in the transfer facilitated and non-transfer facilitated settings, these followed the same pattern as predicted for PECS transfer. Like Ben, Suzy made more requests though verbal, in the facilitated setting following PECS training, than she did in her training setting, and also than in the non-facilitated communication setting. Although not PECS data, this does show a pattern which can be interpreted as an example of a more general transfer of training effect, in that a general skill she learnt from her PECS training, namely how to communicate her wants and needs to others, transferred to other settings. Suzy's requesting in the non-facilitated environment, whilst lower than in the facilitated environment, was still a substantial improvement as she went from no attempts to communicate pre-training, to a functional level of verbal requesting post-training. Again, the argument for Suzy having transferred her communicative skills to the non-facilitated setting

is the same as for Ben; the skill was transferred but there was naturally not as much motivation and reinforcement for her to communicate within this setting when compared to the training and facilitated transfer environments.

Lila's results were contrary to the prediction and the transfer of PECS demonstrated occurred more in the non-facilitated setting and not in the facilitated setting. Unlike Suzy and Ben, her transfer of PECS was not strong in either non-training setting, and her use of PECS in training was quite modest compared to that of the other participants. The first explanation to consider would be the reinforcement available when using PECS in each of the settings outside of training. However, both her non-facilitated and facilitated settings were in public play centre settings, where most items were free choice and of a similar range of activities. The difference to the observer was in the relationship Suzy had with her communicative partners in each setting. In the non-facilitated setting Suzy was supervised by a teacher aide who had experience with PECS, and was not as emotionally invested in Lila's use of the system as her mother. The teacher aide was skilled at using communication opportunities and 'teaching moments' and had these in place (though unsuccessfully) prior to PECS training. The transfer of PECS to the non-facilitated setting, occurred at a rate that was functional to Lila in getting her needs met, such as requesting a snack, milk or favourite music. Prior to PECS training, her only attempts to communicate had been in order to escape or reject stimuli.

In relation to the lack of transfer of PECS to the facilitated training setting, engagement and control became a major issue. Although Lila continued to use PECS at home post-training, she showed very high and persistent levels of escape behaviour and refused to engage in activities of any kind at her facilitated setting. On her arrival she would curl up on all fours and hide herself away in the cushions on the couch. When her mother attempted to try and interact with her and the activities available, Lila would run back to the couch and

conceal her-self again. On most occasions, over time Lila would uncurl and either chat to herself or mouth items around her, and sometimes smile and engage with her mother with hugs. If presented with her PECS folder, Lila would chose a picture without looking, pass it to her mother and hide again in the couch. In retrospect, the classification of this setting as a transfer-facilitating setting was in error, and points to the need of very careful pre-training assessment of potential transfer settings, and for planning for additional interventions when such transfer-inhibiting patterns of behaviour become evident.

In conclusion, the results show clearly that Lila did not transfer PECS to the facilitated setting, but observations suggest that this was due to other issues rather than her ability to generalise and transfer her PECS training. There is nothing valid to indicate whether, or to what degree the results would have been different had the issues with the facilitated setting not arisen. Therefore Lila's results are inconclusive and cannot be used to support or disprove the theory that generalisation of PECS is more likely to occur when its transfer to other settings is facilitated.

Ancillary Results

Suzy's acquisition of language supports the claims made by Bondy and Frost (1994) that PECS can facilitate the development of speech as evidenced by Charlop-Christy et al. (2002), Kravitz et al. (2002) and Schwartz et al. (1998). Ben's non-verbal methods of communicating his wants and needs prior to PECS training was mostly socially inappropriate. This behaviour had dropped significantly when post-training observations were made, and PECS requesting at a similar rate to the pre-baseline observations of other less adaptive means of communication was occurring. This result also supports the findings of other studies that PECS reduces problem behaviours (Charlop-Christy et al., 2002; Hart & Binda, 2010). Although the quality of communicative partners in each setting was not

formally assessed or quantified in any way, the success for Lila of generalising her use of PECS to her non-facilitated setting, also gives credence to the theory that training of communicative partners is of major importance for the transfer and generalisation of PECS to occur (Carré et al., 2009; Howlin et al., 2007; Stoner et al., 2006).

Research Limitations

This study had a number of limitations. First, the design was a somewhat compromised version of a single-case research design, because the results for PECS initiations was always going to be zero at the outset of training, although the pre-treatment observations still allowed relevant information about other communicative behaviours to be collected. A better method may have been to provide a display of pictures representing items and activities in the environment previously determined by a reinforcer assessment to be desirable, and observe if the participants use or attempt to use the pictures to communicate. A zero (or nearly) rate of PECS use could then have been established rather than inferred. Such a procedure might then have been folded into a multiple baseline across participants design to assess initial PECS acquisition.

Second, the observer also provided the PECS training to the participants. Therefore the presence of the trainer in the post-training observations was possibly a discriminative stimulus for the use of PECS. Better practice to increase the validity of the results would have been to have an unknown observer in the post-training observations to eliminate this as a possible confound.

Third, due to unforeseen circumstances (earthquakes and other life events), it was not possible to obtain ratings by other scorers to add reliability to the observations and data recorded, within the time frame for this research. As the pre and post training observations, and the training sessions, were all digitally recorded, obtaining inter-rater reliability scores is

possible and would be essential before this research could be submitted for dissemination or publication.

Fourth, the facilitated and non-facilitated transfer settings had natural differences in the amount of requesting in any communicative format that would be expected for those locales, making comparisons purely between post-training settings unreliable. For Suzy and Ben, both facilitated transfer settings were in their grandparent's houses. This naturally facilitated requesting as toys were usually stored rather than being in the open, and primary reinforcers such as food and drink were out of reach. The non-facilitated transfer setting for Suzy and Ben, and the non-facilitated setting for Lila was their local kindergarten. In the kindergarten settings, toys, activities, lunch boxes and drinks were all freely available at any time. This meant that unless a child wanted the assistance of an adult, there was little requesting required to access desirable stimulus. Lila's facilitated transfer setting was a play group set up in a similar fashion to the kindergartens with free access to toys and activities, which again required little need for requesting to occur.

Finally, no assessment of long-term maintenance of PECS use in either the training or transfer settings was possible (again due to time limitations). For PECS or other ACC techniques to make a substantive contribution to the quality of life of the trained individual and their significant others, maintenance over time is essential. This of course, does not preclude sustaining long-term use by such means as booster training sessions, affirmative feedback to communicative partners, or upgrades to technology.

Future Research

More research into the transfer and generalisation of PECS is required along a number of dimensions. Running the experiment again incorporating improvement to the research design, and inter-rater reliability would be desirable if the likelihood of requesting for each

setting could be rated and more settings at these different levels observed. Transfer to unfamiliar and less-frequented settings could also be included, such as different parks or restaurants, as this would allow more observations of chances for transfer and generalisation of PECS to occur, consistent with the Stokes and Baer principle that generalisation should be planned for rather than just hoped for. The amount of exposure to novel situations with known items available before transfer occurs would be a valuable aspect to assess and manipulate, as while Frost and Bondy (2002) claim that generalisation of settings should occur within training, there is no guideline or data to indicate how many settings children may need to be exposed to before transfer and generalisation occur without being specifically trained. Naturally, this would vary by individual but there could be some correlation between this and other predictors for the outcome of PECS training being researched such as development age scores (Pasco & Tohill, 2011).

Another area of research that could be addressed by a similar study but was not investigated here is the generalisation of pictures across settings. As training sessions were recorded, a post hoc review of the pictures used in the training sessions could analyse how many pictures generalised across settings and how many pictures needed to be provided specifically for a different setting. For example, Ben had a swing card he was trained with at home, that he would use on a different type of swing in his facilitated setting, but he would not use in his non-facilitated environment for a third type of swing, and a photo of that specific swing was provided for his use instead.

Conclusion

Due to the limitations of this research, a definitive outcome to the study's prediction that PECS would generalise better to the setting that had transfer of PECS facilitated compared to the non-facilitated transfer setting cannot be made. PECS training was acquired

by all three participants in their trained setting and made a significant difference to their ability to communicate and (we infer) to their quality of life. The communication skills obtained through PECS training and the use of PECS in the non-facilitated transfer setting, whilst not as great as in the training setting, was still functionally significant for the participants and the communicative partners they began to interact with.

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Appendix A

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PARTICIPANT INFORMATION

For primary caregivers

Generalisation of the Picture Exchange Communication System from the Home Setting into the Community.

The Picture Exchange Communication System (PECS) was developed by Andrew Bondy and Lori Frost in 1994 as a communication aid that enables children with limited functional language to communicate effectively. PECS is a comprehensive program with six phases that start with how to communicate using pictures in a way that is meaningful to the child, and goes through to the use of multiple picture sentences, and onto a variety of communicative functions such as answering questions and commenting. Unlike other augmentative or alternative communication systems, PECS teaches initiation of communication, making this system very popular for use within the field of Autism. Another major advantage of PECS is that it is very easy for everyone within the community to understand what the person is requesting without needing special training.

The purpose of this study is to investigate how well children generalize their use of PECS from home to other places such as an early childhood centre, relative's homes etc.

In this study, your child will first be observed to record what type of communication they currently use in different settings, and what type of items they enjoy and are motivated by. Pre-treatment measures of your child's current level of functioning will also be taken using the *Childhood Autism Rating Scale*, the *Vineland Adaptive Behaviour Scales I* and the *Peabody Picture Vocabulary Test*. Your child will then be trained in the use of PECS to a minimum mastery of level 3 in the PECS protocol. At the end of this phase your child will be able to request desired items by going to their communication display, selecting the appropriate picture, find a person with whom to communicate with and give them the picture. Your child's use of PECS will then be observed in two different settings that are familiar to them. Additional PECS training will be given to your child in those environments if required.

The first three phases of PECS are usually acquired rapidly. Training sessions will ideally occur five days a week, and are unlikely to take more than half an hour at a time. The amount of training will depend on your child's rate of acquisition but should not take longer than four weeks. Follow up observations of your child's use of PECS will then be conducted twice a week for a period of one month.

Appendix A (continued)

To serve as a participant in this study, your child must be five years old or younger, preferably not be in school yet, and have a diagnosis of Autism from a healthcare professional. It is also a requirement that children in the study have no other current form of functional communication, such as speech or sign language. For children to qualify for this study parents and/or primary caregivers must be prepared to support the use of PECS as prescribed and keep a record of PECS use once a week. Training sessions and observations of your child's use of PECS will be videotaped for validation purposes. Permission must be obtained for your child to be observed and video taped within the other environments. Parents or caregivers will be given training in the use of PECS before formal training starts with your child. Children must also be available for the full length of the study.

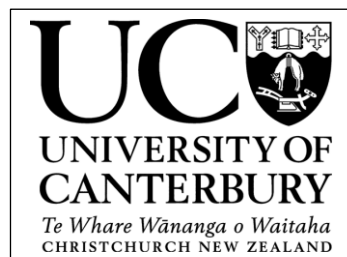
PECS will not inhibit your child's use or development of verbal communication. PECS has been found to facilitate vocalizations and language, and decrease disruptive behaviours in some users. The results of this study will be used in the writing of the researcher's Masters thesis and maybe: presented to the University of Canterbury's Psychology department, reported to a funding agency, presented at a conference, be submitted to international or local journals. Video tape of your child may be used in a presentation only with your consent and any identifying information will be censored. Consent for use of videotape may be withdrawn at any time. Anonymity will be preserved at all times.

The project has been reviewed **and approved** by the University of Canterbury Human Ethics Committee.

Appendix B

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PARENTAL/CARER CONSENT FORM

The Generalisation of the Picture Exchange Communication System from the Home Setting into the Community

I have read and understood the description of the above-named project. On this basis I agree to the conditions of the study and I agree to my child being a participant in this project.

I consent to publication of the results of the project with the understanding that anonymity will be preserved.

I consent to my child being videotaped for research purposes: *please select one of the options below*
And I consent for video of my child to be used in presentations with the understanding that
anonymity will be maintained.

Or But I withhold consent for video of my child being used in presentations

I understand also that I may at any time withdraw my child from the project, including withdrawal of any information I have provided.

I note that the project has been reviewed **and approved** by the University of Canterbury Human Ethics Committee.

NAME (please print): _____

On behalf of: _____

Signature: _____

Date: _____

Appendix C

Table C1

Pictures Used by Each Participant for Requesting During PECS Training

Suzy's Pictures				
Toilet	Lollies	Dress Ups	Dolls car	Red
Hanky	Jam	Dolls House	Colouring	Green
Paper	Vegemite	pram	Barbie Dolls	Yellow
Scissors	Juice	Bubbles	Night Garden	Purple
Spoon	Milk	Balloons	Dolls	Orange
Knife	Mandarin	Books	Balls	Blue
Fork	Chips	Puzzle	Music	Pink
Mum	Apple	Tea set	Slide	Brown
Dad	Bananas	Dvd	Play Dough	Black
Nana	Biscuit	Pingu	Paint	White
Sister	Water	Fifi	Monkey Bars	Dora
Barney	Love to Sing	Igglepiggle	Upsy Daisy	Pontipines
Thomas	Tombliboos	Makka Pakka	Haahoos	Pinky Ponk
Total Number of Pictures = 65				

Table C2

Pictures Used by Each Participant for Requesting During PECS Training

Ben's Pictures				
Crackers Pink	Chase	Trampoline	Cell phone	Bike
Crackers Green	Play In Bed	Swing	Computer	Barrel Swing
Lollies	Funny Face	Slide	Bear Hunt 1	Toilet
Water	Insy Spider	Sand pit	Bear Hunt 2	Lunch box
Rope ladder	Ring o Rosies	Piggy back	Cat In The Hat	Play Dough
Puzzle Board	Twirl	Tickle	Duck On A Bike	Puzzles
CD Player	Tyre swing	Water Play	Wiggles DVD	Kindy
Pooh Bear CD- ROM 1	Pooh Bear CD- ROM 2	Reader Rabbit CD-ROM 2	Reader Rabbit CD-ROM 1	Computer At Kindy
Total Number of Pictures = 40				

Table C3

Pictures Used by Each Participant for Requesting During PECS Training

Lila's Pictures			
Bubbles	Trike	Sunglasses Box	Hi-5 DVD 1
Dancing	Swing	Stickers	Noddy DVD
Milk	Paint	Mr Potato Head	Wiggles DVD 1
Hammock	Tramp	Pom Poms	Wiggles DVD 2
Chocolate	Make Up Box	Video	
Grain Waves	Tea Set Box	Mirror	
Mum	Jewellery Box 1	Music Player	
Nana	Jewellery Box 2	Blanket	

Total Number of Pictures = 28

Appendix D

Table D1

PECS Training Data For Suzy

Session	Phase	Prompted	Independent	Total	% Correct	Distance 1	Distance 2	Range of Pictures	Vocalisation	Verbal	Session Length	M Requests Per Minute
1	1	18	2	20	10%				0	0	30	0.67
2	1	8	6	14	43%				0	0	35	0.50
3	1	14	4	18	22%				16	1	36	0.53
4	1	12	12	24	50%				11	0	44	0.55
5	2	9	12	21	57%		2 m		18	1	34	0.65
6	2	2	11	13	85%	2 m	3 m		12	1	34	0.41
7	2	0	14	14	100%	2 m	A R		11	0	38	0.37
8	3a	3	8	11	73%			20	11	2	37	0.35
9	3a	0	22	23	96%	3 m	I R	25	14	3	45	0.58
10	3b	1	12	14	86%	A R	I R	30	14	0	22	0.64
11	3b	0	12	12	100%	3 m	2 m	36	12	1	32	0.41
12	3b	2	6	8	75%	3 m		30	8	1	29	0.31
13	4	11	0	11	0%	A R	I R	36	11	0	35	0.31
14	4	7	0	7	0%	A R	I R	36	7	0	32	0.22
15	4	4	5	9	56%	I R	I R	36	9	0	37	0.24
16	4	2	6	8	75%	I R	I R	36	8	0	37	0.22
17	4	0	9	9	100%	I R	I R	64	9	0	24	0.38

Table D1 continued.

PECS Training Data For Suzy

Session	Phase	Prompted	Independent	Total	% Correct	Distance 1	Distance 2	Range of Pictures	Vocalisation	Verbal	Session Length	M Requests Per Minute	
18	4	3	2	5	40%	I R	I R	64	5	5	35	0.29	
19	4	1	6	7	86%	T H	T H	64	7	13	37	0.54	
20	4	1	6	7	86%	T H	T H	64	7	12	42	0.45	
21	4	2	3	5	60%	T H	T H	64	5	0	30	0.17	
Total PECS Requests made during Training				260					Total Number of Minutes Training	725			

Note. Session = session number in chronological order; Prompted = number of trials prompted; Independent = number of trials that were independent; Total = number of prompted and independent trials; % Correct = number of trials that were made independently and correct; Distance 1 = maximum distance achieved by participant travelling independently to their board; Distance 2 = maximum distance achieved by participant travelling independently to the trainer; Range of Pictures = greatest number of pictures being discriminated amongst in that session; Vocalisations = number of trials when PECS requests was accompanied by verbalisation; Verbal = number of requests made verbally without the use of PECS; Session Length = duration of session in minutes; M Requests per Minute = mean number of requests made per minute both PECS and verbal.

Table D2

PECS Training Data For Ben

Session	Phase	Prompted	Independent	Total	% Correct	Distance 1	Distance 2	Range of Pictures	Session Length	M Requests Per Minute
1	1	23	0	23	0				30	0.77
2	1	17	0	17	0				21	0.81
3	Reinforcer Assessment								45	
4	Reinforcer Assessment								70	
5	Reinforcer Assessment								47	
6	1	4	8	12	67					1.00
	2	0	24	24	100	4 m	3 m			
	3a	0	10	10	100	3 m	3 m	5	46	
7	3b	4	30	34	88	A R	3 m	4	36	0.94
8	3b	11	32	43	74	I R	I R	4	55	0.78
9	3b	6	46	52	88	A R	T H	12	60	0.87
10	3b	5	36	41	88	A R	A R	12	35	1.17
11	3b	6	32	38	84	A R	A R	15	45	0.84
12	3b	5	28	33	85	T H	A R	15	35	0.94
13	3b	5	46	51	90	T H	A R	15	50	1.02
14	3b	1	29	30	97	A R	T H	30	35	0.86
15	3b	3	15	18	83	A R	A R	30	30	0.60
16	3b	2	19	21	90	T H	A R	30	44	0.48

Note. Session = session number in chronological order; Prompted = number of trials prompted; Independent = number of trials that were independent; Total = number of

prompted and independent trials; % Correct = number of trials that were made independently and correct; Distance 1 = maximum distance achieved by participant travelling independently to their board; Distance 2 = maximum distance achieved by participant travelling independently to the trainer; Range of Pictures = greatest number of pictures being discriminated amongst in that session; Session Length = duration of session in minutes; *M* Requests per Minute = mean number of requests made per minute.

Table D3

PECS Training Data For Lila

Session	Phase	Prompted	Independent	Incorrect	Total	% Correct	Distance 1	Distance 2	Range of Pictures	Session Length	M Requests Per Minute
1	1	19	0		19	0				37	0.51
2	1	4	0		4	0				17	0.24
3	Reinforcer Assessment									31	
4	1	9	0		9	0				13	0.69
5	Reinforcer Assessment									37	
6	1	15	2		17	12				35	0.49
7	1	11	2		13	15				40	0.33
8	1	8	6		14	43				22	0.64
9	Electronic File Corrupted									39	
10	1	2	18		20	90				32	0.63
11	2	6	17		23	74	2	2.5		40	0.58
12	1	0	17		17	100				39	0.44
13	1	0	10								
	2	5	5		20	75				50	0.40
14	1	5	5		10	50		3		38	0.26
15	1	1	5								
	2	4	4		14	64				40	0.00
16	1	0	7		7	100				33	0.21
17	1	1	12								
	2	0	3		16	94				32	0.00

Table D3 continued.

PECS Training Data For Suzy

Session	Phase	Prompted	Independent	Incorrect	Total	% Correct	Distance 1	Distance 2	Range of Pictures	Session Length	M Requests Per Minute
18	3a	1	17		18	94			3	32	0.56
19	3a	0	11		11	100			5	36	0.31
20	3a	14	20	4	38	53			6	50	0.76
21	2		12				2	1	6	44	0.00
	3a	6			18	67					
22	3b	5	15		20	75		3	9	55	0.36
23	3b	5	0		5	0		3	9	30	0.17
24	3a	6	11		17	65				35	0.49
25	3b	6	8		14	57	3	3	9	46	0.30
26	3b	2	14	1	17	82	3	3	9	40	0.43
27	3b	1	16		17	94	3	3	9	40	0.43
28	Electronic File Corrupted										
29	3b	4	11	2	17	65	3	3	6	42	0.40
30	3b	1	8	4	13	62	3	3	6	48	0.27
31	3b	3	7		10	70	2	3	6	44	0.23
32	3b	2	9	2	13	69	3	3	6	33	0.39

Note. Session = session number in chronological order; Prompted = number of trials prompted; Independent = number of trials that were independent; Total = number of prompted and independent trials; Incorrect = number of independent trials when incorrect picture was selected; % Correct = number of trials that were made independently and correct; Distance 1 = maximum distance achieved by participant travelling independently to their

board; Distance 2 = maximum distance achieved by participant travelling independently to the trainer; Range of Pictures = greatest number of pictures being discriminated amongst in that session; Session Length = duration of session in minutes; *M* Requests per Minute = mean number of requests made per minute.

Appendix E

Table E1

Mean Pre and Post Training Communicative Behaviour Data Across Settings: Suzy

Setting	Pre-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 2	4	19.5	0.5	2.5
Facilitated <i>n</i> = 2	0.5	7	8	29
Non-Facilitated <i>n</i> = 2	0	5	0	9
Setting	Post-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 8	0.38	9.13	16.5	20.13
Facilitated <i>n</i> = 8	0.63	7.25	32.16	18.38
Non-Facilitated <i>n</i> = 7	0.14	5.43	7.43	10.71

Note. Non-verbal requests = behaviour that clearly communicated a request using non-verbal forms of communication; Verbal non-operant = verbal behaviour such as babble and echolalia; Verbal mands = independent verbal mands; Verbal other operant = all verbal operants other than mands; Facilitated = PECS transfer facilitated; Non-Facilitated = PECS transfer not facilitated.

Table E2

Mean Pre and Post Training Communicative Behaviour Data Across Settings: Ben

Setting	Pre-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 2	5	2.5	5	5
Facilitated <i>n</i> = 2	14	0	4.5	0
Non-Facilitated <i>n</i> = 2	6.5	0	0	0
Setting	Post-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 8	2.63	0	1.25	0.13
Facilitated <i>n</i> = 8	2.63	0	0	1
Non-Facilitated <i>n</i> = 8	6	0	1.5	0

Note. Non-verbal requests = behaviour that clearly communicated a request using non-verbal forms of communication; Verbal non-operant = verbal behaviour such as babble and echolalia; Verbal mands = independent verbal mands; Verbal other operant = all verbal operants other than mands; Facilitated = PECS transfer facilitated; Non-Facilitated = PECS transfer not facilitated.

Table E3

Mean Pre and Post Training Communicative Behaviour Data Across Settings: Lila

Setting	Pre-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 2	3	3	0.5	2
Facilitated <i>n</i> = 2	1.5	1.5	0	0
Non-Facilitated <i>n</i> = 2	2.5	1.5	0	2
Setting	Post-Training Behaviour			
	Non-Verbal		Verbal	
	Requests	Non-Operant	Mands	Other Operant
Training <i>n</i> = 8	0.88	0.63	0	0.13
Facilitated <i>n</i> = 8	1.88	0.88	0.25	1.38
Non-Facilitated <i>n</i> = 8	4.13	0.38	0.88	2.88

Note. Non-verbal requests = behaviour that clearly communicated a request using non-verbal forms of communication; Verbal non-operant = verbal behaviour such as babble and echolalia; Verbal mands = independent verbal mands; Verbal other operant = all verbal operants other than mands; Facilitated = PECS transfer facilitated; Non-Facilitated = PECS transfer not facilitated.