Outcomes for children with delayed language development:

Does temperament make a difference?

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Abstract

This longitudinal study explored the language and temperament profiles of a cohort (*N*= 72) of young children (2;00 - 3;09) who had a diagnosis of Early Language Delay given by a Speech and Language Therapist. The study investigated associations between aspects of the children's temperament, their main carer's (parent) temperament and their language progress over one year. Standardised assessment of receptive and expressive language skills took place at entry to the study and again after one year to profile the natural history of their early language delay within a community context. All the participants continued to access speech and language therapy services, as appropriate to their needs, during the period of the study. Temperament data was collected using standardised questionnaires completed by the child's main carer.

A series of linear regression analyses were used to predict one year performance from initial language skills at the start of the study alongside child temperament, socio-demographic factors and a measure of child-parent 'goodness of fit'.

The final model for receptive language skills, predicted 78% of the variance in outcomes and included auditory comprehension (76.5 %) and distractibility (1.6%). For expressive language skills the final model, which predicted 59.5% of the variance, involved five variables: auditory comprehension (34%), expressive communication (13.8%), adaptability (5.6%), persistence (3.1%) and negative family history of language difficulties (3%).

Ratings of goodness of fit were significantly ($p < .010$) associated with auditory comprehension skills, such that children with higher auditory comprehension scores were rated as easier to manage then children with lower scores. This association did not hold for expressive communication skills.

Early language delay is a high prevalence condition and this study provides data that suggest that aspects of temperament may confer a degree of protection or risk to children in relation to their language development, once identified with an early language delay. The implications are discussed along with the need for further research in this area.

Key words: language delay, temperament, outcomes, risk and protective factors, goodness of fit.

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List of abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
ALSPAC	Avon Longitudinal Study of Parents and Children
APPVT	Adapted Peabody Picture Vocabulary Test
ASC	Autistic Spectrum Condition
ASQ	Ages and Stages Questionnaire
ATQ	Adult Temperament Questionnaire
BCa	Bias corrected and accelerated
BPVS	British Picture Vocabulary Scales
BSQ	Behavioural Style Questionnaire
CCC-2	Children's Communication Checklist
CDI	MacArthur Communication Development Inventory
CDI:WS	MacArthur Communication Development Inventory: words and sentences
CELF	Clinical Evaluation of Language Fundamentals
CELF-P	Clinical Evaluation of Language Fundamentals - Preschool
CELF-P UK	Clinical Evaluation of Language Fundamentals - Preschool UK
CI	Confidence Interval
CSBS	Communication and Symbolic Behavior Scales
DoTS-R	Revised Dimensions of Temperament Survey
ELD	Early Language Delay
ELVS	Early Language in Victoria Study
FXS	Fragile X Syndrome
GCSE	General Certificate of Secondary Education

KS	Kolmogorov-Smirnov
Lab–TAB	Laboratory Temperament Assessment Battery
LDS	Language Development Survey
LLE	Late language emergence
LOGIC	Munich Longitudinal Study on the Genesis of Individual Competencies
LREC	Local research ethics committee
LSAC	Longitudinal Study of Australian Children
OME	Otitis media with effusion
PEDS	Parent's Evaluation of Developmental Status
PLS	Pre-school Language Scales
PLS3-UK	Preschool Language Scales 3-UK
PPVT III	Peabody Picture Vocabulary Test III
RCSLT	Royal College of Speech and Language Therapist
RDLS	Reynell Developmental Language Scales
SD	Standard deviation
SD	Speech delay
SEP	Socioeconomic position
SES	Socioeconomic status
SLI	Specific language impairment
SLT	Speech and Language Therapist/ Speech and Language Therapy
T1	Time 1
T1AC	Time 1 auditory comprehension
T1EC	Time 1 expressive communication
T2	Time 2
T2AC	Time 2 auditory comprehension

T2EC	Time 2 expressive communication
TEDS	Twins early Development Study
TTS	Toddler Temperament Scale
UK	United Kingdom
URTI	Upper respiratory tract infection
VCFS	Velocardiofacial syndrome

Chapter 1 Introduction

1.1 Background to the study.

In this chapter, I set out the background to this research enquiry along with my interest in and approach to it.

1.2 Not knowing: being a practitioner-researcher

I am a speech and language therapist (SLT). I worked predominantly with children and families in my clinical practice until I took up a post as a lecturer in speech pathology in 2001. I am also a mother to three children, each of whom have taught, and continue to teach me, a lot about communication and communicating within the intimacy of a lifelong relationship.

During my undergraduate degree, I was educated to view research as central to the work of an SLT: that for the discipline to grow, research was needed to understand the confluence of many elements contributing to communication impairments in people and to ensure that interventions offered were worthwhile. Understanding a client's difficulties, setting them in the context of my current knowledge and experience and learning about what is effective to develop their communication is the routine job of

my SLT professional work (Royal College of Speech and Language Therapists, RCSLT, 2006). It was therefore both a small step and a huge leap to move into a different research arena in conducting this study, where the individual was not the centre of enquiry but rather similarities and differences at a group level were the focus of interest and I have found this a challenge.

As a practitioner, providing relevant, sensitive and timely advice and intervention is core to fulfilling my professional responsibilities. My experience has been that the same case management strategies may have different impacts on children with similar communication profiles. This is the core of my questioning – why is this? Matching a communication profile to a management plan does not produce homogenous results. Variability can be accounted for informally by a range of factors as diverse as the child's developmental and health status and the range and type of language environments the child inhabits (Locke, Ginsborg and Peers, 2002; Zubrick, Taylor, Rice et al., 2007). The understanding and management of variability in outcomes is important as it could allow for more discerning and effective interventions to be offered.

Developing my insight into the interplay surrounding communication development has given rise to this research study. I found that as my practice developed, I became increasingly aware of my limited understanding about the interrelationships between individual differences in children and their parents, set within the environmental and developmental context of learning to communicate. This study focused on children referred to SLT for delayed language development and collected data about both the

child's and adult's temperament and the child's language skills at two time points, 12 months apart. It sought to explore, identify and inspect any contributions or challenges posed by specific temperamental features to language development in the context of a diagnosed language delay. Clearly, temperament represents just a small part of a much more complex picture of potential sources of variability and so I have needed to be alert to the imbalance this causes in perspective (Wilson, 1999) – looking through a toilet roll tube is not useful to negotiate the bustle of everyday life. However, looking at one small concept in detail does allow a deeper understanding of it, so that once returned to that everyday context it can be appreciated more clearly for the part it plays in the unfolding scene.

1.3 Early steps in the research: developing the question

The impetus for this research had its roots in Marshall, Goldbart and Phillips' (2008) qualitative research that investigated parents' explanations of language delay in their young children. Amongst parents' beliefs was a clear link between language development and the child's emerging personality, with comments about children being 'shy', 'laid back', 'lazy', 'stubborn' and 'nosey' offered as explanation of slower communication development trajectories.

These parent explanations intrigued me; surely language delay could not be explained by the individual temperament of a child? I found myself drawn back to literature to find out what was known about links between temperament and its impact on

children's language development. I found relatively little research, with inconclusive findings. This is reviewed in detail in chapter 2.

In becoming alert to the construct of temperament, I began to notice the descriptions given by adults to the children I was working with in the nursery setting I practiced in. Many of these children had communication difficulties, often alongside other developmental challenges. I noticed that descriptions of the child's emerging personality matched the style adults chose to interact with the children and they used their descriptions to predict those activities that children would and would not like. Children were variously described as feisty, up for a challenge, or shy and offered activities to reflect this, for example role play, 'messy' play, or a jigsaw activity.

Looking more widely, personality traits in adults have been investigated in relation to suitability for and success in specific careers (Reed, Bruch, and Haase, 2004). Personality factors have been researched in relationship to a range of health problems such as heart attack (type D personality) and recovery from illness for example people high in neuroticism faring less well in cancer recovery (Sher, 2005).

At this point the research topic began to gather momentum and I became committed to the possibility of trying to 'chase down' the qualitative findings of Marshall et al.'s (2008) study with a more narrowly focussed enquiry into the links between temperament traits and language progress, within the context of identified language delay. I was keen to include data on the parents' temperaments too. Parents have an important influence on the environment in which their children develop, can be positive agents of language growth (Landry et al., 1997) and their support for their

children is often the basis for language development interventions (Buschman et al., 2009; Gibbard, 1994; Hoff, 2003).

The motivation for this research has been singular: I want to be an effective practitioner and to do that I need to know and understand more, learn what is going on, get an 'edge' over language delay – to limit and reduce it so that children can take part in their world richly and comfortably. This is the impetus for exploring the role and influence of parent and child temperament in early developmental language delay.

1.4 Structure of the thesis

The thesis follows a traditional structure.

Literature review: A review of pertinent literature is presented. This is not exhaustive but rather highlights and critiques key literature which my study builds on and relates to, providing a context for the project I undertook.

Methodology: Here the research framework chosen is described and discussed along with the procedures followed to gather the data and the analytical processes undertaken.

Results: A description of the research sample is provided and this is followed by data relating to each of the research questions posed.

Discussion: In this section, the key findings from the project are reviewed and explored in the light of existing research. I explore the extent to which the study has answered

the research questions and the implications of my findings. I identify the strengths and limitations of my work, making suggestions for future research.

Chapter 2 Literature

2.1 Introduction

The development of communication skills is a key milestone in the first years of a child's life and when negotiated successfully augers well for the child's future learning and wellbeing. In contrast, children with persisting speech, language and communication difficulties show lower educational attainments (Snowling et al., 2001) and poorer psychosocial outcomes (Clegg et al., 2005; Snowling et al., 2006) than their age matched peers. Such poorer long-term outcomes underscore the importance of continued research into developmental language difficulties in an effort to increase the effectiveness of our knowledge and skill in supporting children to develop their full communication potential in a timely way.

In this chapter, I present a review of literature that is relevant to this research study. There are three main areas explored; language delay, the construct of temperament and finally an exploration of literature that relates to aspects of both language and temperament. The chapter ends with a summary of my understanding of this final area derived from the literature and concludes with the research questions that are addressed in my study.

2.2 Language delay

Language delay is a relatively common early developmental difficulty (Law, Garrett and Nye, 2008; Law et al., 2013), with an estimated prevalence rate thought to be between 5-8% (Law et al., 2000; Tomblin et al., 1997) for those children whose delays persist into the school years.

Developmental language impairments have attracted significant research interest fuelled by their prevalence, impact on children's lives and the variation in outcomes experienced by those affected by them. Within the group of children who are identified with early language delay (ELD) before they start formal education, some will resolve their language difficulties whilst others will have language difficulties persisting into their school years or beyond (Rescorla, 2011). This review is restricted to children identified with ELD who are also described as 'late talkers' by some authors (Roos and Weismer, 2008; Thal et al., 2004), 'late bloomers' (Rescorla, 2009), or having late language emergence (LLE) (Zubrick et al., 2007). There are no key differences between these terms at the point they are applied to children and they rather reflect the desire to be cautious in allocating diagnostic labels in a group of children whose difficulties may be transitory (Dale et al., 2003).

2.3 Theoretical perspectives

Research enquiry into the nature and underlying cause of language impairment has viewed language delay in two major ways, taking dimensional or categorical

perspectives and seeking to test hypotheses to support one or other of these views. ELD represents the earliest detection that language development is not taking an expected route and differs in speed or quality in some way, however identifying the children into transient and persistent impairments is not robust. This gives rise to potentially unwarranted interventions and some missed opportunities in providing the most helpful and timely support to young children.

The dimensional view of language impairment proposes a continuous spectrum of language ability (Bishop, 2003a; Dollaghan, 2004; Ellis Weismer, 2007; Leonard, 1991; Rescorla, 2002). This perspective gives rise to the hypothesis that children with ELD have a less rich legacy of abilities related to language development, in a similar way to different individual capacities for height or cognitive skill. Dollaghan (2004) proposes that this model would give rise to the pattern of wide variability and impact of environmental influence found in children with language impairments. Sub-clinical *weaker* language skills were found in monozygotic twins, where the other of the twin pair had a diagnosed language impairment, Bishop (2006) argued that this data was supportive of a dimensional view of language ability which places children with persisting language impairments at the left hand tail of a normal distribution curve.

In contrast, the qualitatively distinct grammatical profile of children with persistent language impairments has encouraged some researchers to identify specific language impairment (SLI) as a categorical disorder with distinct boundaries suggesting focal deficits in the language systems (Rice and Wexler 1996; Rice, 2007; van der Lely et al., 1998).

2.4 Identification of Language Delay

Typically, understanding of first words and their production occur towards the end of the child's first year of life (Clark, 2003). Early language milestones are characterised by both predictability of stages and variability in timing. Where first words are slow to emerge, children may be identified as having ELD. There are no universally recognised criteria for ELD and, in England, parental concern or developmental checks provide an early catalyst for increased surveillance of language development and subsequent referral to SLT services. Commonly this occurs following the health visitor led routine developmental reviews at 2-2;06 and 4 years as part of the Healthy Child Programme (Shribman and Billingham, 2009). Due to the relative frequency of ELD and its known impacts, early identification is viewed as important so that support can be provided to children in the best ways to promote their language growth before they start school (Boyle et al., 2010; Reilly et al., 2007). Bishop and McDonald (2009) in their study of 245 twin pairs, drawn from the Twins Early Development Study (TEDS, Haworth et al., 2013) cohort investigated identification of language difficulties through an analysis of agreement between referral to SLT, low scores on formal language tests and the Children's Communication Checklist (CCC-2: Bishop, 2003b.), a parent report measure. They found that in differentiating between children who had and had not been referred to SLT, language test data combined with parent report data provided the most robust measure, suggesting that parent report is a valuable addition to standardised psychometric language tests. Roulstone et al.(2003), in deriving their randomised control trial sample to investigate the effectiveness of SLT for preschool children, chose a similar multifaceted approach to inclusion in the sample, mediating

standardised assessment results from the Preschool Language Scales (PLS) (Zimmerman et al., 1992) with SLT clinical judgment to ensure their sample had a clinical validity. Clinical validity, and by that I mean a representativeness of children who are believed to benefit from access SLT services, was important to reflect in deriving a sample for my study so that the study findings are centered on a recognisable group of clients within the SLT practice community .

In contrast to Roulstone et al. (2003) and Bishop and McDonald (2009), ELD has been identified in many research studies through parents responding to advertisements (Law et al., 2000) or in the course of population based longitudinal studies (Henrichs et al., 2012; Northstone et al., 2002; Reilly et al., 2009). In these studies, the research samples have not been drawn from a clinical sample of children whose language delay has necessarily attracted some concern from an experienced adult. This is an important point, since this literature serves a different purpose, such as investigating early predictors of later language outcome or investigating the natural history of language development and variation within it. The criteria used to identify this ELD group typically include description of the child's language abilities using tools such as standardised checklists, which allow parents to say which words their child understands and uses. The most widely used are the MacArthur Communication Development Inventories (CDI) (Fenson et al., 2007) and the Language Development Survey (LDS) (Rescorla, 1989). Thus, a small vocabulary and/or late or absent word combinations are the predominant characteristics by which children are then assigned to ELD groups.

Whilst there is no agreed definition of cut-off points or methods for inclusion in ELD samples, a consensus definition emerges from the literature, which supports the development of knowledge by allowing broad comparisons across research studies. ELD is usually identified by parent report between 18-30 months using the CDI: Words and Sentences (Fenson et al., 2007) with a 10th centile or below cut-off for inclusion in the ELD group or Rescorla's (1989) LDS revealing fewer than fifty words or no word combinations between 18-30 months. Using these measures, typically 10-20% of children meet this operational description of 'late talker' in large population based studies e.g. CDI words and sentences (CDI:WS) (used in the Early Language in Victoria Study (ELVS), Reilly et al., 2010). Where standardised tests are used, 1 or 1.25*SD*s below the mean are the typical cut-off points (Moyle et al., 2011; Wake et al., 2012).

In very young children, expressive language skills are overwhelmingly the primary feature of research interest with scant attention paid to receptive language difficulties in non-clinically derived populations. This is likely to be for a range of reasons including the predominant use of parent report where expressive vocabulary can be more easily and accurately measured than the nuances of identifying what aspects of language are being processed and responded to by a child. For such reasons, parental report of receptive language is not seen as reliable (Bishop et al., 2012). In conjunction with this, for the vast majority of children, language comprehension is in advance of expressive skills (Clark, 2003) so those sample groups of children with expressive delays may be likely to include within their group children with receptive delays also. Due to the nature of collecting data from very young children, a balance needs to be maintained between collecting data and the developmental needs of the child to not be tested for

long periods. Therefore, when researching the language development of young children, it may be that expressive language skills are used by researchers in part as a proxy measure for total language development across domains in the youngest children. This may be particularly pertinent where data is collected as part of a larger cohort study and language is only one component of a wider project data set, for example the Growing up in Australia, Generation R, TEDS, Avon Longitudinal Study of Parents and Children (ALSPAC), (Golding et al., 2001) and the Millennium Cohort studies. An exception to this is a study by Thal et al. (2004) who reported on language development in seventeen children with typical development in comparison to two at risk groups for language impairment, one with unilateral focal brain injury (*n* =21) and the other group comprising 'late talkers' (*n* =20). The late talkers had performed at or below 15th centile on CDI expressive vocabulary between 20-27months. This measure was supplemented by administration of the Reynell Developmental Language Scales (RDLS, Edwards et al., 1997) soon after completion of the CDI. This categorised sixteen of the late talker group to have expressive delay only and four to have a mixed delay involving comprehension and expression of language. At 3 years of age, outcomes were calculated using 110 utterances, generated from spontaneous language samples, collected during free play with the child's parent, free play with a research assistant and book sharing with a research assistant. The late talkers showed development in their language skills but were still significantly delayed on measures of vocabulary diversity, syntax and morphology. Additionally, the late talker group showed more variability in scores than the control group. Further, the lowest late talker scores were for the children with receptive and expressive delay. These findings are based on a very small sample of children but demonstrate the potential value of within group

differentiation of children with ELD to allow clearer understanding of the variability in outcomes.

2.5 Assessment of Early Language Delay

Researchers have used a range of assessment tools in their studies of delayed language development in young children. There is no identified gold standard for measuring ELD and researchers use a variety of methods which reflect the particular philosophy, and purpose of their investigation alongside trade-offs which include the age of the children, size of the sample and resources available for analysis. The most commonly used tools are briefly identified here.

2.5.1 Indirect

Research has demonstrated that parents are accurate informants about their child's development (Rydz et al., 2005; Squires et al., 1998; Tervo, 2005). Accuracy of parent report is improved where questions ask about their child's recent and observable behaviours (Bodnarchuk and Eaton, 2004). Furthermore, parents effectively identify children with developmental delays (Diamond, 1993) and use of parent-completed questionnaires is a useful way to access information about children's development (Bricker and Squires, 1989). Glascoe (1999) found that parental concerns about language, fine motor, cognitive, and emotional-behavioural development were highly predictive of developmental problems.

In addition, parent-completed tools are time- and cost-efficient for researchers.

In relation to reports of language, Dale (1996) identifies that parents are likely to be most accurate when the language behaviours are ones the child is currently using, or are emerging in the child, thus making them easy to observe, and are not too numerous to keep track of. Finally, parents are more accurate where language behaviours are elicited in recognition rather than recall formats.

2.5.1.1 The Language Development Survey (LDS) (Rescorla 1989).

The LDS obtains parents' reports of children's expressive vocabularies and word combinations using a checklist. Parents identify words their child says but are asked not to include those that the child understands but does not yet say. The LDS indicates whether a child's vocabulary and word combinations are delayed relative to norms for ages 18-35 months. The LDS takes approximately ten minutes for the parent to complete. It has good internal reliability, assessed by Cronbach's alpha (0.99) and test-retest (0.97, 0.99) procedures. Sensitivity and specificity of 86-90% (Albores-Gallo et al., 2011) has been reported. The LDS has been used extensively in studies investigating ELD.

2.5.1.2 MacArthur-Bates Communicative Development Inventories (CDI) (Fenson et al., 2007).

CDI: Words and Sentences (Toddler form) is designed for use with children between sixteen and thirty months old. It is in two sections; the first provides a checklist for parents to document both the child's production and use of words organised into

semantic categories. The second section gathers information about early grammar and early utterances. A short form version solely collects data about the expressive use of vocabulary. The tool has been demonstrated to have similar robust psychometric properties to the LDS (Rescorla et al.). It is extensively used as a research instrument and has been adapted into a wide range of languages, some with accompanying standardisation.

2.5.1.3 Ages and Stages Questionnaire (ASQ):

The ASQ was designed to identify children with developmental delays. The questionnaire includes thirty questions that are divided into five areas of development; communication, gross motor, fine motor, problem solving, and personal-social. Parents rate observed behaviours on a three point scale (yes, sometimes, not yet). Squires et al. (1997) explored the psychometrics of the ASQ on a large sample of completed questionnaires. Their results identified high test-retest reliability, inter-observer reliability, and internal consistency. The communication scale has six questions and has been used to identify ELD in large cohorts for example Zambrana et al.'s (2013) large study of Norwegian children.

2.5.1.4 Communication and Symbolic Behavior Scales (CSBS) (Wetherby and Prizant, 2002).

The CSBS was designed to identify children at risk of early communication delays. It is a more comprehensive assessment of communication than ASQ, CDI or LDS, taking about an hour to complete and similar scoring time. It is organised into seven areas of functioning; communicative functions, gestural communicative means, vocal communicative means, verbal communicative means, reciprocity, social-affective

signaling, and symbolic behavior. Data are gathered via parent interviews and direct observations of the child's spontaneous play. Scores are norm-referenced by both chronological age (8–24 months) and also by language stage (prelinguistic, early one-word, late one-word, multiword) yielding standard scores and percentiles for each area as well as composite scores. It is supported by both field validation and psychometric studies (Wetherby et al., 2002).

2.5.2 Direct assessment

Direct assessment is most usually used for children over the age of two years and in smaller samples of children than the indirect methods. Whilst they provide a record of the child's performance at the time of testing they are subject to biases in the way the child responds to the test situation and an unfamiliar tester. Few research studies use these instruments that give more detailed quantitative and qualitative information about a child's language profile. These assessments are typically used in cohort studies which follow up participants who had ELD to investigate which children have continuing (persistent) language impairments and which have recovered.

2.5.2.1 British Picture Vocabulary Scales / Peabody Picture Vocabulary Test

The British Picture Vocabulary Scales (BPVS, Dunn and Dunn, 1997, 2009) and the Peabody Picture Vocabulary Test (PPVT, Dunn and Dunn, 2007) are both assessments of receptive vocabulary which require the child to select a picture from a choice of four when the administrator says a stimulus word. These assessments are employed by researchers but also by SLTs in clinical practice and provide standardised scores for

children aged three to sixteen years and two and a half years to ninety years of age respectively. The PPVT uses American English vocabulary.

2.5.2.2 Composite assessments

The Clinical Evaluation of Language Fundamentals (CELF, Semel et al., 2003), RDLS (Edwards et al., 1997, 2011) and the PLS (Zimmerman et al., 1997, 2009 , 2014) all provide a broad assessment across language domains, having receptive and expressive scales. The CELF is further defined into sub-tests within these two broad areas. These three assessments are robustly standardised and used in both research and clinical settings. They require an SLT or psychologist trained in psychometric testing to administer them and take approximately an hour to administer and score for each child. In research studies, these assessments are characteristically reserved for older children with persisting language impairments where samples are usually smaller and research questions narrower in focus.

Sachse et al. (2007) reported on their comparison of results from two formal standardised language tests (SETK-2, a German picture based test of receptive and expressive language and RDLS III) administered to children aged 24 to 28 months (*N* =31) with those from a parent report measure, a German version of the CDI, Toddler Form (ELFRA-2). All measures were correlated highly with subtests of similar language skills (*r* =0.7-0.9). The authors report that most children classified as late talkers on the parent report measure were also identified by both language tests. Although this study is small, it gives some support to the use of indirect methods for establishing expressive language delays and their equivalence with standardised direct tests.

Most commonly, ELD is based on parent report measures that are capable of identifying late achievement of key milestone's such as vocabulary growth and word combinations. However, these do not provide profiles of language achievement for the participants, thus limiting the identification of possible sub-groups of children taking different routes through language acquisition.

2.6 Prevalence and Incidence

The prevalence and incidence of ELD is poorly defined. Prevalence refers to the number of people with a specific characteristic in the population, whilst incidence refers to the number of new cases of the characteristic within the population. As such these concepts intertwine such that new cases and resolved cases are in flux and may obscure each other. Since definition is in itself problematic as discussed in the previous section, prevalence estimates are subject to particular definitions and cut off points of the population within the context of specific studies. These issues are not specific to early communication difficulties but particular challenges are presented in making decisions about how to define ELD and at what age. Such decisions are made within the context of developing policy and services to meet the needs of the population, for example the provision of population level interventions to enhance language development. Capturing data to define prevalence or incidence is costly and ELD is a condition which is believed to exhibit high rates of resolution of above 50% (Rescorla et al., 2000; Dale et al., 2003). Law et al. (2000) in their review of current knowledge concluded that the identification of universal prevalence estimates should be

secondary to research into the risk and protective factors that operate in communication development.

There are few studies that focus specifically on ELD in comparison to identification of persisting language difficulties. Prospective cohort studies often use a mix of parental report (youngest children) and direct testing (less). Often the children are followed over a significant time period allowing researchers to identify persistent from transient delays. Most of these studies have not been conducted within the United Kingdom (UK) and there may be socio-cultural biases operating which influence the data collection measures in uncertain ways.

The largest prevalence study was conducted by Tomblin et al., (1997 a and 1997 b).This robust study sought to identify prevalence of SLI, rather than ELD. SLI is a more stable form of language impairment, typically diagnosed at a later point than ELD. The study screened language skills in 7,218 kindergarten children aged between 5 and 6 years on a specific date with 26.2% failing the screen. The language of these children (*N* =2084), alongside a control group drawn from children who had passed the screening, was then directly assessed to derive an estimated prevalence rate of 7.4%, using a cut-off point of -1.25 *SD* below the mean. Interestingly the authors noted that there was variation in prevalence, reflective of different racial and cultural backgrounds.

The focus of the current study is to examine associations between ELD and temperament. ELD is known to have higher prevalence rates since it includes those children who will have persisting language difficulties and may be described as having

SLI and those whose difficulties will resolve to within expected parameters for their age.

Law et al. (2013) in their report for Save the Children reviewed six recent prevalence studies focussing on ELD in the preschool years published between 2002 and 2011. The studies as a group are characterised by variability in the terminology used in relation to what they were measuring for early vocabulary development, late talking or language delay. Prevalence rates for ELD ranged from 8.6% (Henrichs et al.,2012) to 48% (Locke et al.,2002). There are several differences between these two studies that may account for the sizeable difference in reported prevalence rates. Henrichs et al.'s (2012) study has the lowest estimate for ELD based on a large stratified cohort (*N* =3759) drawn from the Generation R study in the Netherlands. The measure used was the Dutch version of the CDI taken at 18 and 30 months. This is a parent report measure of words the child understands and uses and is therefore looking at the domain of vocabulary in isolation. In contrast, Locke et al.'s 2002 study recruited slightly older children (3;01-4;08, median =3;06) who were in nursery education situated in areas of high social and economic deprivation in Sheffield, UK. The language measure used was the Clinical Evaluation of Language Fundamentals - Preschool (CELF-P), which places demands directly on to the child to perform as the test is formal. Further, the CELF-P assesses the child's performance across a range of language domains.

Prathanee et al.(2009) reported on a national prospective cohort study of Thai Children (*N* =3905). They found a prevalence rate of 12.34% for ELD based on the LDS (Rescorla, 1989) conducted face to face with parents between 22 and 26 months. This large study importantly adds to our understanding of cross linguistic and cultural

perspectives in language development and impairment. The rate is lower than that found by Reilly et al. (2007) in the ELVS who used the CDI (Fenson et al., 1993) expressive vocabulary scores to assess for ELD in a community sample of 1,720 infants at 24 months finding that 20% of the children met the criteria for ELD.

Consensus has not been reached about the most useful ways to detect language delay in relation to the age group, measures, sample size and inclusion/exclusion criteria. The example above illustrates the need currently to review each data set presented with care as each brings its own theoretical perspective (e.g. that receptive vocabulary can be inferred from expressive vocabulary), logistic constraints and purpose to shape the prevalence figure stated. A benefit from the range of study designs is that language delay can be mapped in relation to its course across the early years, adding to our understanding of when it occurs (early or late) (Henrichs et al., 2012; Reilly at al., 2010).

2.7 Risk and Protective Factors in Early Language Delay:

A key driver in managing language delay is to provide early intervention services to children who could benefit from them, such that their developmental outcomes would be positively affected, whilst simultaneously not providing services that would be unnecessary, ineffective or harmful or to children who would not gain benefit. Sylvestre et al. (2012) assert that:

> ‘to better define the targets of prevention and early intervention

> programs for children affected by LD, one must identify the factors linked to this condition.' p.159

and it is this rationale that continues to drive research into the factors which impact on the early development of language.

This difficulty, of who is in need of additional support, relates to the natural history of the individual's language impairment rather than necessarily to the types of interventions on offer, though these too need to be robustly evaluated. The concept of factors that influence and can predict the future path of language progression is attractive and a considerable range of factors have been suggested and investigated.

The concept of *risk* for language impairment comes from epidemiology. Epidemiology is the study of what causes disease and seeks to answer how, where, when and in whom they arise (Coggon et al., 2014). Thus, the key concerns are to identify predisposing factors (risk factors) which facilitate development of the disease, but also those factors which preclude or minimise cases of the condition arising, buffering the effect of adverse elements (protective factors). From its origins in reduction and prevention of contagious diseases e.g. smallpox and polio it has developed to include the study of a wide range of conditions that affect quality of life and wellbeing.

Epidemiological studies are unable to develop causative models but can show how a factor correlates with a higher incidence of the condition. Factors identified may then move forward to research studies designed to test a hypothesised causative model (Paul and Roth 2011).

Epidemiological studies are of two main types: retrospective (case-control studies) e.g. Tomblin et al.'s (1997 b) study of the epidemiology of SLI, or prospective, such as the ALSPAC project which recruited pregnant women in 1991-2 and intends to follow these children and parents until the children are at least seventy years of age.

One of the crucial elements in an epidemiological study is to clearly define what criteria must be met to establish a 'case' or incident of the condition in question. As has been discussed (see section 2.5) there is no 'gold standard' in relation to tests used or cut off points across studies in the area of language delay and this makes cross-study interpretation of associated factors challenging.

Tomblin et al. (1997a) stress that identifying risk factors may not allow us to identify the cause of language impairment, asserting that they be more usefully conceptualised as:

> 'influencing liability, particularly for complex conditions that are likely to be heterogeneous with respect to cause and, furthermore, have multifactorial causal complexes associated with the disease.' P.326

Risk factors are inspected through the odds ratio (OR) statistic, which expresses the strength of association between the condition and the risk factor e.g. ELD and family history of language impairment. The OR provides the odds of having a defined risk variable among those with a diagnosis of ELD in comparison to the same risk variable being present in those without ELD. Odds ratios can identify adverse risks (OR >greater than 1.0) which increase the likelihood of ELD, protective factors which reduce the likelihood of ELD (OR<less than 1.0). Importantly odds-ratios identify non-significant

findings (where the 95% confidence interval (CI) crosses 0) which within epidemiology may be clinically useful as these 'negative' findings allow existing variables to be 'lost' as a potential cause for concern (Schwartz et al., 2006; Tomblin et al., 1997a). This statistic does enable comparison across studies, particularly where the convention of reporting 95% CIs is maintained.

The US Preventive Services Task Force (Nelson et al., 2006) reported on the usefulness of screening for language delay. This systematic review of screening measures identified gaps in the robustness of identification measures and risk indicators, stating that:

> 'The use of risk factors for selective screening has not been evaluated, and a list of specific risk factors to guide primary care physicians has not been developed or tested. Sixteen studies about potential risk factors for speech and language delay in children enrolled heterogeneous populations, had dissimilar inclusion and exclusion criteria, and measured different risk factors and outcomes.' p.299

It recommended that prospective research studies were needed to develop understanding of the utility and strength of predictive risk factors, citing birth order, family history, male gender, perinatal difficulty, parents' educational level (a proxy for socioeconomic position) and family size as currently the most consistently reported. Since Nelson et al.'s 2006 review several large scale cohort studies have added to our understanding of risk factors in the early years (Henrichs et al., 2012; Reilly et al., 2010; Zubrick and Taylor, 2007).

Bronfenbrenner's ecological theory of child development (1979) provides a framework for conceptualising the ways that factors within and out-with the child have an effect on their development. Bronfenbrenner's (1979) lifelong model proposes that children develop in relation to the family and home, school, community, society and the world. These environments are conceptualized as being proximal to distal 'nested systems' with the child at the centre and early encounters with family most proximal and exerting the first bi-directional influences. The interrelationships between environments across time are critical for development (Gabriel et al., 2010).

Influences within these environments include individual people, 'institutions' such as play groups and health centres, services such as transport systems and health and social services, physical settings the child encounters and the values and beliefs that surround the child. Within this model, risk and protective factors are identified as within the child, within the family and within the local area (society). According to Bronfenbrenner's (1979) model any such influences would interact with each other and may theoretically bestow cumulative protection or adversity in relation to language development.

Proposed influencing variables that the child brings to language development include birth order, having been breastfed, gender, hearing status, medical conditions, pre and post-natal factors, a single vs multiple birth and temperament and genetic endowment. Within the context of the family the educational level of mother and/or

father, family history of speech & language problems or dyslexia, family size, languages spoken and mother's/father's proficiency in home language, maternal age at birth of child, maternal vocabulary, ethnicity, race and parental mental health/stress have all been examined. Within the wider environment and community, socioeconomic disadvantage factors, tobacco smoke, home resources and television watching have all been linked to ELD (Reilly et al., 2010).

This study focuses on relationships between language delay and temperament, exploring whether temperament exerts an influence on outcomes for young children with language delay, thus acting as a risk or protective factor alongside other identified variables. Further, the current study investigates parent temperament traits since parents are key in their role as primary communication partners for the developing child and their own characteristics are likely to interact with their child's to influence how communication occurs within the parent-child dyad.

The literature explores a wide range of variables and not all of these are considered in this review. Harrison and McLeod (2011) present a broad review of risk and protective factors reported in the literature between 1979 and 2008. From this, and Nelson et al.'s 2006 review it is clear that gender, perinatal factors, family history and maternal education are the most frequently investigated. The Longitudinal Study of Australian Children (*N* =4983), (LSAC, Harrison and McLeod, 2011), added to this information by testing out the risk status of 31 factors in relation to; a) expressive speech and language concern, b) receptive language concern, both measured by parental report

using the Parent's Evaluation of Developmental Status (PEDS) (Glascoe, 2000); c) attendance at SLT services, and d) a low score (-1*SD* or below) on the Adapted Peabody Picture Vocabulary Test –III (PPVT-III, Rothman, 2003), a test of receptive vocabulary in 4-5 year old children. Multivariate analysis revealed two factors, male gender (risk, OR =1.29, 1.97) and persistent temperament (protective, OR =0.54,0.82) as consistent across the four conditions.

2.7.1 Child factors:

2.7.1.1 Genetics

The role of genes in language impairment is a current area of investigation and has included the identification of heritability of language difficulties from twin studies (Bishop et al.,2006; Conti-Ramsden,2008), and the identification of candidate genes from studies of probands and their families e.g. CNTNAP2 and FOXP2. However, there is further research needed before the pathways of such genes are understood or clinically useful to the SLT making management decisions for ELD. Most recently, focus has been on the genetic involvement in trajectories of growth across language domains (Rice 2012), reflecting a growing understanding of the ways in which biology and environment interact. Results of research with children below two years of age point towards biological trajectories driving very early communication and vocabulary growth, with the social and environmental milieu having only a small effect at this point. (Reilly et al., 2009; Roulstone et al., 2011; Zubrick and Taylor 2007)

Current progress in this field has been reviewed by Rice et al. (2014), who hypothesise that the genes involved in language growth may be switched on and off and have

breaking mechanisms in similar ways to other genes involved in human growth processes.

Information resulting from genetic mechanisms, which is most readily accessible, includes the language development of children from multiple births, family history of language difficulties and child gender.

2.7.1.2 Twins

Twin studies have found substantially higher rates of SLI in monozygotic in comparison with dizygotic twins (Bishop et al.,1995; Tomblin and Buckwalter,1998), lending support to the theory that shared genes exert a bigger influence than shared communication environment. Bishop et al.'s (1995) study also notes that monozygotic twins also show closer characteristics of the *type* of language difficulty in comparison to dizygotic twins. Bishop et al.(2003) analysed data from the TEDS study which had followed children with ELD through to school age and concluded that ELD appears to have a genetic basis for those children who have persisting difficulties but that for those twins with transient ELD shared environmental factors are important. Rice et al.(2013) in their cohort study of twins (*N* =698) also found higher rates of ELD in monozygotic twins (48%) than in dizygotic twins (32.6%) but also stress the increased incidence of ELD in twins as a group and lower performance in twins when compared to age matched singletons where prevalence rates are approximately 20%. It may be that twins bring particular parenting challenges in relation to the available time for

parent child interaction in comparison to singletons even in a large family and this needs to be considered alongside the findings of increased genetic risk for ELD.

2.7.1.3 Gender

Gender along with family history is one of the most consistently explored risk factors across the literature with the majority of studies finding an association between being male and having a language impairment. This finding is commonly reflected in referrals to SLT. Broomfield and Dodd (2004) explored referral characteristics over a period of fifteen months to a paediatric SLT service. They reported a 70:30 male:female ratio for referred children across diagnosed categories of receptive language, expressive language and speech difficulties. Once speech difficulties were omitted, the male:female ratio rose to 75:25 for children with receptive language difficulties and 78:28 for children with expressive respectively, suggesting stability in the excess of boys with early communication concerns across diagnostic categories.

Tomblin et al. (1997a) calculated separate prevalence rates for language impairment of 8% for boys and 6% for girls in their large sample of kindergarten children and this finding was supported by Law, et al.(2000) who identified ranges of between 1.2:1 and 2.3:1 male:female bias in their systematic review of prevalence. The same conclusions have been drawn across large cohort studies employing questionnaires, (Harrison and McLeod,2010 ; Henrichs et al.,2012; Prathanee et al.,2009; Zubrick et al.,2007) studies using direct testing (Reilly et al.,2010) and and in clinical population samples (Adamson-Macedo et al.,2009; Broomfield et al.,2004; Locke et al.,2002).

A study by Huttenlocher et al.(2010) investigated input to young children by parents. Forty-seven parent child dyads (14-46 months) were videotaped for 90 minutes during a series of nine visits. The researchers found no association between gender and word diversity or syntactic structures offered to these typically developing children drawn from a range of socioeconomic groups. It therefore seems that input alone may not account for gender effects found in children with language delays.

Overall, the current literature demonstrates a good level of consensus about the association between gender and language impairment. This may lead to developing greater understanding of the aetiology of language delay as the causal links underpinning this association are investigated. At a clinical level, gender is immutable, however knowing that more boys will need to access SLT services may facilitate development of appropriate environments and interventions to meet their needs.

2.7.1.4 Temperament style

Interest in temperament as a risk or protective factor for language impairment has grown within the last decade. Law et al.(2000) and Nelson et al.'s (2006) systematic reviews of the literature on prevalence and screening, however, included discussions about potential risk factors without mention of temperament. More recently, a renewed interest in temperament and its associations with development has fuelled research into its role in language development. Aspects of temperament have been associated with risk (reactivity) and protection (persistence) by Harrison and McLeod (2010) but literature is scant and currently no robust association has been mapped between language delay and temperament. This area is the major focus of the study

presented here and a comprehensive exploration of the concept of temperament is presented in section 2.9 and literature in relation to language temperament associations is provided in section 2.10.

2.7.1.5 Hearing concern

Roberts et al.(2004) conducted a meta-analysis of prospective cohort studies that had considered the relationship between otitis media with effusion (OME) and difficulties in receptive and/or expressive language development in children from birth to five years of age. Fourteen studies were included in the review. The authors concluded:

> 'Our findings suggest that OME and the related hearing loss children experienced during early childhood explain none to a very small amount of the observed variation in children's language skills' p. 243

Different definitions of hearing status are operationalised in cohort studies; most often these are populated via parent report, either using an interviewer or postal questionnaire. This has the advantage of capturing information, which may not be available from medical records, but it limits the accuracy of the data obtained. This may in part account for the lack of clarity about the role of OME in relation to ELD. For example, Dale et al. (2003) used a parent report measure of a range of specific symptoms associated with OME including earache, heavy nasal discharge, mouth breathing and difficulty hearing during a cold at 18 months, 3 and 4 years. This broad measure did not take account of the duration of symptoms or their effect on hearing levels. In logistic regression analyses hearing difficulties failed to improve prediction of

persisting language difficulties at 4yrs of age for the children (*N*=802) with ELD in their population drawn from the TEDS cohort study.

These conclusions found support in the Everitt et al.(2013) study of 47 3-4 year olds with specific expressive delay. They report that 80.9% of the children had no history of OME and just 10% had had two ear infections per year as identified by parent report of the child's history, such that ear infections did not serve to predict language outcome for the group.

In contrast, Harrison and McLeod (2010) in the ELVS cohort data identified ongoing hearing problems as a risk factor for both expressive language concern (OR =3.18), receptive language concern (OR =4.43) and for attendance at SLT services (OR =2.95) in their follow up of the cohort at 4-5 years. These findings were also based on parent report of their child's medical history but include a very much larger sample.

OME is a fluctuating condition, which becomes chronic for some children. The literature lacks precision when interrogating the associations between ELD and OME due to inconsistent and vague measures across studies. What we do know is that OME has the potential to reduce hearing within the range of 24-45 decibels. Where children experience frequent OME, medical management is likely to be offered to reduce the impact on the child's hearing (American Academy of Otolaryngology, 2011).

2.7.1.6 Perinatal complications

The literature has established some association between language delay and prematurity (Eapen et al.,2004; Cusson,2003) however findings are characterised by

inconsistency in relation to the association between language difficulties and perinatal complications. Definitions and inclusion about what constitutes a 'case' in this area is problematic with studies using different proxies as fits their design e.g. using birth records (Henrichs et al., 2012) versus parent questionnaire (Harrison and McLeod, 2010). Measures typically include birth weight, prematurity, assisted delivery, need for additional care at birth.

Foster-Cohen et al.(2007) investigated early birth on language outcomes at 2 years in New Zealand. The study used a prospective longitudinal design, with children classified as premature if they were born before 33 weeks gestation or weighed less than 1.5kg. They subdivided this group of ninety children into those who were 'extremely preterm' (<28 weeks gestation, *N* =36) and 'very preterm' (28-32 weeks gestation, *N* =54). Language skills were assessed in these groups and a reference group of full term (38-41 weeks gestation) using the CDI:WS when the children were 2 years of age, corrected for gestational age at birth. Linear relationships were found across the three groups with the extremely premature children showing the worst outcomes and the term children the best in relation to vocabulary size, use of decontextualized language e.g. talking about things beyond the here and now, length of utterance and morphological development. This finding remained robust after social and family factors were controlled. The study results are however based on small numbers of children and data collection at a single time point and it is unclear how the children's other areas of development were progressing such that it is not possible to determine if lower scores reflected global or more language domain specific difficulties. In contrast, Smith et al.(2014), in measuring language skills at school age did not find

support for continued delay by school age. Mossabeb (2012) used the LDS (Rescorla,1989) to screen for expressive language delay in premature children born at 23-34 weeks gestation (*N* =178). In the group, 26% met criteria for ELD, suggesting that language delay was more prevalent in this group than would be expected, though information about other areas of development in relation to language are not reported.

Harrison and McLeod's (2010) large cohort study showed inconsistency across the outcomes investigated. Perinatal factors were operationalised as a cluster of variables; prematurity (birth below 36 weeks gestation), low birth weight (less than 2.5kg), requirement for neonatal intensive care (duration not specified) were not significant for parental concern about receptive or expressive language but prematurity was significantly associated with attendance at SLT (OR =1.84). This may support the premise that prematurity alerts parents and health professionals to the possibility that prematurity may cause developmental problems so that they are more vigilant and keen to access services for children who have been born early.

2.7.2 Family factors:

2.7.2.1 Family history of speech and language difficulties

A family history of language difficulties is one of the most consistently reported risk factors in the literature with a large majority of cohort studies finding it to be significantly associated with ELD. Notably, Tomblin et al.(1997b) found that the mothers' history was not significant whereas the fathers' was. Other studies have not made this separation. Zubrick et al. (2007) ascertained family history through community postal questionnaire (*n* =1766). Analysis showed that having a family

history of language impairment was a significant predictor for late talking at 2yrs with an odds ratio of 2.1. Similarly, in the ELVS large scale epidemiological study, a positive family history of language impairment was predictive of poorer language outcomes at 4 years (OR =1.8) (Reilly et al.,2010). Zambrana et al.(2013) analysed data from the Norwegian Mother and Child Cohort Study to investigate any differential effects between family history and outcome of language delay following different trajectories. They concluded that familial risk for persistent language difficulties was the highest, being 'almost tripled'. Significant, if lower, effects were also seen for transient and late onset language delay.

Bishop et al.(2012) found a significant positive association between family history and persisting difficulties in language at 4 years. Family history for this sample of 24 children was derived from direct testing of their parents' non-word repetition skills, tapping phonological memory skills. This is in contrast to large cohort studies that use parent report of family history. There is a clear trade off here between large sample size, but potential bias in both under and over reporting of family history, in comparison with small sample and gaining direct performance data about parents' language profiles. In summary, the literature strongly suggests that family history of language difficulties does act as a risk marker for difficulties in the children but in itself it is not sufficient to predict that language difficulties will occur and as such is most useful as a marker of potential persistent difficulties if a child's language has already attracted concern.

2.7.3 Environment and community factors:

2.7.3.1 Socioeconomic position (SEP)

Research has identified that the life experiences of children may be significantly influenced by their SEP and that poorer health, learning and language outcomes are positively correlated with low SEP (Hart and Risley,1995; Law et al.,2011). SEP is a complex multidimensional construct, which seeks to capture associations between, and the impact of, material assets and social status on the lives people experience. Galobardes et al. (2006) cite Krieger, Williams and Moss' (1997) broad conceptualisation of socioeconomic *position* stating that it:

> 'refers to the social and economic factors that influence what positions individuals or groups hold within the structure of a society' p. 7

Whilst this broader view is theoretically helpful, since it identifies the dynamic nature of SEP across the lifespan, most literature refers to socioeconomic status (SES) as the term of choice and the terms are used interchangeably as a proxy to capture information about the resources available to groups of people.

Consensus on measuring SEP has not been reached and continues to attract a range of operational definitions, which lead to difficulty in interpreting results across studies with accuracy (Ginsborg, 2006). Galobardes et al. (2006) review the main 'ingredients' underpinning measures of SEP as centring around education, housing, income or occupation. Each of these single elements has its own strengths and limitations in shedding insight into the social environments of groups or individuals and needs to be carefully selected to 'fit' the research question posed. Additionally, some studies

calculate SES for an individual whilst others report the measure for the area in which their study took place.

Since 2000, indices of multiple deprivation, which combine a range of metrics to capture SEP, have been developed and published in the UK. These offer the potential to standardise ways of reporting SEP. Such measures conceptualise SEP broadly, synthesising information about income, employment, health deprivation and disability, education skills and training, barriers to housing and services, crime and living environment. These have a robust multidimensional view of deprivation, but potentially mask detailed inspection of which elements of the measure may account for specific pathways of impact on language development. Perhaps for this reason, there remains little consensus on which measures to choose, with the same investigators using different measures for different studies, for example two recent studies by Law et al.(2011) and Law et al.(2012) used the Scottish Indices of Multiple Deprivation and Mothers' educational level (attainment of five General Certificate of Secondary Education examinations (GCSEs) above grade C or not achieving this) respectively as their chosen measures of SEP.

In relation to associations between SEP and language delay, Hart and Risley (1995) defined SES through parental occupation in their longitudinal study of American children and parents. They analysed hour long video data, sampled monthly, of parent-child talk from forty-two families. They cumulatively added word classes in each sample in an attempt to investigate vocabulary development in the participants from ten to thirty-six months of age. Vocabulary size was estimated from this measure and

the authors concluded that children raised in families where occupational class was low had smaller and more restricted vocabulary in comparison to children from higher status occupation families. Further, the authors found that the quantity of language addressed to children in lower SEP homes was far less. Whilst this research has been widely cited as supporting the relationship between SES and language development, the sample used was small with only a few participants in each SES band. Further, the data collection method, whilst objective, gave only a narrow sample of each child's language performance and may not have been representative of their vocabulary use or knowledge.

Locke et al. (2002) reported on the language and cognitive abilities of 245 nursery age children living in socioeconomic deprivation as measured by entitlement to free school meals although no detail on the proportion of individual children in their cohort who actually received free school meals was given. Children with identified language or cognitive impairments were excluded from the study, which found that the cohort's cognitive skills, measured by British Ability Scales II Early Years (BAS EY II), fitted broadly with what would be expected in the population. In contrast, their language skills measured using the CELF-4, were significantly depressed in comparison with population norms, with 49.3% meeting the criteria for at least moderate receptive language delay and 48.4% meeting criteria for at least moderate expressive language delay. At follow up in primary school these delays persisted (Locke and Ginsborg, 2003):

> 'If these data are representative of the wider population, as we believe they are, they show that a significant proportion of children from areas

of economic deprivation must be at risk' p. 11-12

SEP data at the individual level would have proved a useful addition to the study to allow further inspection of SEP variation within the cohort.

Studies demonstrating a positive correlation between higher SEP and higher early language development are many, typically defining language measures through measures of language production (Becker, 2011; Farkas and Beron, 2004; Letts et al., 2013; Rowe, 2012).

Black et al. (2008) also looked for correlation between SES and receptive vocabulary using the BPVS II in a sample of seventy-six children between 4;08 and 11;06 years. Using the Carstairs Index for SEP they found no significant correlation between SEP and vocabulary in these primary school children. Children with identified language, learning or hearing difficulties were not included in the study. It cannot be known if these results were affected by the children's age and the authors suggest that education may be a positive factor that offsets low SEP. Harrison et al. (2010) explored risk and protective factors in the development of speech and language impairment in children aged 4-5 years. Logistic regression analysis revealed no association between SES and increased risk for any speech or language impairment from data collected by parental report.

Studies which have explored SEP effects as a risk marker for speech delay (SD) or disorder have not demonstrated associations between low SEP and higher speech impairment (Dodd et al.,2003; Keating et al.,2001; McDowell et al,.2007).
Current knowledge suggests there are some associations between low SEP, measured in a range of ways, and risk for language difficulties rather than speech difficulties. However, the breadth of SEP as a measure may obscure what specific factors operate negatively for children to make them more vulnerable to ELD.

2.7.4 Summary of literature on risk and protective factors

Since Law et al. (2000) and Nelson et al. (2006) published their UK and USA reviews of the evidence for universal screening for ELD in children a range of large scale prospective cohort studies have contributed to understanding of associated factors that predispose children to vulnerability for ELD.

The most robust associations are that being a boy and having a family history of language difficulties increase a child's likelihood of experiencing ELD. All other reported factors have inconsistent findings in respect of their association with ELD in published research.

Interpretation of information yielded across studies is hampered by a lack of consistency around definitions of the variables investigated and thus cut off points for 'caseness', quality of information, for example in respect of how contemporaneous it is

when collected, composite and unitary variables, for example SEP measured by one variable or a derived multi-part score.

2.8 Outcomes of ELD

Cohort studies have tracked children with ELD to look for aetiological clues but also to understand the natural history of language impairment. Identifying patterns and course of impairment over time within this highly heterogenous group of children with ELD is key to tailoring early interventions of the appropriate type to the appropriate children so that long term outcomes are maximised. As has been discussed above, a range of candidate factors have been investigated in relation to risk. Most of the literature does not address the detail of the language impairment, that is to say that children are classified as language impaired or not at particular time points. A few studies have looked at children's language profiles in more detail and looked at the predictive value of language status at the first time point in comparison to others. These studies begin to reveal the trajectories of language impairment.

Prediction of outcomes following identification of ELD has been effectively based on early receptive language skills in studies by Chiat and Roy (2008), Flax et al. (2009) and Watt et al. (2006). Further, Desmarais et al.(2008) in their review of the literature about late talking toddlers found support for the relationship between better auditory comprehension scores and better language outcomes.

Reilly et al.(2007) in their cohort found that risk factor models explained little of the variance in communication status (4, 7%) but by including previous communication

scores, derived from the CSBS (Wetherby and Prizant, 2002), taken at 12 months of age to their regression models to explain outcomes at 24 months of age they ascertained that skills acquired at 12 months explained one fifth of the variation at 24 months. The authors conclude that early communication skills may have a larger effect on subsequent development than social or environmental factors.

Henrichs et al.'s (2012) large cohort study in the Netherlands investigated the effect of receptive and expressive language status at 18 months on 30 month language outcomes using the Dutch version of the CDI. Delay in receptive vocabulary at 18 months was found to predict expressive vocabulary delay at 30 months, giving children a nine times greater risk of persistent expressive vocabulary delay (OR =9.09, 95% CI 5.81, 14.21, p <.001) if they exhibited receptive vocabulary delay at 18 months.

They reported that expressive vocabulary at 18 months predicted 11% of variance within expressive vocabulary at 30 months. The addition of 18 month receptive vocabulary to the model added only 0.5% to the prediction of expressive vocabulary. The further inclusion of all influences of risk, predicted 18% of variance within expressive vocab at 30 months (i.e.an additional 7% over that from solely using 18 month expressive vocabulary)

The authors hypothesise that whilst a range of factors associated with language delay may be important as explanations of variability in early language development at an individual level, they do not function as group level predictors. The most robust predictors at group level in this study resonate with Reilly et al.'s (2007) conclusions that early communication skill is the most accurate indicator of later communication. In contrast, Bishop et al. (2012) add weight to the predictive value of early

comprehension skills, rather than expressive skills, finding low receptive language using the Mullen Scales of Early Learning to be the best predictor of persistent language difficulties in their small sample of twenty-four children with ELD.

Rescorla (2011) in her review on the literature of good outcome predictors for children with ELD supports previous expressive skill as the best predictor of later expressive performance arguing that this has been identified in small scale studies as well as large cohorts. Further, Rescorla (2011) suggests that recent research into processing speed, such as that conducted by Fernald and Marchman (2012) may prove fruitful as an earlier indicator of risk for poor language outcome based on the findings of persistent weakness for processing speed in older children with SLI.

Zambrana et al. (2013) report findings from a Norwegian cohort study that followed language development up to five years. In their analyses male gender, family history of language difficulties and poor early communication skills assessed using the ASQ communication scale (Richter and Janson 2007) predicted poor outcomes. Poor comprehension had a similar odds ratio to male gender, with both of these doubling the risk of early, late, transient and persistent patterns of language difficulty. Family history of language difficulty was most associated with persistent language difficulties with children's risk for language difficulties being tripled where there was a positive family history for language impairments.

Everitt et al. (2013) investigated potential markers for persistent language delay in a 12 month follow up study of 47 children aged 3-4 years at entry to the study who had attracted clinical concern because of expressive language delay and a control group (*N* =47) with typically developing language skills. They assessed the children's language

skills using the Preschool Language Scales 3-UK (PLS3-UK), non-verbal IQ and a range of proposed marker tasks that the researchers hypothesised as potentially allowing discrimination between children with temporary and persistent difficulties. These tasks comprised a battery of language processing markers e.g. non word repetition, and linguistic markers e.g. a 3rd person singular probe and a past tense probe both taken from the Test of Early Grammatical Impairment (Rice and Wexler 2001). Although a small study the comprehensive assessment of the children's skills and the inclusion of a control group add strength to the study's findings. At follow up, 76% continued to have specific expressive language difficulties and of this group with persistent difficulties 71% showed difficulties in receptive language skills. Just 24% of the children had difficulties that had resolved.

The children's performance on Recalling Sentences, a modified subtest of the CELF-P UK (Semel et al., 2006) which was used as a marker task for processing skills and the auditory comprehension and expressive communication scales of PLS3-UK usefully predicted persisting difficulties from those that resolved. No one of these measures was superior in this task than the others. The resolution rate of 24% is unusually low, but the children were older than typical ELD samples at the first point of data collection and so were perhaps more likely to be within a 'persistent difficulty' group of children, in comparison to studies of children between 18 months and 30 months of age, who typically exhibit high resolution rates, indeed some of this group may have had 'late onset' trajectory language delay (Henrichs et al., 2012).

In summary, language skills at the first point of identification of ELD are one of the most robust predictors of outcome. Receptive and expressive skills in conjunction with family history provide the best account of variation in outcomes.

This research study will explore dimensions of temperament to investigate if these can add to our understanding of any role they may play in young children's language outcomes in a cohort identified with ELD.

2.9 Temperament

The role and influence of temperament in the development of children is a major theme in this research enquiry. Temperament has been identified in the literature presented in section 2.7.1.4 as a putative factor that could influence language development trajectories in preschool children, with different aspects of temperament conferring risk and protection during the process of language acquisition (Harrison and McLeod, 2010).

2.9.1 Definition and description

The etymology of temperament is from the Latin *temperamentum* (due mixture), which the Oxford English Dictionary defines as 'a moderate and proportionable mixture of elements'.

Zentner and Bates (2008), in their review of temperament concepts, identified essential criteria, common to definitions of child temperament. They asserted that

child temperament includes individual differences in typically occurring behaviours which relate to aspects of emotion, activity, attention and sensory responses which appear early in development (within the first few years of life). These are expressed as qualitatively different across individual children in respect of the intensity, duration, potential and trigger point of the response. These features have very close links to genetic, neurochemical and neuroanatomical mechanisms and show at least moderate levels of endurance across time, for example, early temperamental shyness is predictive of later internalising behaviour difficulties (Caspi et al., 2008).

2.9.2 Development of perspectives on temperament

The concept of temperament spans cultures and traditions, its study, as a route to exploring and identifying the development, nature and impact of the unique personal behaviours of the individual, is longstanding. Temperament is rooted in the writings of philosophers, including Plato (427-347 BCE) and Hippocrates (460-370 BCE) in the West. In Eastern traditions, temperament links to the Chinese concept of *ch'i*, where fluctuations in *ch'i* were proposed to account for individual differences in the expression of emotions and behaviour, and to the Hindu Rig Vedas writings where *gunas* were the concept which explained variation in mood and behaviour (1500-1000BCE) (Rothbart, 2012).

Temperament was articulated in Hippocrates' concept of four essential fluids (phlegm, blood, yellow bile and black bile) whose proportions influenced the wellbeing and character of the individual. The concept was further developed by Galen (130-200 CE) who proposed four humours, a coalescence of physical and emotional characteristics which adults exhibited: phlegmatic, sanguine, choleric, and melancholic. Galen placed

emphasis on the need for regulation of internal states to maintain emotional equilibrium. These influential ideas became embedded in medicine, as physicians sought to maintain this balance through procedures such as purges and bloodletting. Galen's early constructions focussed on the biological underpinnings of temperament but also extended Hippocrates' humours to encompass observations about children, commenting:

> 'The starting point of my entire discourse is the knowledge of the differences which can be seen in little children, and which reveal to us the faculties of the soul.' cited in Rothbart, 2011, p. 15

These four typologies of temperament persisted through to the twentieth century and were expanded to include psychopathologies linked to these types, for example, depression became associated with the melancholic temperament and aggression with choleric types. Importantly, in this conceptualisation of typologies, individuals were required to belong to one type. This view did not allow for growth or change in expression of temperament over time.

In the twentieth century, Pavlov (1849–1936) studied temperament in dogs, seeking to account for their differential responses to classical conditioning (Rothbart, 2012); why were some dogs quicker to train, or require less maintenance once a response was learned? Pavlov became intrigued about the dog's routes to fully conditioned status and maintenance of the conditioning once established across different dogs. Differences in the dogs' behaviour (their reactions) were hypothesised as reflective of the responses of their nervous systems. Pavlov proposed that the latency, intensity and duration of responses to an event were defined at an individual level, though they

shared the underlying process of activation by a stimulus. This construct of 'reactivity' (Rothbart and Bates, 2006) and the qualitative differences in it, between individuals, has remained a key concept in temperament research and clearly illuminates that temperament relates to the individual's experience of and reaction to an event rather than solely the nature of the event itself. Thus, temperament research is concerned with identifying why, for example, being pushed on a swing or seeing Father Christmas invokes delight in one child, fear in another and equanimity in a third.

Thomas and Chess (1977) began a temperament research programme, the New York Longitudinal Study (NYLS) in 1956, based on their clinical observations as practicing child psychiatrists. Thomas and Chess' study is viewed as seminal in contemporary temperament research and challenged the dominant environmental view:

> 'We could not find in our clinical cases or the research literature the direct correlations between such environmental factors and individual differences in patterns of development …. This dissatisfaction with the prevalent theories of the time was a major reason in our decision to investigate the active role played by the child's own characteristics, and specifically his temperament, through the initiation of the NYLS.' Chess and Thomas, 1984, p. 14-15

Chess and Thomas (1984) utilised an inductive approach, gathering data through interviews and observations to derive aspects of child behaviours consistent with temperament traits. They named these features 'dimensions' to encompass a diversity of behavioural expression for each. Although they linked specific constellations of these dimensions to the typologies of 'easy', 'difficult' and 'slow to warm up', their

research foregrounded specific traits over and above typologies. This dimensional approach has spurred researchers to look at the presence and impact of specific temperament features in children (Hepburn and Stone, 2006; Spaulding, 2010).

In current temperament research, categorical approaches, which emphasise typologies, are also still evident (Kagan et al., 1993). These approaches identify membership criteria and emphasise constellations of temperament features to allocate individuals to specific types. This approach is evident in research that seeks to investigate and identify behavioural phenotypes. In this way, contemporary research in temperament mirrors the debates in the language impairment literature about dimensional perspectives, which emphasise a continuum of characteristics and abilities and categorical views of language impairment, which seek inclusion and exclusion criteria, for exclusive diagnostic groups (see section 2.3).

2.9.3 The New York Longitudinal Study (Chess and Thomas, 1956 - 1988)

The New York Longitudinal Study (NYLS) began in 1956. It was a prospective study that used a snowball sampling method (Handcock and Gile, 2011) to recruit eighty-seven mothers and follow their infants from approximately three months of age until early adulthood. Subsequent children, born to the mothers during the first six years of the study, were added to the cohort resulting in 138 children entering the study. High follow up rates were achieved, with 133 of the cohort completing the study. An artefact of snowball sampling is a tendency for little socioeconomic or cultural variation in the sample (Handcock and Gile, 2011). This was indeed the case for

Thomas and Chess' sample, who were all American born New Yorkers, and described as 'from middle or upper middle class background' (Chess and Thomas, 1996, p25). However, the authors assert that for the goals of the project, a sample who shared a similar environment and culture allowed for individual differences due to temperament to be more clearly identified.

Detailed interviews about the child's daily experiences behaviours and reactions were conducted to provide information about each child's temperament. The schedule of data collection is summarised in Table 2.1. Data collection was most frequent at the early stages of a child's life and this contrasts with mid childhood where only data for children with behaviour difficulties were collected due to lack of funding. As new funding was secured, all children were again included from 16 years onwards.

Table 2.1 *Overview of data collection for NYLS*

Child' s age	Scheduled data collection	Comments
3-18 months	Every 3 months	Mother interviewed
19 months-5 years	Every 6 months	Mother interviewed Father interviewed Teacher interviewed at 6 years Intelligence Quotient (IQ) testing, 3 and 6 years Behavioural observations (research team)
6-8 years	Every year	

8-15 years		Only collected data for children with behavioural difficulties
16 years	Once	Mother interviewed Father interviewed Child interviewed
18-22 years	Once	'Child' interviewed
Mid 20's-30's	Once	'Child' interviewed

Following the first year of data collection, thematic content analysis was carried out on the interview data (Thomas et al. 1963). This gave rise to nine categories of behaviour which Chess and Thomas (1996) termed as 'primary reaction patterns' (p 32).These categories are reported to have appeared across interviews and time points. In discussion with Professor Michael Rutter who worked on the project at this time (1962), the terminology for reporting these patterns was changed to 'temperament'. The nine dimensions identified are described in Table 2.2 below.

Table 2.2 *Temperament categories identified by Thomas et al (1957)*

Temperament Category	**Description**
Activity level	The motor component present in a given child's functioning and the diurnal proportion of active and inactive periods
Rhythmicity (regularity)	The predictability and/or unpredictability in time of any function. It can be analysed in relation to the sleep-wake cycle, hunger, feeding pattern and elimination schedule.

Approach or withdrawal	The nature of the initial response to a new stimulus, be it a new food, a new toy, or a new person. Approach responses are positive whether displayed by mood expression (smiling, verbalisations and the like) or motor activity (swallowing a new food, reaching for a new toy, active play and so on). Withdrawal reactions are negative whether displayed by mood expression (crying, fussing, grimacing, verbalisations and the like) or motor activity (moving away, spitting new food out, pushing new toy away and so forth).
Adaptability	Responses to new or altered situations. One is not concerned with the nature of the initial responses, but rather the ease with which they are modified in a desired direction.
Threshold of responsiveness	The intensity level of stimulation that is necessary to evoke a discernible response, irrespective of the specific form that the response may take, or the sensory modality affected. The behaviours utilised are those concerning reactions to sensory stimuli, environmental objects and social contacts.
Intensity of reaction	The energy level of response, irrespective of its quality or direction.
Quality of mood	The amount of pleasant, joyful and friendly behaviour, as contrasted with unpleasant, crying and unfriendly behaviour.
Distractibility	The effectiveness of extraneous environmental stimuli in interfering with or altering the direction of the ongoing behaviour.

Attention span and persistence	Two categories that are related. Attention span concerns the length of time a particular activity is pursued by the child. Persistence refers to the continuation of an activity in the face of obstacles to the maintenance of the activity direction.

(taken from Chess and Thomas 1996, p33-34)

These categories were developed into questionnaire formats suitable for parent report of temperament across childhood so that data could be collected and analysed more quickly for use in clinical and research settings (Carey, 1970, 1986; Lerner et al.,1982; Thomas et al.,1982). Thomas and Chess' (1977) research is set within the context of their practice as child psychiatrists and their interest in the reciprocal interactions between the developing child and their environment.

2.9.3.1 Goodness of fit

Thomas and Chess' (1977) developed the concept of 'goodness of fit' that, they reported:

> 'results when the properties of the environment and its expectations and demands are in accord with the organism's own capacities, characteristics, and style of behaving' p. 11

In addition, they emphasised the reciprocal influences of children on parents and parents on children during development and parenting. Further, Thomas and Chess (1977) discussed that this concept included consideration of both the socioeconomic resources and cultural values surrounding parent and child (Sanson et al., 2004). For

example, researchers have investigated goodness of fit within parent-child dyads and within day care, educational settings (Churchill, 2003; De Schipper et al., 2004) and within parent/doctor information giving (Fisher, 2003; 2005). Klein and Ballantine (1991) in their study of temperament differences across cultural groups and in educational settings additionally argue that idealised temperament patterns form an integral aspect of the ethnotheories of cultures. Such ethnotheories articulate the expectations for behaviour as well as environmental setting, physical and organisational features. It is this idealised temperament and deviations from it that underpin the goodness of fit for a child within all his or her social relationships.

Goodness of fit has continued as an influential model on which to base temperament interventions. It provides an assessment framework, for example, do parent and child show synchrony in their behavioural styles, does this fit gain support or challenge from the socioeconomic and cultural milieu? In turn, this has led to interventions that seek to modify dissonance where it is identified. However, McClowry, Rodriguez and Koslowitz (2008), in their review of temperament interventions grounded in a goodness of fit tradition, noted that interventions have limited evidence of effectiveness,

> 'Such an approach is both intuitively appealing and practical for developing strategies to resolve temperament/environment mismatches. Empirically demonstrating the efficacy of such interventions, however, is complicated by its highly individualized approach. p.121

Whilst there is consensus about what goodness of fit represents conceptually, operationalising how to measure it has been more problematic.
Feagans, Merriwether, and Haldane (1991) generated a goodness of fit measure which asked mothers to rate which child behaviours they believed were most and least desirable, and then to rate their children on each of these. Where parent rated undesirable behaviours occurred frequently, children were considered to have a poor fit with their environment. Other researchers using this technique have identified that the resulting fit is predictive of child and adolescent adjustment (Bird, Reese and Tripp, 2006; Churchill, 2003; Patterson & Sanson, 1999).

An alternative approach established by Lerner (Lerner, 1983; Lerner, Lerner, Windle, Hooker, Lenerz and East, 1986; Lerner, Lerner and Zabski,1985; Lerner and Lerner, 1987), has concentrated on the match and mismatch between expectations from others for the child, for example, parents, carers or teachers, and the children's actual behaviours or temperamental features. Consequently, this strategy defines fit as the divergence between a measure of child temperament and the expectations for that temperament facet as defined by others. Typically, data is collected by parent report questionnaire to measure temperamental traits of children and this data is then compared to a measure that asks parents to rate how important these given attributes are for their child. A big discrepancy in scores is interpreted as an indication of poor fit, whilst similarity in scores is construed as goodness of fit (Lerner and Lerner, 1987).

Another strategy for measuring goodness of fit centres on comparison of parent and child characteristics. The central task is to determine which combination of

temperamental traits in parent and child might be associated with promoting optimal child development and functioning (Bates, 1989). In this framework, an association between any stated parent and child temperamental traits that predict positive child adjustment provides evidence of fit (Bates, 1989).

More recently, Antshel et al. (2007) operationalised goodness of fit as the general parental *perception* of their child's behaviour within a particular dimension and overall manageability. Using the Carey Scales, based on Chess and Thomas' (1977) work, parents rated their child's behaviours, but also their general impression of how the child compared to other children of the same age on a scale of 1 =very easy to 6 =very difficult on each dimension of behaviour and overall manageability. The authors use this measure of parental perception as a proxy for goodness of fit since, they argue, it taps a rating of parental expectation, and whether or not their child is meeting this demand. This links directly to the concept of goodness of fit being achieved when the child is able to meet the expectations of her or his social and cultural environment.

2.9.3.2 Parents' temperament and goodness of fit/manageability

Temperament, as a lifelong relatively stable phenomenon, is important in the way it underpins parenting style and inputs to a bi-directional interplay within the parent and child relationship (Clark, Kochanska and Ready, 2000).

Researchers have overwhelmingly focussed attention on the child's temperament and its interaction with parenting style whilst the temperament features of *parents* have

been little explored. Coplan, Reichel and Rowan (2009) conducted a correlational study of parents' personality and parental style and concluded that the,

> 'relation between maternal neuroticism and overprotective parenting style increased among parents of shyer children.' pp241

What remains unclear is the direction of any influence, do parents promote or respond to shyness in the child? Links between parenting style and later personality traits in the *child* have attracted most interest (Oshino et al. 2013) and this is likely to be because the dominant literature in relation to adults reflects personality theories within which temperament plays a partial role. Some researchers view personality to arise from and relate to temperament style but typically studies follow children to adolescence but not beyond. Chess and Thomas' NYLS provides a notable exception to this.

Research to understand more about the relationship between parent's temperament and their parenting style, including establishing the respective roles of social modelling and temperament in developing a parental style is needed to allow effective support to be given to parents who are finding parenting challenging.

This study adds to current literature by describing the temperaments of a group of parents who have children with ELD and by identifying goodness of fit between parent-child dyads, replicating Antshel et al.'s (2007) approach (see section 2.9.3.1). Establishing the role of such goodness of fit in positive developmental outcomes is pertinent to strengthen the evidence in current intervention programmes (Barkley, 2013; McClowry, Rodriguez and Koslowitz, 2008).

2.9.4 Other models of temperament

Thomas and Chess' NYLS set of dimensions have been highly influential in modern temperament research. Their work has been subject to critique and further development. Work by other researchers, notably Rothbart and colleagues (Rothbart and Derryberry, 1981; Rothbart, 2004; Rothbart and Bates, 2006), Kagan (Kagan 2008; Kagan and Snidman 2004) and Buss and Plomin (1975, 1984), have emphasised neuro-biological underpinnings of temperament, whilst Goldsmith and Campos (Goldsmith and Campos, 1982; Goldsmith, 1993) have accentuated the link between emotion and temperament;

> 'We simply define temperament as early developing tendencies to experience and express emotions' Goldsmith et al., 2000, p. 2

Rothbart (2004) conceptualised that temperament concerns 'individual differences in reactivity and self-regulation' (Rothbart, 2011, p13) that are biologically based and expressed in the domains of emotion, activity and attention. Rothbart's (2004) work took a theory driven approach to expose underlying structure for temperament which has received considerable support in the literature (Kochanska, Murray, and Harlan, 2000; Valiente et al. 2003; Eisenberg, Smith and Spinrad, 2011; Zentner and Bates 2008; Shiner et al., 2012). This influential model, derived through psychometric (factor) analysis of data from 3-12 month old infants (Rothbart, 2004) proposed a structure of temperament that comprised of three substantive dimensions; surgency/extraversion, negative affect, and effortful control. Each of these factors comprised finer temperament facets, such as those described as 'dimensions' by Chess and Thomas (1987), for example, Rothbart's surgency/extraversion factor

encompasses activity level, tendency to be impulsive and sensation seeking which connect to Chess and Thomas' (1987) activity and approach dimensions. Rothbart's model added the concept of 'effortful control', with its links to executive function to the arena of temperament, arguing that cognition has a biological basis that is intrinsically linked to emotion through temperament. Chess and Thomas' dimensions and those based on Rothbart's model have been demonstrated to have empirical and conceptual associations with each other (Mervielde and De Pauw, 2012).

In summary, defining temperament by what it is and is not has proved difficult, with different traditions of temperament research usefully foregrounding particular aspects of children's early occurring individual differences. Shiner et al. (2012) offer the following contemporary definition,

> 'Temperament traits are early emerging basic dispositions in the domains of activity, affectivity, attention and self-regulation and these dispositions are the product of complex interactions among genetic, biological and environmental factors across time. . . . It is important that the field not be dogmatic in adherence to a single definition of temperament. As new findings accumulate, additional basic dispositions may be identified, and an amended definition may prove to be more useful.' p. 437

2.9.5 Stability of temperament

A key principle in temperament research is that temperament reflects a style of behaviour that shows relative stability over time within an individual (Shiner et al. 2012). It is stability that makes temperament a useful concept in understanding

children's individual needs and allows for the development of environmental and interpersonal adaptations and interventions (McClowry et al., 2008). Also central to current understandings of temperament, is that it develops with age through maturational changes as a result of social, environmental and biological influences and interactions (Goldsmith et al, 1987; Rothbart and Bates, 2006). Supporting this view, researchers have found temperament to increase in stability with age, from having moderate stability in infancy (Rothbart, Derryberry and Hershey, 2000; Matheny and Philips, 2001), to greater stability after 24 months of age (Kochanska, 2001) which then increases more slowly until middle childhood, where it maintains stability .

Guerin and Gottfried (1994) and Guerin et al. (2003) provided longitudinal temperament data for a sample of children from two to twelve years of age (*N* = 2years, 98 – 12years, 90) using the Carey Temperament Scales. They concluded that patterns of change and stability varied across temperament dimensions, however, overall there was a trend of reducing change and increased cross- time stability, ascertained by looking at rank ordering of the children's scores over time points. These findings were supported both by Caspi et al. (1995), who reported significant correlation across a period of six years (3-9 years) from their work in the longitudinal Dunedin Multidisciplinary Health and Development Study, and Roberts and DelVecchio's (2000) meta- analysis of over one hundred temperament papers which concluded that moderate rank order stability exists across age span.

In the UK, similar results relating to the stability in assessment of temperament have been provided for Buss and Plomin's (1984) Emotionality Activity Sociability

Temperament Survey for Children (EAS) (Bould et al., 2013). Bould et al. (2013) accessed temperament data from the ALSPAC study (*N* =7429) when children were three, five and six years old. The data yielded test-retest correlations which varied across dimensions and were strongest from five to six years (0.59-0.74) and weakest from three to six years (0.46-0.58). Regression modelling gave evidence of good stability over time with 69-82% of variance being explained by differences between children. The authors comment that analysis confirming the stability of temperament is fundamental to being able to use temperament as a variable in the prediction of child outcomes.

The consensus in contemporary literature is that the interplay between development and temperament, both through experience and neurophysiological maturity, in the infant through to adolescence is characterised such that by approximately five years of age (i.e. the end of the preschool period);

> 'Children's temperament traits meaningfully predict their later personalities but there is also good evidence that children do still change across the childhood and adolescent years.' Rothbart, 2012, p. ii

These trends towards stability have fuelled research into the predictive power of temperament traits. Caspi and Silva (1995) considered continuity of traits in a large community sample (*N* >800) to investigate whether temperament at three years of age was associated with traits at eighteen years of age. At three years children were grouped into one of five categories; undercontrolled, inhibited, confident, reserved,

and well-adjusted, based on ratings made by the researchers via observations. At follow up, the well-adjusted group continued to show normative behavioural profiles. Undercontrolled children exhibited high scores for impulsivity, danger seeking, and aggression, whilst the inhibited group had low scores for these measures and on social potency. Children who had been rated as confident at three years, expressed scores high on impulsivity whilst those characterised as reserved children scored low on social potency, suggesting continuation of their reserved profile. Using data from the same study (Caspi et al. 1995), behaviour problems at fifteen years of age were predicted from behavioural reports between three and five years of age. The authors found that young boys high in approach later showed lower levels of anxiety and withdrawal. Higher levels of impulsivity and aggression, in both boys and girls, were predicted by the presence of low attention control along with membership of the inhibited group at 3-5 years. Further support for the relationship between early identified temperament features and behavioural outcomes is provided by the Munich Longitudinal Study on the Genesis of Individual Competencies (LOGIC) which followed a cohort of two hundred and thirty children annually from preschool to twelve years of age and again when the participants were twenty-three. Asendorpf, Denissen and van Aken (2008) reported on a sample of the children from LOGIC who represented the most inhibited 15% and the most aggressive 15% during their preschool years, derived from observational and parent report data, in comparison to a sample who were rated as below average on these two constructs. This sample was followed up at 23 years old to ascertain their outcomes using self and parental report to gather data about their temperament, social networks and life history. Analyses identified that the inhibited children remained inhibited, as rated by their parents and also had a relatively delayed

start to getting a full time job and having a romantic relationship, although they left home at a similar time to their peers. The aggressive group at 23 years were characterised by externalising behaviour problems, had a higher proportion of criminal charges after their eighteenth birthday, and lower educational achievements. Asendorpf et al. (2008) concluded that prediction from preschool years to adulthood in relation to key social outcomes is possible for children showing extreme inhibition or aggressiveness, whilst also recognising that:

> 'What will remain despite all these attempts at prediction will be a large variance left unexplained because of the immense complexities of human development' p. 1009

For the current study, the literature provides direction that in looking at the outcomes of children with ELD, temperament may be a candidate predictor that provides insight into differential risk for individual children.

2.9.6 Measurement of temperament

Both researchers and clinical practitioners have sought to develop tools to measure temperament to facilitate research and interventions. As with all measurement of behaviour, temperament can be complex to measure and prone to error as well as accuracy. Most research has been conducted using parental report of temperament (Zentner and Bates, 2008), usually through mothers' completing questionnaires, which ask them to rate their child's response in a range of situations appropriate to the developmental age of the child (Joyce, 2010). Such questionnaires reflect the

conceptual view of the authors in relation to the categories reflected in the items included.

Tools developed for very young infants (0-6 months) have been heavily criticised for poor internal consistency (Rothbart, Chew and Garstein, 2001). Vaughn et al. (1981) reported that Carey's (1970) Infant Temperament Questionnaire reflected the mother's characteristics more closely than those of the infants they were rating. This called into question the usefulness of parent report, with Kagan (1998) later commenting:

> 'that parental reports, when used alone, are not a sufficiently valid index of a child's characteristics' (p200).

In contrast, other temperament researchers, including Rothbart and Bates (1998) and Carey and Jablow (1997), argued for acceptable objectivity from parent report and greater insight since parents know their children very well. Chess and Thomas (1996) outlined their procedure for maximising accuracy, when collecting parental report. They argued that emphasising to parents that individual differences between children are normal and asking parents to *illustrate* facts rather than make interpretations, e.g. rather than, 'my child is happy' – '*what* does he do to show this, *when* is he happy, *how* does he behave when he is happy, give me an example' reduces respondent bias. In addition, they trained observers and employed them to conduct home observations of the child's behaviour for 13% of the sample. These showed a significant positive correlation with the parents' reports.

The issue of lack of objectivity remains debated in the literature (Rothbart and Bates, 2006; Kagan and Fox, 2006; Zentner and Bates, 2008) yet the parent report method remains frequently used due to,

> 'The economy of reports, the rich coverage of difficult-to-observe situations, and the evidence that reports possess validity.' Zentner and Bates, 2008 p. 28

Questionnaire tools are the most frequently used method for gathering data for clinical work and for cohort research where temperament measures are used as part of a larger data collection strategy (ALSPAC, TEDS, Growing Up in Australia, Growing Up in New Zealand).

Observational methods involving laboratory visits have been developed for use in focussed temperament research. In the laboratory setting, a series of situational events are devised to elicit specific aspects of temperament, for example Laboratory Temperament Assessment Battery (Lab–TAB) (Gagne et al., 2011). Laboratory instruments have been shown to provide valid child temperament data (Durbin et al., 2007) and may be adapted for use in home settings (Seifer et al., 1994) where specific situations, such as a stranger interacting with the child, may be observed. However, these have limited use in community settings because they are time consuming and expensive, may only access some aspects of behaviour and at a single point in time leading to concerns of representativeness (Dougherty et al., 2011).

In summary, temperament research is based primarily on data from parent report measures, which reflect the theoretical models of temperament advocated by the authors of the instruments. Shiner et al. (2012) note that there is considerable overlap

of temperament traits between models. This is confirmed by de Pauw, Mervielde and Leeuwen's (2009) examination of the structure of questionnaires, which were based on Chess and Thomas (1984) and Rothbart (2004), Buss and Plomin's (1984) theoretical models. De Pauw et al. (2009) identified significant similarity across the questionnaires, but also commented that each framework yielded non-overlapping information that usefully added to the shared temperament data.

It is likely that measurement instruments will continue to reflect the differences in the conceptualisation of temperament and so it is important that researchers are explicit in reporting their data collection tools.

2.9.7 Influences on temperament development within the environment

Maternal behaviours have been shown to play a role in influencing child temperament (Kochanska, Aksan and Joy, 2007). Maternal sensitivity has been associated with infants' reactivity and self-regulation (Propper & Moore, 2006) which are central to Rothbart and Derryberry's (1981) conceptualisation of temperament. One hypothesis for this link is that where an infant has difficulty in achieving regulation of their own physiological arousal, they rely on their caregivers to aid them to relieve any distress or over-arousal (Sroufe, 2000). Further, caregivers moderate negative emotions, by initiating soothing behaviours such as rocking or distraction, for example and reinforce positive emotions such as delight and interest by mimicking these behaviours (Thompson, 1994). Within Chess and Thomas' (1984) temperament framework, the

dynamic interactions of parent and child temperaments on each other are viewed as 'goodness of fit' and important to the child's optimal development.

The mechanism for children's development therefore, includes the interplay of reciprocal transactions between the child's characteristics and environmental factors, which importantly include maternal characteristics (Hinshaw, 2008).

2.9.8 Behavioural phenotypes

Temperament profiles have been studied in groups of people who have an identified syndrome, as part of research into patterns of behaviour related to chromosomal or genetic differences. Behavioural phenotypes have been defined as:

> 'a characteristic pattern of social, linguistic, cognitive and motor observations consistently associated with a biological/genetic disorder.' O'Brien, 2006, p.339

Much research into temperament has sought to generate data about temperament profiles, so that intervention plans can be developed or fine-tuned to the needs of specific groups based around predominant characteristics (Antshel et al.,2007; McClowry et al., 2008), however more recent research also aims to identify potential sub-types within broad diagnostic groups. For example, Hepburn and Stone (2006) used temperament profiles to investigate if they were able to distinguish children with a diagnosis of an autism spectrum condition (ASC), who either exhibited a lack of fear or were fearful.

2.9.8.1 Attention Deficit Hyperactivity Disorder (ADHD)

Research investigating temperament in children with ADHD (Karalunas et al., 2014) contributed further to this research impetus in identifying three subtypes of ADHD based on temperament trait clusters. This study of children aged between seven and eleven years who had been diagnosed with ADHD (*N* =437) included a control group (*N* =190). Multiple neurophysiological measures were taken, along with temperament report using Temperament in Middle Childhood Questionnaire (Simonds and Rothbart, 2004) completed by a parent or guardian. The authors identified three presentation varieties of ADHD based on the temperament profile data; a mild type showing core ADHD symptoms only, a surgent type identified by high activity and approach levels and an irritable type who showed high levels of negative emotion. The authors assert that the temperament information yielded by this study was associated with coherent differences in the central and peripheral nervous system responses of the study participants and state that temperament data can usefully add to the development of clearer classification systems for heterogenic disorders. Further study would be needed to replicate these findings as well as looking in more detail at which models of temperament could prove fruitful for classifying subgroups within broad diagnostic categories. Karalunas et al. (2014) used a model based on Rothbarts's (2004) neurobiological theory of temperament. It may be that this model has particular strengths to bring to an understanding of ADHD and it would be valuable to look at whether other models such as Chess and Thomas' (1984) interactional model also provide comparable insights.

2.9.8.2 Down Syndrome

Gunn and Berry (1985) used the Toddler Temperament Scale (TTS) to gather data about the temperaments of 2-3 year old children (*N* =37) with Down Syndrome, along with reference data for thirteen siblings of the group, who had no known disability. The results of this study suggested that the toddlers with Down Syndrome did exhibit a distinct profile; they were milder in their responses (lower in intensity), had a more positive mood and more regular body rhythms. These patterns were different from those of their siblings with the exception of rhythmicity. The authors acknowledged that it is difficult to generalise these results because of the small sample size.

2.9.8.3 Williams syndrome

Williams syndrome arises from a deletion on chromosome 7 (Ewart et al., 1993) and is another example of a neurodevelopmental disorder. Children with Williams syndrome typically experience cognitive and motor delays (Bellugi and St. George, 2001). Research has identified a behavioral profile of strengths which include some aspects of expressive language development, social interest (Plesa Skwerer et al., 2006), facial recognition, and auditory rote memory (Bellugi & St. George, 2001, Dykens, 2003; Mervis and Klein-Tasman, 2000). However, people with Williams syndrome often experience difficulty with motor and visuospatial skills. A temperament profile that is characterized by high activity, high approach, increased distractibility, low persistence and low adaptability (Perez-Garcia et al., 2011; Mervis and Klein-Tasman, 2000; Hahn, Fidler and Hepburn, 2014) has been identified.

2.9.8.4 Fragile X Syndrome

Hatton et al. (1999) investigated the temperament profile in a cohort of forty-five boys aged 4;11-7;04 who had Fragile X Syndrome (FXS). FXS is caused by a mutation in the FMR-1 gene and is the most commonly identified cause of learning disabilities in children with an estimated prevalence of 1 in 4000 boys and 1 in 6000 girls (www.fragilex.org.uk). Temperament was established using the Behavioural Style Questionnaire (BSQ) (McDevitt and Carey 1978). The authors concluded that although the cohort differed from their reference sample on five of the nine dimensions there was wide variability within the profiles and no characteristic profile could be securely identified. Further, the temperament profiles did not reflect differences in cognitive ability and the authors comment that this was supportive of the independence of temperament and cognition as separate constructs. Kau et al. (2000) also measured temperament in children with FXS. In this study, the Revised Dimensions of Temperament Survey (DoTS-R) (Windle and Lerner, 1986) was used to collect data from forty-one boys between 3-6 years of age and a control group of sixteen boys with developmental learning disabilities of unknown origin who were matched for age, cognitive development and language skills. The authors' analysis identified a more positive mood and less social withdrawal than in the group with developmental learning disabilities, whilst also noting higher levels of avoidance to unfamiliar situations or objects. They conclude that this avoidant style has implications for how activities and learning experiences need to be scaffolded for children with FXS.

2.9.8.5 Velocardiofacial syndrome (VCFS)

The DOTS-R was also used by Antshel et al. (2007) in their study into the temperament profile of sixty-seven children with velocardiofacial syndrome (VCFS) aged between six and fifteen years and their parents. This study used a control group matched for age, race and gender *N* =47 and a smaller (*N* =18) group of sibling controls. The study identified that the children with VCFS were less regular in their rhythms, less able to sustain their focus of attention, less positive in mood, less persistent and less adaptable than either their siblings or the controls. This profile was not changed by considering gender effects. Antshel et al. (2007) conclude that children with VCFS have a more 'difficult' temperament than siblings or peers, identifying that the constellation of traits identified are challenging for parents to manage. Further, they acknowledge that this may be due to learning difficulties rather than a unique temperament constellation in VCFS.

2.9.8.6 Autism Spectrum Conditions (ASCs)

The temperament profiles of children diagnosed with ASCs have been studied and shown to be more active, less intense in reactions, more withdrawn, less adaptable, less persistent and with a higher response threshold (Bailey et al., 2000; Hepburn and Stone, 2006; Garon et al., 2009, Bolton et al. 2012). Brock et al., (2012) used the BSQ in their study of children with ASC (*N* =54) and children with developmental delays (*N* =33) aged between 3-8 years. Both groups showed different profiles to the normative sample. Furthermore, they differed from each other in approach and intensity of response, with the children with ASCs being more withdrawing and less intense. Brock

et al. (2012) assert that the inclusion of a group with developmental delay may add to the clarity of observing overrepresented traits in ASC. Brock et al. (2012) also divided the group with ASC into those with sensory hyporesponsiveness and hyperresponsiveness, assessed by parent report and observation. They reported that hyporesponsivity was associated with low adaptability, low distraction and low reactivity, whilst a profile of low approach and negative mood was associated with hyperresponsivity. The authors concluded that their cohort of children with ASC were differentiated as a group from both typically developing and developmentally delayed children on the dimensions of (low) distractibility and (low) approach and that the recognition of this profile may benefit development of appropriate interventions. Del Rosario et al. (2014) also used the Carey Scales to investigate the development of temperament over time in babies whose siblings had a diagnosis of ASC, and were therefore at increased risk of ASC diagnosis themselves (Ozonoff et al., 2011). Analyses revealed that low approach, low distractibility and high activity at 24 months distinguished toddlers who went on to be diagnosed with ASC from high risk toddlers whose development remained typical. Further, the trajectories of the siblings with ASC group showed decreasing adaptability and approach over time whilst activity levels increased. This small scale study is unique in considering the trajectory of temperament in a group of high risk infants. The authors acknowledge that the addition of a low risk typically developing group would add usefully to the results.

2.9.8.7 Summary

Temperament features have been identified as over or under represented within specific groups of children with a range of phenotypes. Research has identified that this may support future development of interventions, either by accounting for temperamental preferences in their delivery or by addressing the temperament features that cause challenges to learning and socialisation directly. This is an area for future research and development. Characteristic temperament profiles may exist in children with language impairments and this current study aims to add knowledge in this area.

2.10 Language and Temperament

Language delay, as a commonly occurring developmental challenge, has also attracted research interest in relation to potential insights and associations with temperament Having reviewed the literature relating to early language difficulties and temperament, the papers discussed in this section involve a particular consideration of relationships between these two areas. Although this arena is confounded by the variability in definitions and terminology used in both language and temperament research, I have sought to draw out specific dimensions of temperament that have been studied in relation to communication development and can also later be inspected in relation to the data generated in this research enquiry. Some authors have studied links between language and temperament using clusters of traits. These are included in Table 2.3 since they add to the body of current understanding about the links between language

and temperament, however where papers describe this approach it is not possible to disentangle the relative contributions of individual traits within a cluster and so I have not included these in consideration of unitary temperament dimensions.

It is worth mentioning that much of this literature has been published since I began this study in 2007 and was therefore not available to support and challenge my conceptualisation of the project's questions or design. This represents a growth of interest in the multifactorial and reciprocal influences on development in the past decade.

The papers span cohorts of children with both typically developing language and those where language concerns had been identified. The emphasis and motivation for some of this research has been to understand more about temperament and for others to understand aspects of language development in more depth. These differences in focus have influenced the designs with which temperament and language skills have been measured.

The research study described in this thesis used a questionnaire based on Chess and Thomas' (1996) nine dimensions of temperament and I have chosen to present the literature under labels used within this framework, though some studies involve consideration of multiple dimensions. Not all of these nine temperament traits have been considered individually in relation to language development or difficulty by researchers. For example, I was unable to find any papers relating to rhythmicity and language development and so of the nine dimensions, five which have attracted exploration into associations with language are considered here; adaptability, approach, distractibility, mood and persistence.

In Table 2.3 the breadth of contemporary language and temperament research is presented to contextualise this area both in terms of scope and methodologies employed which reflect underlying theoretical models of temperament. These are then drawn from to consider specific dimensions of temperament in relation to language, following Chess and Thomas' (1996) model of temperament.

Table 2.3 *Language and temperament research*

Language & Temperament Research	Design	Sample Characteristics			Language measure	Temperament Measure	Key conclusions
		Size	Age	Type			
Paul and Kellogg, 1997	Retrospective with control group *At 6yrs *N* divided: History of ELD (22) & ELD (6)	*N* =28* C =23	2;00 - 6;00	Language delay	LDS (Rescorla, 1989). Slow expressive language development < 50 words, control > 50 words	Temperament assessment battery for children (Martin 1988). Completed by parents and clinicians (after 2hr observation)	Children with a history of slow expressive language development were rated significantly lower on Approach/Withdrawal than controls. Approach/Withdrawal scores were significantly correlated with average sentence length in spontaneous speech at both ages and MLU also predicted Approach/Withdrawal scores in regression analyses.
Dixon and Smith, 2000	Longitudinal, within group correlational questionnaire	*N* =40	13-20 months		Communicative Development Inventory	Carey Temperament Scales [Infant Behavior Questionnaire, TTS] (McDevitt & Carey, 1978)	3 groups of temperament were constructed: Attentional control (persistence and distractibility), emotionality (approach, adaptability and mood) and 'other' (activity, intensity, threshold and rhythmicity). Advanced language production at 20 months predicted by greater adaptability, more positive mood and greater persistence at 13 months

							(Study 1). No association for 13 month approachability or distractibility.
Anderson, Pellowski, Conture and Kelly, 2003	Exploratory group design	*N* =31 C =31	3;00-5;04	Children who stutter + control group	Speech disfluency measure based on 300 words during parent child interaction	Behavioural Style Questionnaire (McDevitt and Carey, 1978) jointly completed by parents	Between group differences found that children who stutter were slower to adapt, less distractible and less regular in body rhythms. Discusses if temperament influences development of stammer, stammer influences temperament or, more likely, a reciprocal influence with temperament potentially having a role in maintaining stuttering
Spere, Schmidt, Theall-Honey and Martin-Chang, 2004	Extreme groups design – top and bottom 15% on shyness screen	*N* =22 C =22	4;02-4;11	Children identified as shy and non-shy from typically developing cohort	PPVT (Dunn & Dunn, 1997) & Test of Auditory Analysis Skills (TASS, Rosner 1979) [phonological manipulation requiring expressive response]	Colorado Childhood Temperament Inventory (Buss and Plomin, 1984)	PPVT: shy children scored close to age, whilst non-shy group exceeded age by 8.5 months. TASS: shy children scored significantly lower m =2.18 than non-shy m =4.09

Hauner, Shriberg, Kwiatkowski and Allen, 2005	Retrospective convenience sample	*N* = 29 C = 87	4;00 - 5;00	*N* =Speech delay with psychosocial involvement C = speech delay	Recorded speech /conversation samples. % consonants correct.	Observation from clinical records of negative mood, negative approach /withdrawal, persistence and attention	Speech delay with psychosocial involvement had more severe speech delay than matched comparison group. Temperament may mediate or maintain speech difficulties. Negative mood, low persistence and low attention are risk factors for increased severity of speech delay.
Coplan and Armer, 2005	Correlational convenience sample	*N* = 82	4;01 - 6;00 M= 4;11	Typically developing & in school	Expressive one-word picture vocabulary test-R (Gardener 1990)	Child Social Preference Scale (Coplan, Prakash, O'Neil and Armer,2004)	Shyness did not significantly correlate with expressive vocabulary production scores (*r* =-.08)
Dixon, Salley and Clements, 2006	Experimental: within group	*N* =39	21 months	Typically developing, not high risk	Novel word & non-verbal learning: typical/distraction conditions (cognitive, auditory, social)	Early Childhood Behaviour Questionnaire - attentional focussing	Children high in attentional focus are less affected by distractions in learning words than children low in attentional focus. High attentional focus protects against the adversity conferred by environmental distractions

Salley and Dixon, 2007	Observational	*N* =51	21 months	Typically developing, not high risk	MacArthur CDI:WS Early Social Communication Scales	Early Childhood Behaviour Questionnaire - attentional focussing	Joint attention did not correlate with vocabulary size. Inverse relationship between low executive control and high negative affect and language development. Fear, frustration, sadness and discomfort linked to poorer language development. High negative affect predicted lower joint attention.
Carson, Carson, Klee and Jackman-Brown, 2007	Cohort questionnaire correlational study	*N* =17 C =30	25-31 months	N=language delay C= Typically developing	Mullen Scales of Early Learning or the LDS Developmental Profile – 2 (academic & communication scales)	Temperament and Atypical Behaviour Scale (TABS)	Parents of children with language delay rated as less nurturing (less responsive/ stimulating to child, interact less). Use more punitive discipline children with slow language development more withdrawn, difficult to engage and less reactive
Zubrick, Taylor, Rice and Sleggers 2007	Epidemiological prospective observational study	*N* =1766 Typical = 1528, Lang	24 months	Community cohort	ASQ Bricker and Squires, 1999	DOTS-R; Windle, 1992) Parent completed [activity, approach, task orientation,	Relative to children without LLE, a significantly greater proportion of children with LLE had reported negative mood quality (31.3% vs. 23.7%).

		delay = 238				mood, flexibility, rhythmicity]	
Prior, Bavin, Cini, Reilly, Bretherton, Wake and Eadie 2008	Prospective longitudinal large cohort - questionnaire	*N*= 1760	12-24 months	Community cohort	CSBS MacArthur Bates CDI	Approach/withdrawal using Short Infant and Toddler Temperament Questionnaires	Girls were lower in approach (shyer) than boys. For CDI production, gender explained 2.8% of variation, shyness 0.32%
Westerlund and Lagerberg, 2008	Cohort questionnaire correlational study	*N* =1091	17-19 months	Typically developing	Swedish communication screen (based on CDI)	Bates, Freeland and Lounsbury 1979, difficultness scale	'Difficultness' not significantly related to better expressive language. High communication quality, lower maternal age, being female were significantly and independently associated with expressive vocabulary.
Noel, Peterson and Jesso, 2008	Correlational study	*N* =56, low SES mother-child	2;08-4;10	Typically developing	PPVT (Dunn and Dunn, 1997) and Expressive Vocabulary Test (Williams, 1997) Narrative prompts in play.	EAS (emotionality, activity, sociability) Temperament Survey for Children (Buss and Plomin, 1984)	Child sociability temperament is positively associated with increased narrative length and more connectives. High emotion linked to lower receptive vocabulary, shorter narratives and less description. Higher parent stress associated with lower receptive and expressive vocabulary.

Reynolds and Evans 2009	Experimental Matched groups	*N* =20 shy C =20 non-shy	Mean *N* =5;10, C =5;08 years	Typically Developing	Narrative elicited via 'Frog where are you?' (Mercer Mayer 1969) wordless book at home with parent	Child Behaviour Questionnaire (Rothbart, Ahadi, Hersey and Fisher 2001), Children's Shyness Scale (Spooner,2006)	Non-shy children spoke more words, used a greater variation of modifiers and had more complete utterances and used more dialogue. No significant difference in MLU, total number of utterances or frequency of modifiers
Spere, Evans, Hendry and Mansell, 2009	Experimental group design (home vs school conditions)	*N* =19 shy, 23 average, 25 non-shy	Mean: 4;08	Typically developing	Sentence Imitation Test of Language Development 3, Comprehensive Receptive & Expressive Vocabulary Test 2 Language sample: Wordless book	Colorado Childhood Temperament Inventory (Buss and Plomin, 1984)	Shy children spoke fewer utterances during the shared book task and this was the case for their parents. No significant differences were found on the receptive/expressive language tests for the three groups in the home vs school contexts.

Usai, Garello and Viterbori, 2009	Questionnaire based correlational study	*N* =106	28 months	Typically developing	Italian version of MacArthur CDI:WS completed by day-care staff	Questionari italiani del temperamento. [inhibition to novelty, activity, social orienting, emotionality & attention] completed by daycare staff	3 temperament profiles identified: inattentive (*n* =32), inhibited (*n* =23) and typical (*n* =51). Children with typical profile had the most developed language and least language risk characteristics (vocabulary <1.5*SD* below normative mean, no combinations, no morphology). Children with an inattentive profile had least developed language and highest risk score.
Spaulding, 2010	Matched groups, experiment	*N* =22 C =22	4;00 - 5;04	*N* =SLI C =typically developing	Test of Early Expressive Morphology, Structured Photographic Expressive Language Test (Preschool) & Test of Language Development	Inhibition task : children trained to press button corresponding to picture on hearing word, or to inhibit trained response on hearing a 'stop' command. Resistance to Distractor task (distractors irrelevant to task)	Children with SLI performed significantly less well on distractor and inhibition tasks, even when non-verbal cognition differences were controlled for.

Harrison and McLeod, 2010	Prospective longitudinal large cohort	*N* =4983	4;03 - 5;07	Community cohort	Receptive and expressive language skills via PEDS (Glascoe, 2000); Use of SLT services; APPVT (Rothman, 2003)	Short Temperament Scale for Children (Sanson et al. 1987) [sociability, persistence & reactivity]	Increased odds for expressive /receptive speech and language concern, APPVT low score and attendance at SLT were associated with having a more reactive temperament, reduced odds were conferred by increased persistence and sociability
Van Agt, Verhoeven, van den Brink and de Koning, 2011	Prospective cohort	*N* =3748	2 years, follow up at 8, 9 years	Community cohort	Parent: Language history questionnaire (problem/treatment) & CCC-2 (Bishop, 2003b) Teacher: educational progress measures, receptive vocabulary test	Dutch School Behaviour Checklist: Revised [extraversion, attitude to schoolwork, agreeableness & emotional stability] Health related quality of Life questionnaire	Language impairments persisting into school years have an impact on behaviour and daily life: lower scores on attitude to schoolwork and agreeableness.

Strand, Pula, Parks and Cerna, 2011	Longitudinal	*N* =340	4;04-4;08	English and Spanish speaking Head Start attendees	PPVT (Dunn and Dunn, 1997) & Developmental Continuum Assessment System: listening & speaking subscale (Dodge, Colker & Heroman 2002)	Shyness-anxiousness scale of Teacher-Child Rating Scale (Hightower 1986)	'Shyness-anxiousness impacts the development of receptive language, but receptive language does not impact shyness' p366
Prior, Bavin, Cini, Eadie and Reilly, 2011	Prospective longitudinal large cohort	LI =310 C =1249	4 years	Typically developing & language impaired groups	CELF-P	Australian Pre-school Temperament Scale (Prior, Sanson and Oberklaid,1989): [approach, persistence & difficultness]	Children with language impairment did not differ on sociability/shyness from the typically developing group but were poorer at self-regulation (persistence) and rated as more difficult than the control group.
Kubicek and Emde, 2012	Extreme groups, longitudinal design	*N* =77	15 & 30 months	Early and late talker groups	Parent: MacArthur CDI:WS	Toddler Behaviour Assessment Questionnaire (Goldsmith et al. 1987) [activity, social fearfulness, anger proneness,	Early talkers used more positive emotion and later talkers more negative emotion words. Later talkers were described by parents as less adaptable and more negative in mood at 15, 21 & 30

					Observation: language sample (MLU)	persistence, expression of pleasure] Observation: Lab–TAB (Goldsmith & Rothbart, 1996)	months but trends did not reach significance.
Garello, Viterbori and Usai 2012	Questionnaire based correlational study	*N* =109	24-30 months	Typically developing	Italian version of MacArthur CDI:WS completed by daycare staff First Language Test: receptive & expressive vocabulary & syntax	Questionari italiani del temperamento (Axia, 2002) [inhibition to novelty, activity, social orienting, emotionality & attention] completed by daycare staff.	3 temperament profiles identified: inattentive (*n* =30), inhibited (*n* =28) and typical (*n* =45). Children with typical profile had the most developed vocabulary Children with an inattentive /inhibited profile had lower vocabulary and higher risk scores for language delay than 'typical' children. Inattentive children had the least developed language. Extends/ confirms 2009 study
Henrichs et al. 2012	Prospective longitudinal large cohort	*N* =5497	18 and 36 months	Typically developing	Dutch version of MacArthur CDI:WS completed by mothers at 18	Child Behaviour Checklist (Achenbach and Rescorla, 2000) by mothers at 18 months	Expressive vocabulary delay (below 85th centile) at 18 months was weakly associated with internalising problems at 18 months and internalising/externalising problem

	(questionnaire correlational)				months & LDS at 30 months	and both parents at 36 months	scores at 36 months for boys alone. Continuing expressive vocabulary delay predicted highest risk of mother reported problems at 36 months.
Leve, DeGarmo, Bridgett, Neiderhiser, Shaw, Harold, Natsuaki and Reiss, 2013.	Prospective longitudinal cohort	361 toddlers adopted at birth.	9, 18 & 27 months	Typically developing	LDS (Rescorla, 1989).	T1: Distress to Limitations subscale of the Infant Behavior Questionnaire (Rothbart, 1981), T2&3: Anger Proneness subscale of the Toddler Behavior Assessment Questionnaire (Goldsmith, 1996).	Structural equation modeling showed that prenatal risk on toddler effortful attention at age 27 months was not significant once genetic influences were considered. Genetic influences had unique effects on toddler effortful attention. Latent growth modeling showed that increases in toddler negative emotionality from 9 to 27 months were associated with poorer delay of gratification and poorer language development.
Smith Watts, Patel, Corley, Friedman, Hewitt, Robinson and Rhee, 2014	Prospective longitudinal correlational twin study – home and 'lab'	*N* =816	14, 20 & 24 months	Typically developing	Sequenced Inventory of Communication Development (Hedrick, Prather and Tobin, 1975)	Shyness: observation with category coding in laboratory. Parent report from: Colorado Childhood Temperament Inventory (shyness	Behavioural inhibition (shyness) was not predictive of receptive language skills but *was* predictive of expressive skills.

						scale)(Rowe and Plomin 1977) TTS (approach sub-scale) (Carey and McDevitt, 1978), Differential Emotions Scale (fearfulness subscale) (Izard, Dougherty, Bloxom and Kotsch, 1974).	
McNally & Quigley 2014	Prospective longitudinal large cohort	*N* =11134	9 months	Representative national sample	Communication subscale of ASQ	Fussy/difficult scale of Infant Characteristics Questionnaire (Bates et al. 1979)	A more difficult temperament, being male, low birth weight and perinatal ill health significantly increased the risk of failing the ASQ
Laake and Bridgett, 2014	Longitudinal, correlational within group	*N* =83	10, 14 months	Typically developing	Bayley Scales ; 3rd edition – language section	Infant Behaviour Questionnaire, Revised (Garstein and Rothbart, 2003) [activity, high intensity pleasure, perceptual sensitivity, smiling/laughter, vocal	Positive affect at 10months predicted expressive β=.30, t-2.24, *p* =.020 but not receptive language.

						reactivity and approach]	
Christensen, Zubrick, Lawrence, Mitrou and Taylor, 2014	Longitudinal , correlational	*N* =3847	4 and 8 years	National sample	Adapted Peabody Picture Vocabulary Test-III (PPVT-lll) Rothman, (2003)	Short Temperament Scale for Children (STSC): [persistence, reactivity and sociability]. Sanson, Prior, Oberklaid, Garino and Sewell (1987).	Receptive vocabulary delay at 8 years was substantially predicted by low receptive vocabulary at 4 years, low maternal education, and low school readiness. Moderate risks were low maternal parenting consistency, socio-economic area disadvantage, low temperamental persistence, and non-english speaking background status.

2.10.1 Adaptability

The essential component of adaptability, for Chess and Thomas (1996), lies in the ease or difficulty with which a person copes with changes in environment whether arising from physical differences or social rules. Anderson et al. (2003) used an exploratory group design to investigate if there were temperamental differences, as reported by parents, between children who stutter (CWS) and matched peers who do not stutter (CWNS). Additionally time since the onset of the stutter was ascertained to test out if the experience of stuttering was affecting reported temperament characteristics within the group. Thirty-one children aged between 3;00 and 5;04 (mean age = 4;05) were recruited into each group via advertisements placed in a free parent magazine or referral from professionals. The groups were matched in respect of age, gender, socioeconomic status and ethnicity. The BSQ (McDevitt and Carey, 1978) was jointly completed by parents in their homes who were asked to provide a consensus rating (95%), or completed by the parent who lived with the child (5%). The authors identify this as a strength of the design but I think this is rather complicated since inter-parental agreement is typically found to be modest (Rothbart and Bates, 1998; Wachs, 1999) and it is unclear how the style of each parent within their relationship may have contributed to their consensus response. Significant differences were found between the groups for adaptability ($F(1, 60) = 6.14$, $p = .016$) with 26% of the CWS group scoring 1*SD* or more above the mean, reflecting that they were slow to adapt their behaviour in response to changes in their environment or routines in comparison to 13% of the CWNS group. No effect relating to time since onset of the stutter was found, suggesting that their temperament profile predated the onset of stuttering for these children. The authors state that being slow to adapt may be a causal factor in the

development and maintenance of stuttering in young children. They argue that being slower to adapt to new situations is likely to make them more reserved and cautious, thus making it more difficult or stressful to make new friends or settle into new environments such as nursery. In turn, this may reduce their interactions in such settings as they prefer to maintain their current behaviours and routines. They conclude:

> 'Such responses might result in less frequent communication, which, in turn, may lead to fewer opportunities for communicative practice, feedback and development.' P. 1230

The authors call for further research into the ways in which communication development may interact with a child's temperament. However, currently, I have been unable to find published research that has tested out the utility of these potential causal pathways to dysfluent speech and indeed they may be difficult to validate.

In an extreme groups (early and late talker) longitudinal design, Kubicek and Emde (2012) followed seventy-seven typically developing first born children from 15-30 months of age. A mixture of both home and laboratory visits were conducted every 3 months, using the Toddler Behaviour Assessment Questionnaire (Goldsmith, 1987) which identifies activity, social fearfulness, anger proneness, persistence and expression of pleasure as temperament variables. Questionnaire data was complemented by observational data collected using the structured Lab–TAB (Goldsmith and Rothbart, 1996) standardised temperament tool (see Kubicek and Emde, 2012 for a full description of the tool). Information about the children's language development was accessed using the CDI:WS and a language sample to

calculate mean length of utterance (MLU). The results revealed that the early talkers used more positive emotion words in their expressive language and later talkers more negative emotion words. Later talkers were described by parents as both less adaptable and more negative in mood at three of the time points (15, 21 and 30 months) though these trends did not reach statistical significance. However, the authors stress that such temperament features may influence their early relationships in ways that shape the developmental context in which they grow and learn. They propose a similar causal chain to Anderson et al. (2003) where temperament traits have an impact on the people and opportunities for communication development of the child at an individual level and that this may lead to group trends in developmental status, in this case communication development.

This suggests that further research is indicated to explore both single temperament dimensions and ways in which these cluster together and influence developmental trajectories. Such multifactorial studies would need detailed data collection and large sample sizes so that effects are more likely to be signalled and can be contextualised appropriately. Kubicek and Emde (2012) and Anderson et al.'s (2003) studies have investigated links between temperament dimensions and differing aspects of communication, in different populations. Kubicek and Emde (2012) found non-significant trends in non-adaptability for late talkers who at the start of the study represented the lower bounds of typical language development. It cannot be known whether such trends would be significant in children with identified ELD. Similarly, Anderson et al.'s (2003) children had attracted clinical concern for their stutter but not

for delayed language development. This study will look at adaptability in children with identified ELD at two points of data collection.

2.10.2 Approach

The dimension of approach is closely linked in temperament to the more familiar concept of shyness. Shyness has a large component of approach but is a concept that primarily relates to people, whereas approach encompasses responses to situations and objects as well as social approach. As a composite measure, shyness is likely also to involve aspects of low adaptability i.e. slow response to new social situations and activities. Shyness has attracted a degree of research interest and papers in this section relate to both (low) approach and shyness.

A study by Paul and Kellogg (1997) was one of the first papers to report on the temperaments of children with a history of ELD. This longitudinal study reported on a group of twenty-eight children who had been identified as having an expressive language delay at two years of age. A matched control group of twenty-three children was also recruited. The children were followed up annually for language development measures. At six years of age, temperament data for these children was collected using the Temperament Assessment Battery for Children (Martin, 1988) and expressive language data using Developmental Sentence Scores (Lee, 1974). The children with ELD were then assigned to either an ongoing (chronic) expressive language difficulty group (ELD, n=6) or a history of ELD group (HELD, n=22). All the control group continued to meet the language criteria for no expressive delay (NL, N =23).

Children with a history of slow expressive language development were rated significantly lower on approach by clinician ratings and this dimension also approached significance on parental ratings. The ELD group did not show significant differences and the authors acknowledge that it is difficult to draw any confident conclusion due to the very small group size of six children. The authors comment that the scores were very similar to those given for the HELD group. Furthermore, approach scores were significantly correlated with average sentence length in spontaneous speech at ages four and six, and MLU was predictive of approach/withdrawal scores in regression analyses.

The authors conclude that having low approach may result in lower motivation to communicate with others and that this may lead to a slowing of their language growth in combination with other factors that influence language development. They argue that ELD represents a developmental lag reinforced and maintained by a tendency towards withdrawal and consequently reduced motivation for communication.

Spere et al. (2004) investigated both the receptive and expressive language skills of typically developing shy four year olds in Canada. Shyness was assessed using the Colorado Childhood Temperament Inventory (Buss and Plomin, 1984) completed by parents whilst receptive language was measured with the PPVT (Dunn and Dunn, 1997) and expressive skills using the Test of Auditory Analysis Skills (Rosner, 1979) which taps phonological manipulation skills and requires an expressive response from the child but is not conversational. I view the inclusion of receptive language abilities as a strength of this study, though only receptive vocabulary was measured rather than a more global measure of receptive language. Using an extreme groups design twenty-

two children scoring in the top and bottom 15% were allocated to shy and non-shy groups, each being matched for gender and school experience. Results for receptive vocabulary, using a two way ANOVA showed that shy children had significantly lower scores than their non-shy peers whilst gender was not significant. Further analysis of the scores was undertaken to compare them to standardised age norms and found that the shy children, although having lower scores, were performing within their expected age level (mean difference 0.27 months). In contrast, the non-shy group performed above age level (mean difference 8.50 months). Results for expressive skills followed the same pattern with shy children having significantly lower scores (m =2.18) than the non-shy children (m =4.09).

Discussing their results, Spere et al. (2004) emphasise that it was the non-shy group who performed differently from the standardised norms, and they suggested that the children's high approach behavioural style may have conferred an advantage on them in respect of language development, possibly through operation of the same causal mechanism in reverse, as that proposed by Paul and Kellogg (1997) for children with ELD.

These subclinical differences in assessed receptive and expressive language between the groups are interesting, though they need to be interpreted with caution due to the small sample size, single time point of data collection and narrow subset of language skills measured.

Spere et al (2009) and Reynolds and Evans (2009) followed up Spere et al.'s (2004) findings in two studies which drew participants from the same longitudinal study. It is unclear whether some of the children participated in both studies, either in the

experimental or control groups. Spere et al. (2009) sought to test out if children with low approach had an enhanced language performance at home with their parents, in comparison to their school environment. A battery of receptive and expressive language tests was used with nineteen shy, twenty-three mid-range and twenty-five non-shy typically developing children (m = 4;08 years). The results did not show any home/school context effect across the three groups, though there was a trend such that shy children spoke the least and non-shy children the most on all tasks. In a similar way, parents of shy children spoke the fewest utterances and parents of non-shy children the most. They conclude that there were minimal differences in the language of shy versus non-shy children, although a trend of increased language performance alongside increased approach characteristics was identified. The hypothesis that shy children would have poorer language skills was not supported by the data. Further, the hypothesis that data collection at home, particularly for the shy children would yield better language scores was not borne out.

Drawn from the same longitudinal cohort, Reynolds and Evans' (2009) conducted a qualitative investigation of the narratives of shy (*N* =20, 5;10) and non-shy children (*N* =20, 5;08). Results revealed that shy children spoke less, used less dialogue within their narratives and used fewer modifiers. These features resulted in less linguistically developed narratives in the shy group. Analysis of the scaffolding strategies employed by parents did not differ across the two groups. Reynolds and Evan's concluded that facilitation style did not account for the differences found.

In contrast to Spere et al.'s (2004) and Reynolds and Evans' (2009) findings, shyness did not significantly correlate with expressive vocabulary production scores (r =-.08) in

Coplan and Armer's (2005) study of young children (*N* =82, m =4;11). However, expressive vocabulary was positively and significantly related to their teachers' ratings of pro-social behaviour at the end of the preschool year ($r = .28$, $p < .010$) using the Child Behaviour Scale (Ladd and Profilet, 1996) which assesses children's social adjustment with their classmate peers. The authors postulate that pro-social behaviour may benefit expressive vocabulary or that expressive vocabulary may support pro-social development. However, correlational design is not able to identify the direction of these possible pathways.

Prior et al. (2008) as part of the large ELVS prospective longitudinal cohort study, reported on early relationships between temperament and language development from data gathered at twelve and twenty-four months of age (*N* =1760). Language data was gathered using the CSBS (Wetherby and Prizant, 2002) and the MacArthur Bates CDI. Vocabulary production, reported by parents, was the defined outcome measure. Shy temperament was measured using the approach/withdrawal scale of the Short Infant and Toddler Temperament Questionnaires (Prior, Sanson and Oberklaid, 1989). An extreme groups comparison using the top (shy) and bottom (outgoing) quartiles on the approach/withdrawal scale was used to test the hypothesis that low approach would be associated with expressive vocabulary. The group higher in sociability had significantly higher language scores on both the CSBS ($p < .001$) and CDI ($p < .006$). The cause of this relationship is not ascertainable from the correlational design of the study. Regression analyses found that a composite model of gender, shy temperament and mother's relationship satisfaction explained 5% of the variance in expressive outcomes, with shyness adding a modest 0.32% ($p < .003$) to the model.

Being a girl explained the majority of the variance (2.8%). Harrison and McLeod (2010), investigating risk and protective factors for language delay in this same large cohort, reported that decreased odds for low score on the Adapted PPVT-III was conferred by higher scores on the sociability dimension of their temperament measure (OR =0.87, CI[0.81, 0.93]). This finding did not however hold for expressive/receptive speech and language concern, or for attendance at SLT services.

Further data collection, when this same cohort were four years of age (Prior et al., 2011), sought to identify differences in temperament between children with identified language impairment (LI =310) and peers with typical language development (C =1249). Language impairment was identified using the CELF-P2 (Semel et al., 2006) with a cut off for LI defined as more than -1.25*SD* on an overall receptive and expressive language composite score. The Australian Pre-school Temperament Scale (Prior et al., 1989) was used to assess temperament dimensions of approach, persistence and difficultness. Contrary to their earlier cohort data, children with language impairment did not differ on approach from the typically developing group (t = -0.99). The language impaired children were, however, less persistent (t= -2.19) and rated as more difficult (t = -5.38) than the control group. This finding of non-significant approach differences is interesting, since approach is one of the most consistently reported findings correlated with poorer language outcomes. Further research is indicated in order to investigate if there is perhaps a sensitive age period for this finding or whether it holds for approach within typically developing children but not for those with ELD or language impairment. Following from this, it occurs to me that an underlying process that could be operating is that once a child has had a language

difficulty identified, parent report of the child's temperament undergoes some subtle recalibration, as a part of accepting the child's differences. Consequently, parents may rate their child compensating for those difficulties e.g. 'he is very sociable, *considering* he can't talk very well'.

In summary, the literature is approaching consensus on the nature of the relationship between language development and approach, there is increasing evidence that children lower in approach perform less well than matched peers on expressive language tasks, whilst remaining within expected limits for language development (Prior et al., 2008; Spere et al., 2009; Reynolds and Evans, 2009). This same effect has not been replicated in respect of receptive language skills, or for children with identified language impairment (Harrison and McLeod, 2010) who show similar profiles of approach to age matched peers. A recent paper by Smith Watts et al., 2014 is unique in utilising a prospective longitudinal correlational design to investigate receptive and expressive language development and behavioural inhibition in same sex twins (*N* =816) at three time points (14, 20 and 24 months), and across two locations (home and laboratory). Latent growth curve modelling was used to explore individual variation and change over ten months at an individual level. This age is a point in development where language acquisition is in a rapid growth phase. Their analysis supported findings of other researchers that receptive language development is not impacted by a child being low in approach, however expressive language development was affected by having a low approach or high approach temperament, with shyer children having less developed expressive language skills.

The authors concluded that,

> ‘Behavioural inhibition does not inhibit language acquisition, but that behaviourally inhibited children may be helped by greater attention to support developing their expressive verbal abilities’ p15

There is still much to learn in this area and research that looks at different domains within expressive language to ascertain whether any specifically benefit or lag behind in the context of children’s approach levels would bring greater insights into the mechanisms of language learning and communication drivers and desires of young children. Programmes of research may need to use a variety of methodological approaches in this endeavour. For example, observational studies, using video footage, with raters blinded to the child’s language status may allow a different perspective to the use of questionnaires, whilst in-depth interviews would reveal insights into the interplay of language and temperament as they are expressed in children.

This study aims to add to knowledge about approach levels and language progress in a clinically defined population of children with ELD.

2.10.3 Distractibility/Attention

The concept of distractibility refers to the individual’s ability to maintain attention to either a self-chosen or directed focus, in the context of competing stimuli. As such, it is a component that develops throughout childhood, as well as showing wide individual variation (Ruff and Capozzoli, 2003). The concept is closely linked to aspects of attention and executive control. The distractibility dimension was investigated by Dixon and Smith (2000), to see if it was implicated in language acquisition. The

mothers of a cohort of forty children completed the TTS when the children were 13 months old and again at 20 months. The CDI (Fenson et al., 1993) was completed when the children were 20 months. Analysis revealed that advanced language production at 20 months was correlated with greater adaptability, more positive mood and greater persistence at 13 months (Study 1). However, there was no association between language production at 20 months and 13 month distractibility. This null finding was unexpected since accounts of language development include the role of positive attentional control in supporting language acquisition (Bloom, 1993; Tomasello and Farrar, 1986). The sample was relatively small (*N* =40) and this may have in part accounted for the lack of relationship found in this study. Dixon, Salley and Clements (2006) conducted further research to specifically look at the contribution of attention control to word and non-word learning in typically developing low risk 21 month old children (*N* =39). The children's temperament was measured via the Early Childhood Behaviour Questionnaire (ECBQ, Putnam, Garstein and Rothbart, 2006) though the authors do not make clear in their report whether this was completed jointly by parents or by mother or father. The cohort were split into two groups: low (*n* =19) and high (*n* =20) attentional focus based on responses to the ECBQ.

A novel word learning and non-verbal learning protocol was administered in a laboratory setting to the children. The protocol included 'typical' (baseline) and distraction conditions. Cognitive distraction involved adding an extra object to the task. There were two variants of the social distraction condition; A: an unfamiliar woman entered the room, smiled and looked at the child but did not speak. In contrast in the auditory *and* social distraction condition, B: an unknown woman entered the

room, greeted the child by name and then read a book out loud in a language unfamiliar to the child.

Finally, in the mechanical distraction condition, a noisy toy (Mr Monkey who bobbed his head up and down and clashed his cymbals) situated on top of a cupboard in the child's sight, was activated during the trial. Results revealed that children who were identified on the ECBQ as high in attentional focus were less affected by distractions in learning words than children low in attentional focus. Children low in attentional focus were most affected by social distraction conditions (p =.008). The authors concluded that high attentional focus served as a protective factor against the adversity conferred by environmental distractions when children are learning new words.

Some research enquiry has investigated distractibility in children with identified speech, language and communication difficulties. Anderson et al. (2003) in their study of temperament differences in young children who stutter (CWS) and children who do not stutter (CWNS), found differences between the two groups such that children who stuttered were less distractible than children who did not. Anderson et al. (2003) propose that this is consistent with the children being low in adaptability (see section 2.10.1) and hypothesise that they are less likely to be distracted from tasks they are involved in since they prefer routine to change. This is a thought-provoking hypothesis, which would be interesting to test out. For example, identifying whether familiarity with both a task and distractors from it cause variation in the expression of distractibility could allow insight into sub categories of this broad concept.

Spaulding (2010) investigated differences in the ability to ignore distractions in a group of young children (age 4;00-5;04 years) with SLI (N =22) and a typical language control

group (*N* =22), matched for age, gender and socioeconomic status. A computer task sought to minimise linguistic, memory and attentional demands so that distraction effects were the prime measure. Outcome effects were expected to be longer response times and a decrease in accuracy in distractor trials compared to non-distractor trials.

The children were required to press a button to feed a cow ice cream when they heard the cow ask for ice-cream but to not press if the cow asked for pizza. Following practice, the children completed ninety trials. Half of the trials had distractors of either environmental sounds, visual or linguistic type. Children with SLI performed significantly less well on the distractor trials. This was in contrast to the non-distractor trials where the two groups performed at a similar level. Further, these differences remained even when non-verbal cognition differences were controlled for. In conclusion, these results suggest that young children do find it more difficult to achieve a task in the context of a range of irrelevant stimuli and that where children have identified SLI, these effects are significantly enhanced. However, the authors do not address the children's responses to distraction from a *temperament* framework and it occurs to me that it would be interesting to investigate other aspects of temperament which may account for the children's performance, for example adaptability and approach. Further research looking at profiles of temperament in children with language impairment are needed to establish a broader perspective of distractibility and the role it may play in causation and maintenance of language difficulties for these children.

The ability to focus one's attention in order to process stimuli relevant to the task, and exclude those that are not, is a key skill underpinning successful completion of everyday tasks and it is likely that the requirement for this type attention varies. The research papers presented here represent attempts to understand the ways in which levels of distractibility, within a temperament framework (rather than a cognitive or neuro psychological framework), may be influential in supporting a child's developing language. This work is at an early stage and does not fit easily with either experimental methods, which are too narrow and confounded by young children's responses to test situations, or observational methods that describe but cannot explain. Further larger scale profiling of distractibility in young children across childhood would allow more accurate baselines and trends to be seen prior to work investigating differences in distractibility in special populations.

2.10.4 Mood

Mood refers to the general balance of seeming happy or unhappy. Children's disposition, in relation to having positive or negative mood, has been associated with language development outcomes (Karrass and Braungart-Rieker, 2003; 2004). Rieser-Danner (2003) conjectured two potential routes through which high negative mood may influence language development. Firstly, that a temperament high in negative mood may effectively limit available resources for information processing during language learning opportunities, since a high burden is placed on the child's behavioural control systems in order to regulate this negative affect. Alternatively, negative affect may influence the interpersonal relationships through which language

acquisition is promoted, such that these may have a tone that leads to less language learning opportunity, either in frequency or quality.

Salley and Dixon (2007) conducted a study with a group of 51 typically developing children who were 21 months old. The study aimed to explore whether links between temperament and language could be explained by joint attention skills. Joint attention skills refer to the non-verbal coordination of attention by two communication partners, towards specific objects or events (Mundy et al., 2007). It is initiated by one partner, who looks at an object and then back and forth between the communication partner and the object. The other partner responds by turning their gaze to the object referenced by the initiating partner so that mutual sharing of the object/event is accomplished. These behaviours provide a secure early environment to establish language learning opportunities (Vaughan Van Hecke et al., 2012). Salley and Dixon (2007) used a questionnaire design to gather data about the temperament of fifty-one children, in particular their attentional focussing, using the Early Childhood Behaviour Questionnaire (Putnam et al., 2006). The CDI:WS (Fenson et al., 1993) was used to collect information about the children's language development from parents and an adapted version of the Early Social Communication Scales, involving a book task and an 'attractive toy' task was then used in a laboratory based session with the child sitting on the parent's knee and an unfamiliar experimenter. Results from the analysis of the videotape found that joint attention did not correlate with the children's vocabulary size. Whilst correlations were found between temperament and language, these were not found to be mediated by joint attention. Mood however was found to correlate both with joint attention and language development. Negative mood, including

discomfort, fear, frustration and sadness was associated with poorer language development whilst children higher in positive mood (pleasure, smiling) displayed better language ability in the study.

Negative mood was inversely correlated with language skills, in particular, frustration showed significant modest negative correlations ($p < .050$) across language measures including total vocabulary, morphology and mean length of utterance.

This study foregrounds the complexity of relationships between different developing systems in young children. Systems which may be expected to work supportively with each other, such as joint attention and language, may do so only for specific periods of time perhaps in a similar way to that described by Rice et al. (2014) (see section 2.7.1.1), something which could not be captured in a study with only one time point of measurement.

Further investigation of links between mood and language would be useful, especially if conducted in a longitudinal way with larger samples and recruiting children with positive, typical and negative mood to ascertain if these features show stability across time and their impact on language across time.

Zubrick et al. (2007) in contrast used a large scale epidemiological study to investigate relationships between a wide range of maternal, family and child characteristics and language development. The children (mean age = 24 months) were allocated to typical language development (*N* =1528) and LLE (*N* =238) groups based on a cut off score of -1*SD* below the mean on the ASQ (Bricker & Squires, 1999), resulting in a cohort prevalence of language delay of 13.4%. The DOTS-R (Windle, 1992) questionnaire, completed by mothers, gathered data on activity, approach, flexibility, mood,

rhythmicity and task orientation. Relative to children without LLE, analysis of the data set showed that a significantly greater proportion of children with LLE had reported negative mood quality (31.3% vs. 23.7%, $\chi^2(1) = 3.44$. $p < .050$). However when all child, family and maternal factors were entered into a logistic regression model, negative mood did not contribute to the prediction of LLE. This suggests that although negative mood occurred more frequently in this group of children growing up in Western Australia relative to their peers without LLE, it did not predict language outcomes and the cause of its greater frequency was not established. Future follow up of this large cohort may allow a clearer view of the contribution of negative mood over a longer time period which may begin to establish if mood changes as language skills change.

Kubicek and Emde, (2012) pursued a different approach, using an extreme groups design (early (*n*=39) vs late (*n*=38) talkers), to test out Rieser-Danner's (2003) hypothesis that children high in mood, either positive or negative, are required to allocate resources to regulating their mood and thus have less resource available for language learning. Data were gathered at three monthly time points when the children were 15-30 months of age (six times) in their own homes. Data collection included language information using CDI:WS completed by parents, language samples collected during free play at home to calculate mean length of utterance (MLU). Additional laboratory visits took place at 15, 21 and 30 months to assess the children's responses to positive and negative emotion-eliciting situations (see Kubicek and Emde, 2012, for a description of the Lab–TAB protocol). Finally developmental assessment home visits, using the Bayley Scales of Development were completed at 15 and 30 months. Temperament was ascertained using the Toddler Behaviour Assessment Questionnaire

(Goldsmith, 1987) which included dimensions of activity, social fearfulness, anger proneness, persistence and expression of pleasure.

The combination of home versus laboratory based assessments and multiple measurement points gave this study rich, in-depth information about the participants' language, temperament and developmental status. However, it is noteworthy that despite the use of an extreme groups design, based on expressive language at 13 months, all the children by 30 months were performing within expected ranges for their age on language skills and so conclusions cannot be drawn about children with ELD from Kubicek and Emde's (2012) data.

Kubicek and Emde's (2012) data revealed that earlier talkers used more positive emotion and later talkers more negative emotion words. Additionally, later talkers were described by parents as less adaptable and more negative in their mood at all three time points that temperament data were collected (15, 21 and 30 months) but these trends did not reach significance.

Support for negative mood being associated with less well developed language were confirmed by Leve et al. (2013). Their prospective longitudinal cohort study drew data from 361 typically developing toddlers adopted at birth across three time points (9, 18 and 27 months). Parents completed the LDS to give information about the child's expressive vocabulary and for temperament the Distress to Limitations subscale of the Infant Behavior Questionnaire (Rothbart, 1981) at 9 months. At 18 and 27 months the Anger Proneness subscale of the Toddler Behavior Assessment Questionnaire (Goldsmith, 1996) was used. Latent growth modeling showed that increases in toddler

negative emotionality from 9 - 27 months were associated with poorer language development ($p < .050$).

In summary, there is some modest support from the literature that negative mood is associated with less well developed language skills in very young children. There is insufficient direction from the literature however to reach any firm conclusions from this, or for either Rieser-Danner's (2003) attentional resource or reduction in language enhancing relationships hypotheses to be confirmed. Further research will be important in establishing any effects more robustly especially in children with identified ELDs.

2.10.5 Persistence

The ability to continue to complete an activity or goal is the essence of persistence. A relationship between levels of persistence and language outcomes has been identified in large prospective population based community cohort studies in Australia, under the auspices of the Australian Institute of Family Studies (LSAC and the Australian Temperament Project) and the Murdoch Children's Research Institute (the ELVS). Findings reported by Prior et al (2011) identified that children with language impairment (N =310) were lower in persistence (p <.001, Cohen's d -0.38) and rated as more difficult (p <.001, Cohen's d -0.43) than their peers with typical language development (N =1249), at four years of age.

Whilst these findings cannot suggest a mechanism for this association, the authors contend that low persistence identifies these children as poorer at self-regulation,

which is a skill needed for learning in school. They argue that as such low-persistence confers a disadvantage and is likely to be unsupportive to language progress.

Harrison and McLeod (2010) reported on risk and protective factors for the children involved in LSAC as they reached between four and five years old. Data on the children's receptive and expressive language skills were collected via the PEDS (Glascoe, 2000), administration of the Adapted PPVT-III (APPVT, Rothman, 2003) and questions about the child's use of SLT services in the previous year. Reduced odds for expressive/receptive speech and language concern, APPVT low score and attendance at SLT were conferred by increased persistence. This effect was modest but consistent across all the measures [ORs 0.54 - 0.82] suggesting that persistence is supportive of children's language development. A more recent study by Christiansen, Zubrick, Lawrence, Mitrou & Taylor (2014) also using data from the LSAC (*N* =3847*)* investigated receptive vocabulary skills, measured using the Adapted PPVT (Rothman, 2003) when the children were 4 and 8 years old. Twenty-nine risk variables relating to child family and environmental factors, measured at 4 years, which may have been associated with poor outcomes at 8 years, were entered into a logistic regression analysis to calculate odds ratios for the included variables. Among the factors included in the analysis were the same persistence, reactivity and sociability measures derived from the Short Temperament Scale for Children (STSC) (Sanson et al., 1987). Many of the variables individually increased the odds of being in the low APPVT group (scoring below the 15th percentile). The variables associated with the largest risk of poor outcome at 8 years were low APPVT score at 4 years (OR: 5.32), the child not being read to at home (OR: 4.86) and low family income (OR: 4.15). Being low in persistence (OR: 2.75), having

high temperamental reactivity (OR: 1.75), and having low temperamental sociability (OR: 1.77) all increased the risk of low receptive vocabulary score, but again at only modest levels. Nevertheless, these data add further support to the far reaching effects of temperament in shaping children's developmental outcomes.

Conture et al. (2013) in a review of temperament and its connections to speech and language, urge researchers to advance understanding of the ways in which temperament relates to both typical and atypical development of speech and language skills. They identify investigations that are longitudinal as potentially having capacity to tease out where language and temperament variables act as mediators or moderators in the development of the other.

2.10.6 Summary

Candidate temperament variables from the current literature that may be associated with language development involve approach, adaptability, distractibility, mood and persistence. Currently, research reports are characterised by mixed support for findings across studies and no clear consensus about any language temperament links. In some cases, the dimensions identified as linking to language skills have not been specifically defined in research reports and without knowledge of the type of questions or observations made it is difficult to build knowledge across papers which have used differing conceptual frameworks and measurement tools for temperament in an appropriately considered way.

2.11 Rationale for this study

There is much still to learn about how temperament may support or challenge the child's developing language. Deepening understanding in this area may illuminate the role of temperament in children's development.

The study presented here intends to make an additional contribution to understanding the links between language development and temperament. It reflects Conture et al.'s (2013) call for longitudinal studies by collecting data at two time points one year apart. Further, it considers both expressive and receptive language skills and has collected data in an ecologically appropriate way in the children's own homes after they had spent time playing with me in an effort to reduce the demands of testing on young children. It will address gaps in knowledge about the links between temperament and the development of receptive and expressive language skills over a period of one year. In particular, it will report on the stability and change in temperament and language skills over this time period.

This arena of interest gave rise to the following study aims:

2.11.1 Aims for the study

1. To describe the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two time points, 12 months apart
2. To describe the temperament characteristics of a group of pre-school children accepted on to the caseload of community SLT services.

3. To describe the temperament characteristics of the parents of the cohort.
4. To investigate relationships between the temperament dimensions, which differ from normative expectations, auditory comprehension performance, expressive communication performance, and temperament variables associated with language differences from the literature.
5. To investigate relationships between cohort auditory comprehension and expressive communication outcomes and parent ratings of child manageability.
6. To investigate relationships between biographical and demographic variables, alongside any previously identified predictors of cohort auditory comprehension and expressive communication outcomes.

Chapter 3 Methodology

3.1 Introduction

This chapter details, discusses and critiques the overall research design employed in the study. My research philosophy is presented and its relationship to the methods of data generation, the form of data that were sought and the ways in which these were 'transformed' into knowledge through analysis is presented.

3.2 Design

A quantitative repeated measures design was used to gather data to fulfil the research aims as presented in section 2.10.7.

The study was essentially exploratory. It sought to gain insight into potentially relevant aspects of temperament in relation to progress for children with language delay. With conflicting reports in the literature about the presence or nature of associations between language and temperament, there was no mandate for the development of directional hypotheses. Thus, an exploratory design allowed broad research questions to be framed. I set this study within a post-positivist paradigm, consistent with using a quantitative methodology.

The study was designed within this tradition to further explore an idea generated from previous research I was involved in. This previous qualitative research developed grounded theory (Glaser and Strauss, 1999) in relation to parents' beliefs about the causes of their young children's delayed language development (Marshall et al., 2008).

The current study takes a step further in exploring the parents' expressed belief that their child's personality influenced the trajectory of acquiring developmental language milestones and offered an explanation for their language delay.

Primarily quantitative data was generated from a purposive sample (Kelley et al., 2003) of children with identified ELD whose parents accepted an invitation into the study. Data were obtained through the use of standardised questionnaires and standardised language assessment during home visits to parent/child dyads. These measures were repeated after a twelve month period. All the participants lived in the same geographical region and attended SLT services at entry to the study. Preliminary analysis of the data for each individual began concurrently with the data collection phase of the study, so that each participant could receive feedback about the information yielded from their data. Some biographical and demographic information was collected, providing a context for the participant sample and risk factors for language delay. Data were analysed quantitatively to provide descriptions of the cohorts' characteristics and investigate relationship patterns between language and temperament data.

3.3 Research Philosophy

Shih (1998) identified four areas for consideration when deciding on a research design: the philosophical paradigm to be used, the nature of the phenomenon of interest, the nature of the research questions, and the practical considerations related to the research environment and the efficient use of resources. As a practitioner-academic-

researcher I believe that research is a fundamental approach to interrogating and developing theoretical understanding and clinical practice. It involves challenging the assumptions upon which current knowledge and practice are founded, allowing the possibility of new understandings and insights to emerge be tested and take their place within the traditions of the profession of SLT.

The way in which research is conducted has a direct relationship with the underpinning views of the researcher in relation to what knowledge is, how it is gained and thus the appropriate tools to employ in discovery (Punch, 2005). My personal philosophy is integral with the research philosophy underpinning this inquiry. My study was framed by the philosophical paradigm of post-positivism. Congruent with this paradigm, I believe that knowledge is never complete, it is socially derived and constructed from what people within a particular society or culture notice and then use in distinctive ways. Knowledge is not absolute but always open to development, refinement and reinterpretation in the light of new information, perceptions, interest. Furthermore, the knowledge we (as a society) have constructed is not more than a 'current best guide' since its expression is always subject to a range of error, bias and misinterpretation. I believe that knowledge itself is an idea not a fixed reality. I identify with the world view of critical realism, that ' there is a reality independent of our thinking about it that science can study.' (Trochim, 2006) and that such study can reveal new insights about the focus of study.

This position influenced the formation of the research questions and my expectations of the potential of the study to contribute to an understanding of developmental language delay. In essence, I sought to illuminate the arena through a different lens, to

add to an appreciation of the variability and complexity of developmental language difficulties and to establish if this lens of temperament could add anything useful to current understandings and practice.

3.4 Considerations in Developing a Data Collection Strategy

The collection of appropriate data is fundamental to all research. In keeping with my beliefs about knowledge, I believe that social data, by this I mean data about people, is influenced by the way in which it is obtained, who obtains it, when and where. Data is not solely a static commodity out there waiting to be picked up by researchers, rather I believe that I am seeking to collect information which will never be complete or quite what I might wish it to be (or quite what the participants of the study would wish it to be either!). It is simply real within, at least, the confines of the interaction between myself and the participants and our shared understanding of the research being undertaken. I believe that information gathered in this way has an internal 'realness' which, when interpreted with due care to account for the contexts in which the data have been collected and analysed, can 'establish a warranted assertibility' (Crossan, 2003). In this section, I present some of the issues explored in order to produce a way of collecting data that was relevant to the study. As with all other aspects of the study, such decisions were driven by and congruent with my philosophical viewpoint.

The starting point in considering an appropriate methodology came from reflection into the intended research problem. As such, it was necessary for me to have some vision of the end point of the study in order to establish a realistic research plan, thus,

the study has concisely defined aims (see section2.11.1) which link with the data collection methods used. My concern in designing the most appropriate methodology, was to endeavour to furnish the study with data capable of addressing the central research questions, whilst acknowledging the constraints of my resources and the acceptability of data collection for participants. Equally, I considered a range of real life problems and their potential impact on the research design. Thus, the influence of:

a) the study's purpose - to inform my understanding about temperament and its relationship to language development and to share these findings with professional colleagues

b) the time constraints - I have completed the study as a part-time researcher

c) financial constraints – the project had no dedicated budget

d) ease of access to research setting – a committed gatekeeper was needed to refer participants to the study and access to NHS contexts requires careful advanced planning

e) ethical constraints – parents with young children are a vulnerable group with many responsibilities and busy lives. Children have their unique responses to strangers and to the structure of formal language testing

f) my skills in employing a method effectively – to maintain the quality and consistency of the data collected

g) acceptability of research tools within the practitioner field - spanning both temperament and language communities

h) acceptability of research tools to the participants – time needed to complete data collection and ‘function’ of the instruments in relation to parents’ and children’s expectations

Designing a research methodology thus became an exercise in the relative merits of particular 'trade-offs' (Hammersley, 2013).

In designing a strategy suitable for addressing this intended research problem, I found it important to reflect on the sort of information that would properly answer the stated research questions. Essentially the study was exploratory in nature, striving to shed light on the way in which temperament and progress in language development may interact, whilst acknowledging that other factors are also playing their part (Bishop, 2001; Law et al., 2000; Nelson et al., 2006). Major early decisions centered around the choice of whether to employ direct observational methodologies for both temperament and language or a testing approach for language coupled with parent report measures for temperament.

Further considerations focused on whether to take a study sample from the whole population, or from within the population of children with identified language delay.

What was clear was that I wanted to have some external measurement at a group level and go beyond the individual beliefs expressed by parents about their children.

My question was based on the premise that for individual children, parents felt temperament played a role in language acquisition but what I wanted to find out was

whether any patterns exist that are present beyond the individual level and can be seen in group behaviour.

I chose to use standardised language and temperament measures for a clinically defined group. My reasons for these choices came from the ability of these measures to provide a 'quasi norm' by providing data from the standardization sample as normative data to contextualize my results. Further, I judged that standardised measures were likely to be less intrusive to participants than repeated naturalistic observations, whilst additionally allowing for a bigger cohort to be recruited due to reduced time taken to collect standardised data in comparison with observational data. Following from this, I was able to recruit a larger clinical sample than if I had had a reference group for comparison.

An essential part of study design at this point was finding access to suitable participants and engaging support from local SLT services. After searching for information about referral rates to services I approached a local Primary Care Trust to request their support in hosting the study and acting as gatekeepers. This process took from October 2006 when I made an initial approach to the Head of Service to May 2007 when I obtained a letter of approval from the manager, which allowed me to submit a Local Research Ethics Committee (LREC) application.

3.5 Ethics

Ethical decisions are threaded through the design and conduct of the research. Initial ethical issues included the design of the study, choices of measurement tools, participant samples, relationships with gatekeepers, the research community, and employers/sponsors. These continued during the data collection phases as new challenges not previously anticipated occurred which caused further reflection about how to maintain and act out my ethical position in the most well judged way, balancing the perspectives of different individuals and groups. Ethical challenges in the analysis and interpretation of results and in their publication also exist and underline the importance of viewing ethics as a fundamental building block of research design. As an ethical researcher I am charged with:

> 'a responsibility to anticipate problems and insofar as is possible to resolve them without harming the research participants or the scholarly community.'
>
> Association of Social Anthropologists, 1999, p. 1

Thus, a thorough exploration of the ethical issues surrounding this study were undertaken and formalised through ethical approval being granted from the relevant LREC prior to the commencement of the study (see appendix 1). This involved my attendance at the LREC committee. It was reassuring for me that the committee gave feedback that they were impressed with the quality and scope of the information I had submitted. In addition, an honorary research contract was obtained (see appendices 2 and 3) to allow me to access clinical sites and participant homes. This process took five

months from beginning the application to having ethical and research governance procedures in place.

Anderson and Arsenault (1990) assert that the researcher is the main contributing factor to ethical standards. Accordingly, my personal beliefs formed an influential part of the ethical approach used in this study. I sought to make it clear to all participants the nature and purpose of the study and shared with them my genuine desire to see the research area more clearly and to learn from them during our conversations and data collection. As far as I was able, I shared my responses to their conversation honestly as it occurred and have sought to give accurate representation and interpretation to their data. This was translated practically by providing a summary report for each participant within a week of them completing the temperament questionnaires and negotiating with each participant whether or not they would like the language assessment data shared with their SLT. It also meant making decisions about whether a participant wanted to continue with the research or not. I had imagined this would be straightforward but when several phone messages were not returned or appointments cancelled, it was difficult to know when to withdraw and when to persevere. As the project grew, I started to feel a responsibility to the data already collected as well as to the participant and I at times felt unsure of myself in negotiating a conflict of interest. I sincerely hope that both the attrition in my participant sample as well as the high number of complete data collections attest that I got this as comfortable for the participants as I was able to.

This research project was also developed in line with ethical guidelines produced by the RCSLT (2003, 2006) which urge researchers to reflect upon whether their research

will significantly affect the treatment a participant would otherwise receive and whether their right to confidentiality is infringed.

Since my study recruited current service users, these issues had to be considered carefully and reflected in the information provided to participants prior to them consenting to enter the study and during the study. The ways in which this was managed are discussed in the procedure section, 3.6.3.

Some of the issues related directly to the position of practitioner-researcher; as a SLT I knew it was likely that I would become aware of children showing particularly concerning features of language difficulty, which revealed themselves in the context of data collection, yet were possibly unavailable to the treating SLT and this was in fact the case. Prior to recruiting participants I had decided that I would routinely give information about who to contact if they were concerned about any aspect of the study (see appendix 6), but also that I would offer to share their child's performance with their SLT if I had particular professional concern. I maintained this stance (but often felt myself as if on uneven ground wearing ridiculous high heels that made me wobble), though in practice it was complicated to ask consent to do this not knowing what the service response might be. This meant I would offer to pass on specific information, which I felt would benefit both the participant and the service, on rare occasions or at the request of the parent. This position also needed to be negotiated with the SLT service gatekeeper. Within the framework of the study, it was appropriate to give very general language advice and to provide parents with reassurance that their child's named SLT could answer their more specific questions. As the study progressed, I found that some SLTs would contact me to ask about when my second point of data

collection would be, wishing to time their own review appointments to make use of the information from the language assessment conducted as part of the study. Information about the constraints of the study was shared in these instances; I could not give guarantees about the parents' choice to share information.

Informed consent was obtained from all adult participants (see appendix 7) and the assent of children was respected. Where a child was not content to engage with me at a visit a further appointment was arranged with an explicit option to withdraw from the study. Participants were given oral and written information about:

a) the purpose of the project (including that I was undertaking a PhD)

b) my identity and qualifications

c) measures to protect confidentiality

d) details of involvement - duration, frequency, length of visits

e) that a request to withdraw could be made at any time and would always be accepted

These guidelines were rigorously implemented.

Any engagement in research procedures has an effect on the participants. Ethical codes state that no harm should come to participants. In a study without physical risks, it was still necessary to consider that some people may experience a degree of psychological distress from participating in the study, indeed personal issues were commonly raised during the data collection sessions. It was important, therefore to allow time at the end

of the visit to review the data collection and any topics that had been covered, briefly putting this contribution within the context of the wider study and finally allowing the participant to clarify feelings and intended actions where appropriate. Permission to include the data in the study was reconfirmed along with information about who the data would be shared with.

Study information sheets (see appendix 6) clearly stated that should I have any safeguarding concerns about a child or if a parent disclosed such information to me that I would act on this to protect the child by informing the child's SLT, therefore breaking confidentiality. Within this framework, I would inform the parent that I was going to do this. During data collection I never had cause to have concern about a child's safety in this way.

All researchers have an ethical responsibility to be competent; for this study this has included taking care to ensure that the research is necessary, and producing a realistic research plan which is within the my capabilities and resources. I also had an ethical responsibility to the NHS service with whom I had an honorary contract (see appendix 2 and 3). It was important that I had some knowledge of the services offered so that I could be accurate in responding to parent-participants' questions and not compromise the relationships parents had with the SLT service, or that the participants and SLT service had with researchers.

3.6 The Study

The data collection for the study was conducted from November 2007 to August 2011 in two local Primary Care Trusts. I collected all the data. Eighty children and their main carers were successfully recruited to the first phase of the study from ninety-four parents and children who were referred by the gatekeepers.

3.6.1 Participants

The sampling strategy used was a non-probability purposive sample (Kelley et al., 2003). The gatekeepers were asked to publicise the study to suitable participants who met the inclusion criteria immediately following their first visit to the SLT service. In practice this meant that the SLT invited participants at the end of the first appointment if the family seemed to meet criteria and the SLT judged that they were robust enough to engage with the study protocol. The study participants were young children who had not yet started school and had been referred for SLT assessment due to slower than expected language development. Each child's main carer was also recruited. The inclusion criteria for the study were designed to encompass as many suitable children as possible. Specifically these criteria were:

a) Children between 2;00 and 4;06 years old at the point of entry to the study. This is the age band at which most children are identified with language delay.

b) Children referred to SLT because of slower than expected language development. The research project aimed to identify the temperamental profiles of young children who have delayed language.

c) Children acquiring English as their main language. The research tool being used for language assessment had been standardised for a monolingual UK English speaking population.

d) Adults who are main carer for a child recruited to the study. Adults needed to be very familiar with the child to fill out the temperament questionnaires accurately and to provide background information about the child's early situation and development.

e) Adults able to understand and communicate effectively in English. The research instruments required confident English language skills.

The following exclusion criteria were applied:

a) Children who had identified significant learning disabilities in addition to their language delay. These children were likely to have had wider developmental issues that would not have allowed clear interpretation of the research instruments.

b) Adults unable to read or understand, with my support, the published data collection tools being used. These adults were likely to have had significant learning disabilities themselves or have a limited understanding of English because it was not their primary language. These factors would affect the accuracy and reliability of parental report.

The study children comprised a subset of children referred to the SLT service during the time of the study and I do not have information about those who met criteria but chose not to participate. I therefore have no insight into how representative the sample was in relation to the 'typical' caseload for the service and so any resulting bias

is unknown. However, the children entering the study all met the pre-school service inclusion criteria (see appendix 19).

The study's primary carer adults were all parents of the children. From this point therefore the adult participants are referred to as 'the parents'.

At the proposal stage I had aspired to recruiting a sample of 250 dyads which I had hoped would yield approximately 200 complete data sets for analysis. This sample size was chosen with a view to allowing robust analysis in a project with many variables that was likely to result in potentially small groups of shared characteristics. In reality, recruitment was difficult and since I had to allow 12 months for each data set to be completed, I stopped recruiting after two and a half years to allow time to complete the study within the PhD registration period. The size of the sample was disappointing but nevertheless represents significant effort in obtaining a data set suitable for addressing the research questions. I do recognise that my interpretation of the data in relation to the framework for analysis has been shaped by the size of the sample, for example keeping both girls and boys in one group rather than comparing them.

3.6.2 Research Instruments

Three types of data were collected from participants: demographic, language and temperament information. Each is described below.

3.6.2.1 Demographic information

Some of this information was collected prior to entry into the study to check that potential participants met the inclusion criteria. Firstly, information about learning a

language in addition to English to ensure that English was an equal or primary language for the child such that the assessment tool would be valid. A further question about the child's experience of childcare was used to ensure that the temperament questionnaires were completed by the participating child's main carer. Neither of these variables were entered into further analyses beyond initial descriptive statistics. For example learning a language in addition to English to ensure that English was an equal or primary language for the child such that the assessment tool would be valid. A short set of further contextualising questions was compiled to provide a clear context for the study. This was designed to capture information relating to potential risk factors for language delay derived from current literature (Bishop, 2001; Law et al., 2000; Nelson et al., 2006). Information about the factors below were collected through face-to-face questioning at the first visit and updated at the second point of data collection (see appendices 9 and 10):

i. Family history of language or literacy difficulty, operationalised as a first or second degree relative, i.e. sharing 25% or more of genetic information

ii. Peri-natal difficulties, operationalised as the child having needed medical support 0-2 months of age,

iii. Socioeconomic deprivation, operationalised as a postcode Multiple Deprivation Index (MDI) rank of between 1- 8120 equates to being in the most deprived 25% of areas in England. The MDI is a composite score of income, employment, health deprivation and disability, education skills and training, barriers to housing and services, crime and living environment. England is divided by the National Office for Statistics into 32, 482 Lower Layer Super Output Areas (LSOA) rank 1 equates to the

most deprived area and 32482 to the least deprived. Each LSOA has a minimum population of 1,000 people with a mean of 1,5000. I chose to use this measure to try to capture the complexity of the concept of deprivation. There is no uniform way in which researchers into deprivation and language represent this concept. The decision I made in using this was based on its transparency and objectivity and its link to a community rather than an individual so that it captured a sense of the developing child's environment.

iv. Education of parent, operationalised as qualifications above or below the level of five General Certificates of Secondary Education (G.C.S.E.'s) grades C- A.

v. Upper respiratory tract infections, operationalised as the number of ear infections or colds lasting longer than a week

vi. Hearing, operationalised as parents' concern about hearing or a failed hearing test

3.6.2.2 Temperament information

Choosing a technique to measure temperament in children and adults was a key decision and significantly shaped the data available for analysis. There are a wide range of tools used to collect data about temperament. The main approaches are through interview, questionnaire and observation.

Interview methods typically involve asking a series of standardized questions. Answers are recorded by the interviewer and subsequently rated according to an established set of criteria. Advantages of this technique include being able to probe for more detail and clarify the way questions have been interpreted by the respondent. Respondents with a range of language levels can be included successfully with the researcher adapting her communication style to facilitate the respondent's replies. Disadvantages

include the relative expense of interviews and the potential lack of direct comparability across interviews. Furthermore, in interview situations participants may try to please the researcher and be less free in the responses they give. As such data is likely to be influenced in unknowable ways by the relationship formed between the researcher and participant.

Questionnaires are frequently used to assess temperament; ratings may be given by parents and other caregivers, teachers, or from the person themselves. The ratings typically require a numerical rating to be assigned to each question associated with a temperament construct. Questionnaire ratings are commonly normed on a large sample. The advantages of questionnaires are that items are standardized, they are completed relatively speedily and are a reasonably inexpensive way to collect information. Their disadvantages include potential response bias (Fischer, 2003), inability to clarify ambiguous or incomplete responses and inaccessibility for respondents with low literacy levels.

Observation techniques may be naturalistic or structured. Typically, observations range from being coded on pre-determined schedules, through to video observations that are later used for coding against a range of constructs. Observational methods are very time consuming and video-taped behaviours can be difficult to interpret reliably and accurately. For example, a child at play may move from activity to activity; are these interpreted as expressions of activity level, distractibility, persistence or all of these? Transparent coding systems would need to be developed, refined and reliability established for each dimension of temperament. However, following development of

robust materials such methods have high ecological validity and are accessible to a wide range of participants.

Temperament is a difficult thing to measure and the literature attests to no method being without a range of associated difficulties (Rothbart, 2011). For this study, I required a technique that would be appropriate to the sample population of children and adults, efficient in its administration, replicable across time and ideally having been used previously as a research instrument. I decided on using a questionnaire, but to conduct this face to face with the participant to circumvent issues of ambiguous understanding of the questions or low literacy levels. This approach also allowed for checking for missed items. A review of available tools revealed that only the Carey Temperament Scales and Adult Temperament Questionnaire were structured around the same temperament constructs as each other and were differentiated by age allowing measurement of these constructs across the whole age span of participants, including separate questionnaires for children 1-2 years of age, 3-7 years and for adults. In addition, parts of the questionnaires had been used in both the ALSPAC, 1991 study and The Twins Early Development Study (TEDS). This gave me confidence that these instruments were well respected and likely to remain published during the duration of the study. Further, they could allow for useful comparisons when interpreting the results of this study.

For these reasons, this study used the Carey Temperament Scales for the children and the Adult Temperament Questionnaire for the parents. Both these tools are derived from the New York Longitudinal Study (Chess and Thomas, 1999) and therefore have

the advantage of using the same constructs across both child and adult participants. The scales are organised around Chess and Thomas' nine distinct dimensions of temperament (see section 2.12.3). The instruments provide a series of statements of behaviour that the adult self-rates to indicate which fits most closely to their own behaviour. In a similar way, the child scales ask an adult who is very familiar with the child to rate the child's behaviour.

Goodness of fit measures are revealed through parents' subjective impressions of the child's rating on a general manageability scale in comparison to other children of the same age.

The questionnaires were developed and standardised on a population of American children and young adults and are among the most widely used instruments to assess temperament in clinical populations. Unlike the PLS3-UK however, there has been no standardisation on a UK sample and potential differences in cultural expression of temperament may affect the results in unknown ways and magnitudes. Despite this significant drawback, there was no similar UK alternative. There is a body of literature that documents cultural variations in temperament in children from very different cultures, such as Japan and Latin America (Gartstein et al., 2010) and Australia, Italy, the Netherlands, Poland, Spain, Sweden, and the United States (Super et al., 2008). However, little attention has been paid to cultural variation between superficially similar cultures such as the UK and United States. Klein and Ballantine (1991) do provide a direct comparison in their study comparing children across Israel (*n* =108), United States of America (*n* =132), and England (*n* =180). They identified no significant

group differences between USA and English groups on temperament assessed by teacher ratings.

Each of the scales used is described below.

3.6.2.2.1 Toddler Temperament Scale (TTS)

This questionnaire is standardised for children between 12-35 months of age. It is a ninety-seven item questionnaire that is designed to be completed by the child's caregiver. Each item describes a behaviour, which is rated on a six-point Likert scale:

1= almost never, 2= rarely, 3=variable, usually does not, 4=variable, usually does, 5= frequently, 6=almost always.

A copy of the TTS can be seen in appendix 11

The statements are randomly arranged across dimensions and some are reversed in response direction for each dimension. The item scores for each dimension are added together and divided by the number of items in the scale, to derive a score for each dimension.

Reliability of the scale was assessed during standardisation through establishing internal consistency (Cronbach's alpha, α) and one month test-retest reliability (*r*). This information is presented in Table 3.1 below. It is notable that measures of alpha were low where fewer test items exist and approach acceptable levels (0.70-0.85) where larger numbers of items were present (Tavakol and Dennick 2011). Test-retest reliabilities showed good levels of consistency (0.69-0.89).

Table 3.1 *Reliabilities for the Toddler Temperament Scale*

Variable	No of items	Cronbach's α (*N* =304)	95% CI for α		Retest (*r*) *N* =47	95% CI for *r*	
			Lower	Upper		Lower	Upper
Activity	12	.77	.73	.81	.88	.85	.90
Adaptability	9	.53	.45	.61	.76	.71	.80
Approach	12	.85	.82	.87	.89	.86	.91
Distractibility	11	.72	.67	.76	.69	.63	.74
Intensity	10	.67	.61	.72	.71	.65	.76
Mood	13	.63	.57	.69	.87	.84	.90
Persistence	11	.76	.72	.80	.82	.78	.85
Rhythmicity	11	.72	.67	.76	.81	.77	.85
Threshold	8	.57	.49	.64	.76	.71	.80

3.6.2.2.2 Behaviour Style Questionnaire (BSQ)

The Behavioural Style Questionnaire (BSQ) is standardised for children 3;00-7;11 years of age. It is a hundred item questionnaire that is designed to be completed by the child's caregiver. Each item describes a behaviour, which is rated on a six-point Likert scale:

1= almost never, 2= rarely, 3=variable, usually does not, 4=variable, usually does, 5= frequently, 6=almost always.

A copy of the BSQ can be seen in appendix 12.

The behaviour statements are randomly arranged across dimensions and some are reversed in response direction for each dimension. The items for each dimension are scored in the same way as for the TTS (see section 3.6.2.2.1).

Reliability of the scale was assessed during standardisation through establishing internal consistency (Cronbach's alpha) and one month test-retest reliability(*r*). This information is presented in Table 3.2 below.

Table 3.2 *Reliabilities for the Behavioural Style Questionnaire*

Variable	No of items	Cronbach's α (*N* =350)	95% CI for α		Retest *r*, *N* =53	95% CI, retest *r*	
			Lower	Upper		Lower	upper
Activity	13	0.76	.72	.80	.93	.88	.96
Adaptability	12	0.72	.67	.76	.85	.75	.91
Approach	11	0.80	.77	.83	.94	.90	.97
Distractibility	10	0.70	.65	.74	.82	.71	.89
Intensity	12	0.71	.66	.75	.75	.60	.85
Mood	12	0.66	.60	.71	.87	.78	.92
Persistence	10	0.60	.53	.66	.70	.53	.82
Rhythmicity	9	0.48	.39	.56	.80	.68	.88
Threshold	11	0.47	.38	.55	.67	.49	.80

Measures of alpha were low for the threshold and rhythmicity dimensions, modest for mood and persistence and acceptable for the remaining dimensions. Test-retest reliabilities showed good levels of consistency (0.67-0.94) with only the threshold dimension lower than 0.70.

3.6.2.2.3 Adult Temperament Questionnaire

This questionnaire is standardised for adults (age 18 and above). It is a fifty-four item questionnaire, with six questions for each dimension and is designed to be completed by the adult. Each item describes a behaviour, which is rated on a seven-point Likert scale:

1= hardly ever, 2= rarely, 3=once in a while, 4=sometimes, 5= often, 6= very often, 7=almost always.

A copy of the Adult Temperament Questionnaire (ATQ) can be seen in appendix 13.

The behaviour statements are arranged randomly across dimensions and some are reversed in response direction for each dimension. A mean score is calculated for each dimension.

Reliability of the scale was assessed during standardisation through establishing internal consistency (Cronbach's α) and one month test-retest reliability (*r*). This information is presented in Table 3.3 below. Internal consistency had acceptable levels (0.69-0.93). The reported test-retest reliability was acceptable other than being weak for persistence and adaptability. Retest questionnaires were calculated for only a small sample of twenty-five adults.

Table 3.3 *Reliabilities for the Adult Temperament Questionnaire*

Variable	No of scale items	Cronbach's alpha (*N* =25)	95% CI for alpha		Retest *r* *N* =25	95% CI for retest *r*	
			Lower	Upper		Lower	Upper
Activity	6	.83	.70	.92	.90	.78	.96
Adaptability	6	.74	.54	.87	.64	.33	.83
Approach	6	.78	.61	.89	.85	.68	.93
Distractability	6	.72	.51	.86	.70	.42	.86
Intensity	6	.71	.49	.86	.84	.67	.93
Mood	6	.69	.45	.85	.82	.63	.92
Persistence	6	.79	.63	.90	.66	.36	.84
Rhythmicity	6	.83	.70	.91	.89	.76	.95
Threshold	6	.76	.58	.88	.76	.52	.89

3.6.2.3 Language Information

Collecting data to describe the children's language skills was key to the study. Language assessment is challenging in terms of accuracy, with both receptive and expressive assessment requiring performance skills from the child. The study objectives dictated collection of language data that was capable of being repeated over time to provide information about language growth. A range of instruments were available and well established within the SLT profession. A key consideration for the study was using a tool which children would be unlikely to be offered during their SLT service treatment plan so that any practice effects associated with the assessment would not invalidate assessment as part of routine care or for the study.

The PLS3-UK (Zimmerman et al., 1997), a respected clinical tool for assessment of young children's language development, has been widely used in both practice and research settings. It is designed to broadly measure typical language development in children from birth to seven years of age. The PLS3-UK has two subscales, Auditory Comprehension and Expressive Communication which were standardised on a UK population. Each consists of forty-eight items arranged into eight receptive and expressive tasks for each six month interval from birth to 4;11 and eight receptive and expressive tasks for each twelve month period for ages 5;00-7;00 years. The tasks use objects pictures, conversation and, at early age bands, parent report of the child's language skill and behaviour. The auditory comprehension scale includes evaluation of attention, semantics, structure and integrative thinking skills e.g. comparison and inference. The expressive communication scale includes evaluation of vocal

development, social communication, semantics, structure and integrative thinking (see appendix 17).

The reliability of the scale was determined during its standardization through calculation of internal consistency and retest reliability. Internal consistency was good; 0.75-0.88 for the auditory comprehension scale and 0.85-0.91 for the expressive communication scale. This information is presented in Table 3.4.

Table 3.4 *Internal consistency for PLS3-UK subscales*

		Auditory Comprehension			Expressive Communication		
Age	*N*	α	95% CI for α		α	95% CI for α	
			Lower	Upper		Lower	Upper
2;00 – 2;05	96	.86	.82	.90	.85	.80	.89
2;06 – 2;11	102	.86	.82	.90	.86	.82	.90
3;00 – 3;05	101	.88	.84	.91	.90	.87	.93
3;06 – 3;11	98	.88	.84	.91	.91	.88	.93
4;00 – 4;05	98	.81	.75	.86	.90	.87	.93
4;06 – 4;11	100	.75	.67	.82	.85	.80	.89

Test re-test reliability was calculated for a sample of eighty-five children who were randomly selected and allocated across three age bands. The original mean scores and retest means are reported in the manual alongside the reliability coefficients. The sample demonstrated good levels of retest reliability for both expressive (0.82-0.92) and comprehension (0.89-0.90) subscales. This information is presented in Table 3.5.

Table 3.5 *Test-retest reliabilities for PLS3-UK subscales*

		Auditory Comprehension			Expressive Communication		
Age	*N*	Retest *r*	95% CI for *r*		Retest *r*	95% CI for *r*	
			Lower	Upper		Lower	Upper
3;00-3;05	28	.89	.77	.95	.82	.64	.91
4;00-4;05	30	.90	.80	.95	.92	.84	.96
5;00-5;11	27	.89	.77	.95	.94	.87	.97

Standard administration and scoring protocols are detailed in the test manual. These were explicitly followed to allow the standardisation of the results. The administration allowed instructions to be repeated, items to be presented out of sequence and breaks to be taken during testing. Guidance was provided about the starting point for testing at different ages, typically one year below chronological age, alongside the establishment of basal and ceiling requirements and this was adhered to.

3.6.3 Procedure

3.6.3.1 Piloting

I was already familiar with using the PLS3-UK but piloted the temperament tools using volunteers who had young children and this allowed me to estimate the time that data collection would take and alerted me to some potentially problematic questions.

3.6.3.2 Recruitment

Following discussions with SLT gatekeepers, potential participants were given written and verbal information about the study and invited to participate. Gatekeepers made decisions about who to mention the study to but I also made notices which were placed in the waiting areas of clinics and on the desks of gatekeepers so that parents who noticed these could enquire about the study if they chose to. Where parents agreed to find out more about the study, the gatekeeper passed on their contact details to the SLT administrator and then on to me.

3.6.3.2.1 First point of data collection (T1)

Arrangements were made for a first visit during a telephone conversation with each participant. During this conversation, informal consent to take part in the study was confirmed and any questions answered.

During the first visit, consent for the parent and child to participate was obtained in writing. Background information about the participants' characteristics was obtained using the 'Participant initial questionnaire schedule'. The parent was then asked to complete the Adult Temperament Questionnaire and the age relevant Carey Temperament Scale (TTS or BSQ). Most parents completed this by themselves though some parents opted for me to read the questions and complete it as a structured interview. While the questionnaires were being completed, I engaged the child in play and interaction to build a rapport prior to conducting the PLS3-UK at a second visit. Typically the second visit was arranged within a week of the first. At this second visit I conducted the PLS3-UK with the child and provided the parent with a summary report from the analysis of the temperament questionnaires (see appendix 15 for a sample report, with names changed). This report highlighted similarities and differences between the parent and child. Following completion of the language assessment, parents were offered the choice to have a photocopy of the language assessment sent to the child's SLT for inclusion in the case notes. Parents were informed that specific feedback from the language assessment would not be given by me but only via the SLT who had a more comprehensive knowledge of the child's skills, if they opted to share the assessment information.

3.6.3.2.2 Second point of data collection (T2)

Participants were re-contacted by telephone after a year and asked to take part in the second stage of data collection. For the majority of families the temperament questionnaires were posted out prior to the visit and just one visit to collect data about the child's language and update background information (see appendix 10) was made. This ended their participation in the study. Following this, a summary report from the temperament questionnaires (see appendix 16) was posted to the participants and the language assessment was copied to the SLT service for participants who had chosen this.

3.6.3.2.3 Changes to the data collection protocol.

For some families one or two additional visits were made to ensure that their participation took place at a pace that suited both parent and child. None of the children refused to cooperate with the language assessment, though some of the children found it easier than others to take part in an adult led standardized process. Where children were sleepy or unwell when I arrived, appointments were rearranged.

For a few parents, the wording of the temperament questions was difficult to understand and I rephrased these to allow parents to make a judgement about them. A few parents preferred to have the questionnaires read aloud to them.

An overview of the routes participants took through the study is provided in appendix 4.

3.6.4 Data management

The study generated a large amount of paper containing data. Each participant dyad had a case number allocated and this was recorded on all paperwork associated with them. Files

were kept in a locked filing cabinet and in a locked room. Temperament reports were written on my computer which was password protected. Data management adhered to MMU's data protection policy (2011) and the data Protection Act (1998).

The data generated by each participant dyad was coded and entered into IBM SPSS Statistics 19 to facilitate its organisation and prepare it for data analysis.

Entering numerical data is prone to human error and I cannot vouch that all the data is completely accurate. However, I remained alert to the possibility of making errors throughout each stage of the data entry and analysis process. In initial data entry, I spot checked five questions in each instrument to see if the numbers were accurate. Five cases were checked by someone outside the project, where I read out the data and he checked the SPSS entry. These procedures did not reveal any errors.

On a few occasions I spotted errors at entry, for example when I had an extra value with no remaining fields. This enabled me to go back and find the error (usually missing a field earlier).

Data entry took place in stages: all temperament data needed to be entered as soon as it had been collected to allow me to generate information for the temperament summary report to parents. This data had to undergo manipulation so that all values were oriented in the same direction. This was done by running bespoke syntax in SPSS to reverse the scoring for required items. An example can be seen in appendix 14. A separate file was maintained with the data in an 'untransformed' state. Once all data had been collected and checked this data set was altered so that temperament variables faced the same direction (1=low, 6

=high). Special attention to this temperament data was needed during checking to ensure that no unplanned transformations had taken place.

There was no missing data. During data collection, I checked that all questions had been answered by participants and where items had been missed I requested the participant to fill in the missing questions. This was facilitated by the structure of data collection which generated temperament data at the first visit.

3.6.5 Analysis of data

The purpose of data analysis was to reveal information capable of answering or addressing the stated research questions. Descriptive statistics were used to provide summaries of the sample's characteristics. These included patterns of distribution, measures of frequency (counts and percentages), central tendency (mean and mode) and measures of dispersion (range and *SD*s).

The psychometric properties (reliability, validity, internal consistency and standard error) of the instruments used were calculated for the recruited child and parent samples to allow comparisons to be made between the original standardization of the instruments.

The research aims were translated into a series of defined questions (see Table 4.8). Descriptive statistics were used to provide cohort information about language and temperament. Further analysis identified language progress and language change using *t*-tests and significant difference measures. Correlation and inferential techniques were used to explore the relationships between measured variables. The variables were a) known risk

factors for language delay identified from the current literature, b) the nine dimensions of temperament and manageability rating derived from the New York Longitudinal Study (Chess and Thomas, 1991) for children and their parents, and c) receptive and expressive language scores derived from the PLS3-UK. Multi−variate analyses used multiple regression techniques to identify predictors of the final outcome (language scores).

Linear regression models were developed using SPSS enter and stepwise methods. In the enter method all the specified variables are introduced into the equation in one step (forced) in order of decreasing tolerance. Independent variables must pass tolerance tests in order to be included (probability of *F*: entry =.05, removal =.10). This method was used to interrogate expected relationships between likely variables and the outcome measures of auditory comprehension and expressive communication skills after one year (aim 4 and aim 5). The stepwise method with a probability of *F* for entry into the model set at .05 and for removal of variables set at .10 was used for the more exploratory regression analyses performed to answer aim 6 questions. In contrast to the enter method, the stepwise method only enters the variables which are good predictors into the final model equation. One variable is entered at each step and those which do not contribute to outcome prediction are removed.

In exploring the predictive value of independent variables in relation to outcome dependent variables (auditory comprehension and expressive communication), Tabachnick and Fidell (2013) argue that there are limits to the number of variables that can be usefully entered into a linear regression model and give the guidance of using no more than one predictor variable for every eight participants + 50 (50+(8x predictors)) to be sure that the predictive

use of a resulting model is not compromised. They assert that where too many variables are entered for the size of the sample, there is a risk of exaggeration of inconsequential fluctuations in the data. For the T2 cohort size of seventy-two in this study, this limits the number of chosen independent variables to three (50 + (3x8) = 74) for a multiple linear regression. However, recent research into the impact of sample sizes on the accuracy of regression coefficients (Austin and Steyerberg, 2015) states that a minimum of two participants per variable were able to yield acceptable estimations of regression coefficients and CIs. The authors caution that in estimating the model's R^2, a higher number of participants per variable was required for unbiased results. However, with just two participants per variable adjusted R^2 achieved reliable values.

The research aims are presented alongside the analytical approaches used in addressing them in Table 3.6.

Table 3.6 *Analytical strategies used to explore research questions*

Research aim	Analytic approach
To describe the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two time points, 12 months apart.	Descriptive statistics to interrogate language assessment scores. Inferential statistics to investigate progress over time (significant difference/ clinical change), relationships between auditory comprehension and expressive communication (correlation, linear regression).

To describe the temperamental characteristics of a group of pre-school children accepted on to the caseload of community SLT services.	Descriptive statistics *t*-tests Correlations
To describe the temperament characteristics of the cohort's parents.	Descriptive statistics *t*-tests Correlations
To investigate relationships between the temperament dimensions, which differ from normative expectations, auditory comprehension and expressive communication performance, and temperament variables associated with language differences from the literature.	Correlation Multiple linear regression
To investigate relationships between cohort auditory comprehension and expressive communication T2 outcomes and parent ratings of child manageability.	Correlation Multiple linear regression
To investigate relationships between biographical and demographic variables alongside any previously identified predictors of cohort auditory comprehension and expressive communication T2 outcomes.	Correlation Multiple linear regression

In using these statistical analyses, statistical significance based on probability theory is key in identifying positive results. It was important to also be aware that statistical significance does not necessarily imply *clinical* significance, that is a result which would change a clinical

decision for the participants by a SLT. Typically, analysis is focussed on movement from one point to the next over time. In analysis of clinical data it is important to bear in mind that the measured size of change does not necessarily map onto one which moves a group or set of individuals from a clinical to a non-clinical population.

Cohen (1988) advocated the use of power analysis as a way of looking at effect size. Such correlation techniques indicate the size (power) of the relationship between variables and Cohen (1988) notes that this may be more informative than the probabilities indicated by statistical significance. Where appropriate, effect sizes are reported alongside significance values and strengths of associations are reported (see Table 3.7).

Table 3.7 Effect sizes reported in analyses

	Small	Medium	Large
Cohen's *d*	.2	.5	.8
Pearson's *r*	.1	.3	.5
R^2	.02	.13	.26

Chapter 4 Results

4.1 Introduction

This chapter is organised into three main sections as follows:

1. A description of the study's sample of participants and their characteristics
2. A presentation of the data collection tools used and their characteristics with respect to the study sample
3. A presentation of the research questions, alongside the results of the analyses conducted

4.2 The participant sample and their characteristics at entry to the study

4.2.1 The children:

Eighty children were recruited and entered the study, sixty (75%) were boys and twenty (25%) girls. Their ages ranged between 24-45 months, with a mean age of 32 months and range of 21 months, reflecting the recruitment criteria for the study.

The distribution of the ages showed a positive skew (.531) and slight negative kurtosis (-.190). The skew value fell outside an acceptable range for normal distribution (Field, 2009) and this was confirmed by the Kolmogorov-Smirnov (KS) test of normality $D(80) = .10$, $p = .036$ (see *Figure 4.1*).

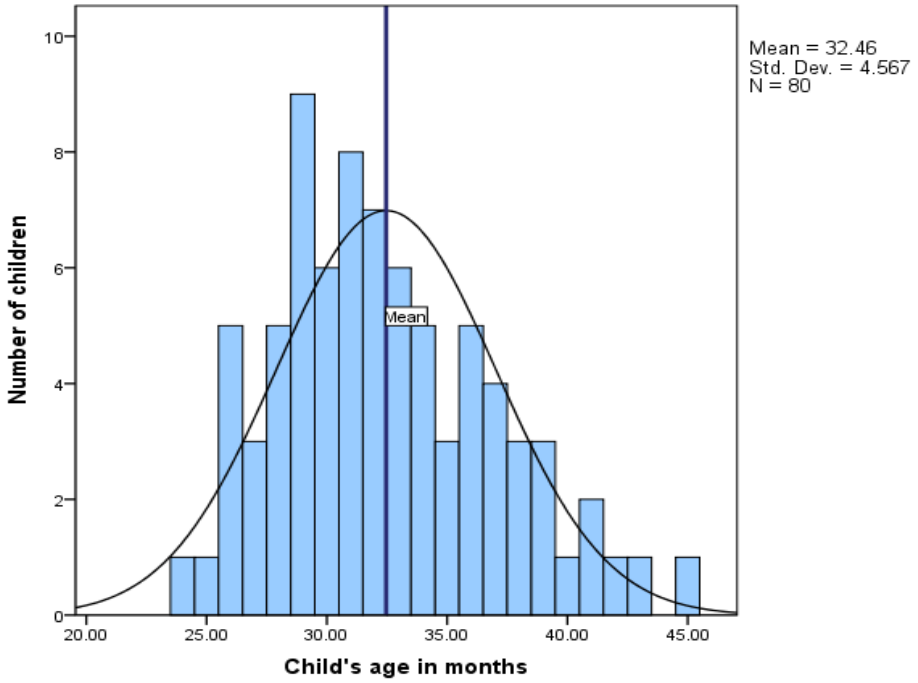


Figure 4.1. Distribution of children's ages.

Since there were very many more boys than girls in the sample, measures of central tendency for gender were calculated. These showed very similar features: the mean age was 32.30 months for boys and 32.95 months for girls. The whole sample was therefore treated as a whole. A summary of these characteristics is presented in Table 4.1.

Table 4.1 *Children's age (months) by gender*

	Girls, N=20	Boys, N=60
Mean	32.95	32.30
Median	32.00	32.00
Mode	29.00/30.00[a]	31.00
Range	17.00	21.00
Minimum	26.00	24.00
Maximum	43.00	45.00

a. Multiple modes exist. Both values shown

The characteristics reported below relate to initial entry to the study.

4.2.1.1 Languages spoken at home

Seventy-one of the children lived in monolingual English homes, whilst nine of the children were being raised in a bilingual environment.

4.2.1.2 Ethnicity

Seventy (88%) of the parents described their children's ethnicity as white British. Seven children (9%) were described as having mixed ethnic heritage, two children (3%) were Asian and one black (1%). Parents did not provide additional detail in relation to ethnicity, which was asked as an open question (see appendix 9). These figures closely match the languages the children heard in their homes. This information is represented visually in *Figure 4.2*.

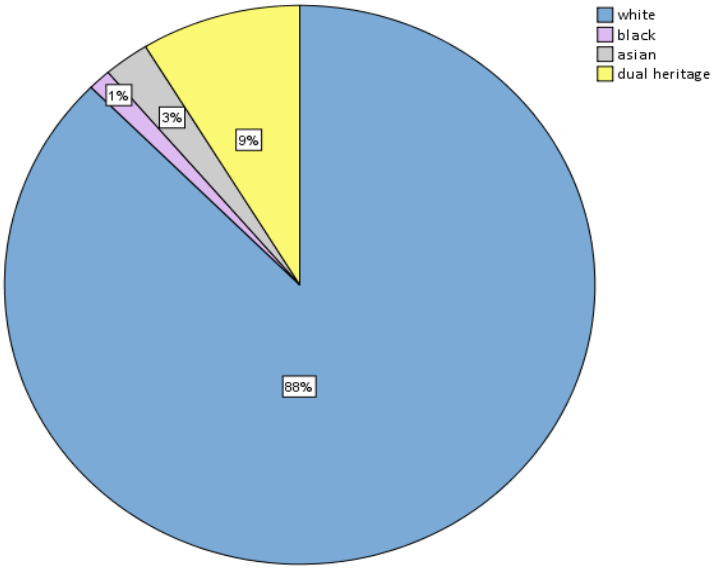


Figure 4.2. Children's reported ethnic group.

4.2.1.3 Birth order

Thirty-six of the children (45%) were first born, with thirty-one (39%) being the second child in the family. Few of the children were later born and from bigger families (16%). This information is summarised in *Figure 4.3*.

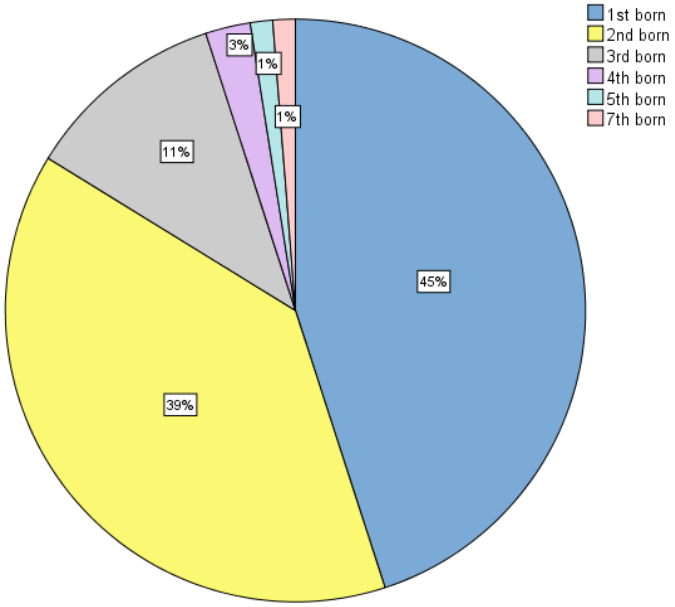


Figure 4.3. Children's family birth position.

4.2.1.4 Siblings

Sixty-one of the children (76%) had siblings. The number of siblings ranged from one to six but the majority of these children had one sibling (53%). Nineteen of the children were singletons (24%). This information is displayed in *Figure 4.4*.

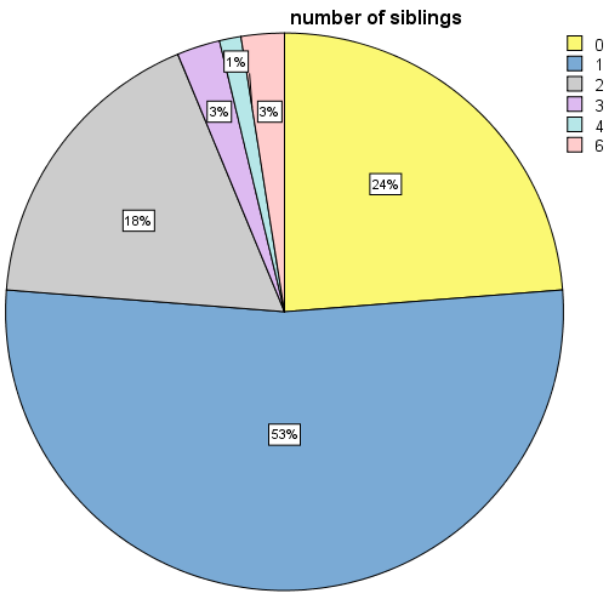


Figure 4.4. Number of siblings.

4.2.1.5 Family history of language or literacy difficulty

Parent participants reported on any language or literacy difficulties they knew of within their child's family. More specifically, this was operationalized as first-degree relatives (maternal or paternal, full siblings) and second-degree relatives (defined as a blood relative, which included the child's grandparents, aunts, uncles, nephews, nieces or half-siblings). Forty-four (55%) of the children had a first degree relative with a history of language or literacy difficulty, with these numbers being evenly spread across paternal, maternal and sibling histories. An additional seven children (9%) had an identified second degree relative with language or literacy difficulties. Twenty-nine (46%) children had no known family history (see *Figure 4.5*).

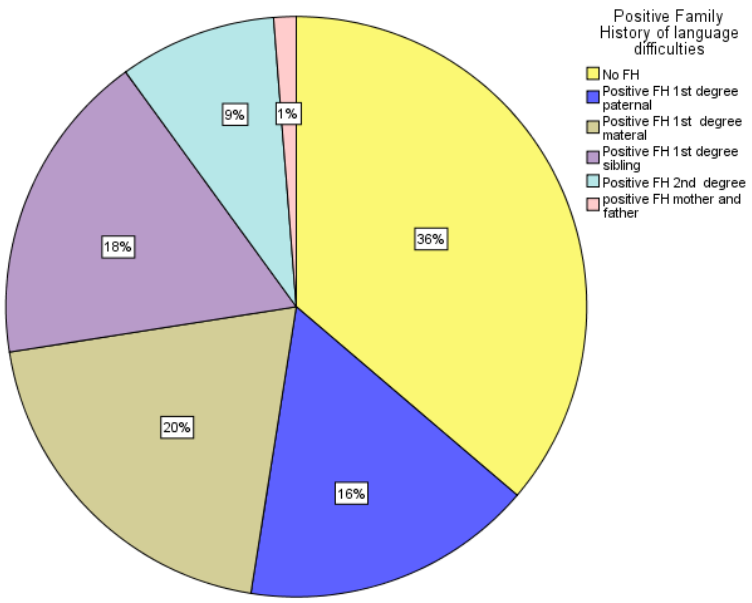


Figure 4.5. Family history of language and literacy difficulties.

4.2.1.6 History of peri-natal difficulties requiring medical support 0-2 months of age

Twenty-one children were reported to have needed additional medical support in their first two months of life (26%), whilst 59 (74%) had received only routine medical surveillance.

4.2.1.7 Prevalence of upper respiratory tract infections (URTIs)

Parents provided information about the number of ear infections or colds lasting longer than a week that their child had had within the previous 12 months. Fifty-six of the children (74%) were reported to have had only one or two 'bad colds' lasting longer than a week or colds that lasted only one or two

days. Thirty of the children (26%) experienced more frequent colds, with parents reporting three or more within the previous year.

4.2.1.8 Parents' concern about hearing

Data were collected in relation to any concerns parents had about their child's hearing ability. This data was not a proxy for identifying children with hearing loss but rather sought to uncover parental concern about hearing. Only one parent reported being concerned about their child's hearing, with 79 (99%) of the parents expressing no concerns.

4.2.1.9 Socioeconomic deprivation

The children's home postcodes were used to derive the Multiple Deprivation Index (MDI) rank for the Lower Layer Super Output Area (LSOA) in which they lived (see section 3.6.2.1 for further detail). England has 32,482 ranks with 1 being the most deprived area and 32,482 the least deprived. A rank of 1-8120 represents living in the most deprived 25% of areas in England, a rank of 16,241 or lower represents the lowest 50% of areas. The mean rank for the Local Authority area in which the children lived was 14,235, showing that they lived in an area just under the mean rank for England. The MDI ranks for the study children covered a spread of 98% of the available ranks and had a range of 31,911 (between 253 and 32,164). The mean rank was 15,377 and the mode

was 7,886 (see *Figure 4.6*.). Looking at the distribution of the cohort data, it showed a slight positive skew (0.13), and negative kurtosis (-1.11). Skewness fell within the twice the standard error cut-off limit for acceptability but kurtosis fell outside this value. The KS test confirmed that these data were not suitable to be treated as normally distributed, $D(80) = .13$, $p = .002$. Sixty-two of the study children lived in the highest 75% of ranks whilst eighteen children had postcodes in the lowest 25%.

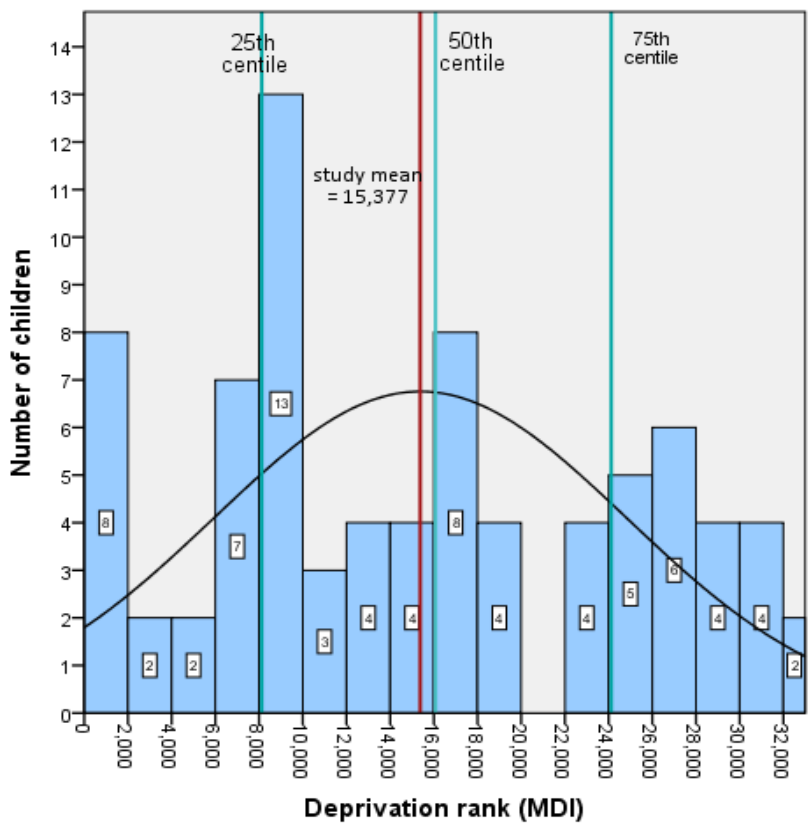


Figure 4.6. Distribution of deprivation ranks.

4.2.1.10 Children's experience of childcare

The children experienced a variety of carers in their day to day lives (*see Figure 4.7*). Fifty-four children were cared for solely by their parents (67.5%) whilst eight children (10%) also received regular care from the extended family. Fifteen of the children also had nursery care (18.8%) with a further three children spending time with a childminder (3.8%).

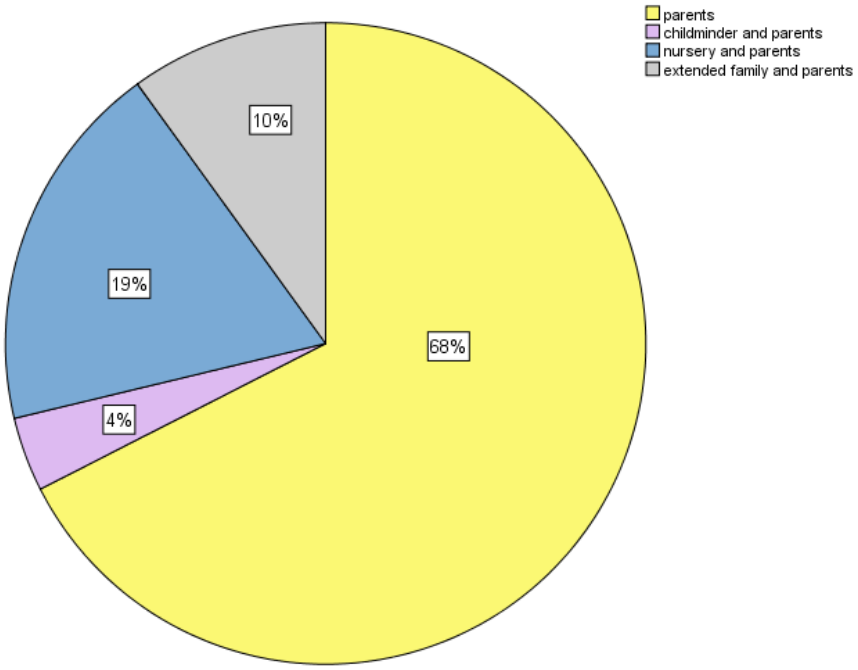


Figure 4.7. Children's childcare experience.

4.2.2 The parents

Seventy-six of the participating parents were mothers (95%) and four were fathers (5%). The parents' ages ranged between eighteen and forty-five years (range =27 years), with a mean age of 32 years 7 months. The distribution of ages is shown in *Figure 4.8*.

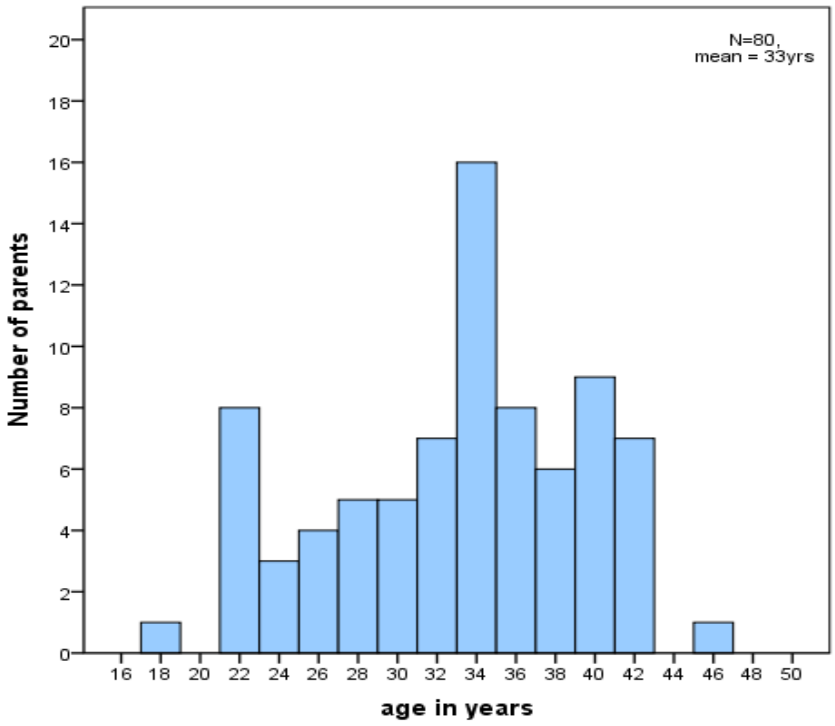


Figure 4.8. Distribution of parents' ages.

4.2.2.1 Parents' education levels

Parents reported on their educational level, more specifically information was collected to identify whether parents had attained qualifications above or below the national expected level of five G.C.S.E.'s grades C-A. Some of the older parents had not done G.C.S.E.s but had taken O' levels or CSEs, in these cases achieving five passes A - C was taken as a proxy, although not directly equivalent. Seventy-one of the parents had qualifications that met the national minimum (89%) and nine parents had qualifications below the national minimum (11%).

4.3 The participant sample and their characteristics after one year

4.3.1 Children who completed the study

At the second point of data collection, Time 2 (T2), seventy-two of the original eighty children took part (90%). The mean age at T2 was 45 months (3;09) and the range was 21 months. Many of the characteristics were unchanged: languages spoken at home, ethnicity, perinatal history, birth order, siblings, family history and socioeconomic deprivation.

The parents reported a small reduction in URTIs from 26% of the group having three or more episodes at T1, to 20% having more than three URTIs during the year at T2. At this second time point, 5% of parents could not remember this information.

Further, at T2 nineteen (26%) of the children were no longer receiving SLT services, whilst fifty-three children (74%) remained on the SLT caseload.

4.3.2 Children who did not complete the study

The eight children who did not complete the study were all boys (whole cohort, 75% male). Their mean age at T1 was 32 months (whole cohort, 32 months).

The reasons for not continuing the study were varied. Six of the families were not contactable through the phone numbers and addresses they gave at the first point of data collection and the gatekeeper had no updated details recorded. Two families were contacted successfully but did not want to continue in the study, one stated changed work patterns and the other personal illness.

The eight children who did not participate in the second phase of data collection closely mirrored the characteristics of the whole cohort. The details of their demographic characteristics are in appendix 18.

Their parents were all mothers with a mean age of 28 years. Seven of the parents had five GCSEs (or above) and one did not.

4.4 The data collection tools and their characteristics with respect to the study sample

Details of the tools used in data collection are described in section 3.6.2.

4.4.1 Preschool Language Scales 3-UK (PLS3-UK)

The PLS3-UK was standardised on UK children. Measures of its internal reliability (Cronbach's alpha, α) for this study cohort were calculated to provide a context to interpret the study sample and compared to the standardisation sample.

The internal consistency for the sample was similar to that provided in the test manual. The results are presented in Table 4.2 and Table 4.3.

Table 4.2 *Internal reliability for PLS3-UK subscales (Study cohort T1)*

		Auditory Comprehension			Expressive Communication		
Age	*N*	α	95% CI for α		α	95% CI f α or	
			Upper	Lower		Upper	Lower
2;00 – 2;05	24	.92	.87	.96	.85	.75	.92
2;06 – 2;11	35	.91	.86	.95	.81	.71	.89
3;00 – 3;05	18	.77	.59	.90	.89	.80	.95
3;06 – 3;11	3	.92	Not calculated, low *n*		.89	Not calculated, low *n*	
4;00 – 4;05	0	-	-		-	-	
4;06 – 4;11	0	-	-		-	-	

Table 4.3 *Internal reliability for PLS3-UK subscales (Study cohort T2)*

		Auditory Comprehension			Expressive Communication		
Age	*N*	α	95% CI for α		α	95% CI α	
			Upper	Lower		Upper	Lower
2;00 – 2;05	0	-	-	-	-	-	-
2;06 – 2;11	0	-	-	-	-	-	-
3;00 – 3;05	18	.94	.89	.97	.94	.89	.97
3;06 – 3;11	33	.90	.84	.94	.94	.91	.97
4;00 – 4;05	18	.92	.86	.96	.95	.91	.98
4;06 – 4;11	3	.82	Not calculated, low *N*		.90	Not calculated, low *N*	

4.4.2 Carey Temperament Scales

The Carey scale instruments used in this study were the TTS for children up to 2;11 years, BSQ for children from 3 years of age and the ATQ for all the adult participants. All of these were standardised in the USA. Measures of internal reliability (Cronbach's alpha, α) for this study cohort were calculated to provide a context to interpret the study sample and compare this to the standardisation sample. The results are presented in **Error! Reference source not found.**, Table 4.5, Table 4.5, Table 4.6 and Table 4.7.**Error! Reference source not found.**

4.4.2.1 Toddler Temperament Scale (TTS)

This scale was solely used at T1, since all the participants were above 2;11 years at T2. Thus no test-retest data are available. Internal consistency ranged between 0.85-0.53 for the standardised manual, whilst the cohort ranged between 0.83-0.44. Internal consistency (Cronbach's alpha) values for dimensions in the manual and for the study cohort overlapped within the 95% confidence limit range, with the exception of rhythmicity.

4.4.2.2 Behavioural Style Questionnaire (BSQ)

The BSQ was used at both points of data collection, at T1 with children who had reached 3 years of age and for all the children at T2. Table 4.5 present the internal consistencies of the measure, alongside those for the study group. All the 95% CIs overlapped between the standardisation and study samples.

Table 4.4 *BSQ internal reliabilities for standardisation and T1 study sample*

		BSQ Manual Standardisation			BSQ Study Participants		
Variable	Number of items	α (*N* =350)	95% CI α		α (=19)	95% CI for α	
			Lower	Upper		Lower	Upper
Activity	13	.76	.72	.80	.74	.52	.82
Adaptability	12	.72	.67	.76	.85	.73	.93
Approach	11	.80	.77	.83	.58	.23	.81
Distractibility	10	.70	.65	.74	.44	-.03	.75
Intensity	12	.71	.66	.75	.55	.18	.80
Mood	12	.66	.60	.71	.63	.32	.83
Persistence	10	.60	.53	.66	.81	.66	.92
Rhythmicity	9	.48	.39	.56	.65	.35	.84
Threshold	11	.47	.38	.55	.10	-.65	.60

Table 4.6 details the cohort internal and test-retest reliabilities in comparison to those of the standardisation sample. Test retest values for the study cohort took place over

one year rather than one month, again all CIs overlapped with the exception of approach.

Table 4.5 *BSQ internal and test-retest reliabilities for standardisation and study samples*

Variable	*No of items*	*Manual α (N =350)*	*95% CI for α*		Study α (*N* =73)	*95% CI for α*		Manual 1 mth Retest *r* (*N* =53)	95% CI, retest *r*		Study 1yr Retest *r* (*N* =18)	Pearson's 95% CI		Study ICC	95% CI ICC		*f*	*Sig*
			Lower	*Upper*		*Lower*	*Upper*		*Lower*	*Upper*		Lower	upper		lower	upper		
Activity	*13*	*.76*	*.72*	*.80*	*.78*	*.70*	*.85*	*.93***	*.88*	*.96*	.79**	.51	.92	.78	.50	.91	*2.13*	*.16*
Adaptability	*12*	*.72*	*.67*	*.76*	*.78*	*.70*	*.85*	*.85***	*.75*	*.91*	.69**	.33	.88	.69	.34	.87	*.34*	*.98*
Approach	*11*	*.80*	*.77*	*.83*	*.78*	*.70*	*.85*	*.94***	*.90*	*.97*	.60**	.18	.83	.58	.17	.82	*1.80*	*.20*
Distractibility	*10*	*.70*	*.65*	*.74*	*.76*	*.67*	*.83*	*.82***	*.71*	*.89*	.39	-.09	.72	.35	-.13	.70	*3.17*	*.09*
Intensity	*12*	*.71*	*.66*	*.75*	*.69*	*.57*	*.79*	*.75***	*.60*	*.85*	.43	-.05	.75	.42	-.04	.74	*.11*	*.75*
Mood	*12*	*.66*	*.60*	*.71*	*.57*	*.41*	*.70*	*.87***	*.78*	*.92*	.49*	.03	.78	.48	.03	.77	*.59*	*.45*
Persistence	*10*	*.60*	*.53*	*.66*	*.73*	*.63*	*.81*	*.70***	*.53*	*.82*	.65**	.26	.86	.65	.28	.85	*.09*	*.77*
Rhythmicity	*9*	*.48*	*.39*	*.56*	*.64*	*.50*	*.75*	*.80***	*.68*	*.88*	.89**	.72	.96	.88	.70	.95	*4.39*	*.05*
Threshold	*11*	*.47*	*.38*	*.55*	*.42*	*.20*	*.60*	*.67***	*.49*	*.80*	.63**	.23	.85	.61	.21	.83	*.70*	*.42*

4.4.2.3 Adult Temperament Questionnaire

The parents all completed the ATQ at both time points. The internal reliabilities for the study cohort lay within the reliability CIs for the manual standardisation with the exception of threshold, which was lower than the manual 95% CI.

Table 4.6 *ATQ internal reliabilities for standardisation and T1 study samples*

		ATQ Manual Standardisation			ATQ Study Participants		
Variable	No. of items	manual α (*N* =25)	95% CI for α		Study α	95% CI for α	
			Lower	Upper		Lower	Upper
Activity	6	.83	.70	.92	.84	.78	.89
Adaptability	6	.74	.54	.87	.76	.67	.84
Approach	6	.78	.61	.89	.79	.70	.85
Distractibility	6	.72	.51	.86	.66	.53	.76
Intensity	6	.71	.49	.86	.58	.42	.71
Mood	6	.69	.45	.85	.68	.55	.77
Persistence	6	.79	.63	.90	.82	.75	. 87
Rhythmicity	6	.83	.70	.91	.80	.72	.86
Threshold	6	.76	.58	.88	.57	.39	.70

Table 4.7 *ATQ internal and test-retest reliabilities for standardisation and study samples*

Variable	No of items	Manual α (*N* =25)	95% CI for α		Study α	95% CI for α		Manual,1 mth Retest *r* *N* =25	95% CI for retest *r*		Study Retest *r* (1yr)	95% CI		ICC	95% CI for ICC		*f*	Sig
			Lower	Upper		Lower	Upper		Lower	upper		Lower	upper		Lower	Upper		
Activity	6	.83	.70	.92	.89	.85	.93	.90	0.78	0.96	.86	.70	.93	.86	.78	.91	.29	.60
Adaptability	6	.74	.54	.87	.67	.54	.78	.64	0.33	0.83	.72	.46	.87	.72	.59	.82	.03	.86
Approach	6	.78	.61	.89	.83	.76	.89	.85	0.68	0.93	.84	.66	.93	.83	.75	.99	.01	.94
Distractability	6	.72	.51	.86	.66	.53	.76	.70	0.42	0.86	.62	.29	.81	.62	.45	.74	.00	.98
Intensity	6	.71	.49	.86	.52	.33	.68	.84	0.67	0.93	.72	.45	.87	.71	.58	.81	.02	.90
Mood	6	.69	.45	.85	.74	.64	.82	.82	0.63	0.92	.74	.49	.88	.74	.62	.83	.03	.87
Persistence	6	.79	.63	.90	.79	.70	.86	.66	0.36	0.84	.86	.71	.94	.86	.79	.19	.05	3.87
Rhythmicity	6	.83	.70	.91	.85	.79	.90	.89	0.76	0.95	.74	.49	.88	.74	.61	.83	.30	.58
Threshold	6	.76	.58	.88	.39	.14	.58	.76	0.52	0.89	.60	.27	.80	.60	.43	.73	.12	.74

4.5 Presentation of the research questions and the analyses conducted

The overarching aim of this exploratory study was to investigate if there was a difference in outcomes for children referred to SLT with delayed speech and language development that related to temperament, i.e. is temperament a risk factor for language delay and can some temperament characteristics support good outcomes for children with language delay?

To interrogate the data in relation to this aim, a series of more defined questions were addressed and these are presented in Table 4.8 below.

Table 4.8 *Research aims and questions*

1. To describe the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two points, 12 months apart.
a. Do the children have a receptive language delay, as measured by the PLS3-UK?
b. Do the children have an expressive language delay, as measured by the PLS3-UK?
c. Do the children have a receptive language delay, as measured by the PLS3-UK after 1 year?
d. Had the children made progress in receptive language skills after 1 year?
e. Do the children have an expressive language delay, as measured by the PLS3-UK, after 1 year?
f. How much progress do children make in expressive language skills after 1 year?
g. What is the relationship between receptive and expressive language skills after one year?
h. Do auditory comprehension and expressive communication scores at entry to the study (T1) predict auditory comprehension scores after 12 months (T2)?

i. Do auditory comprehension and expressive communication scores at entry to the study predict expressive communication scores after 12 months (T2)?
2. To describe the temperament characteristics of a group of pre-school children accepted on to the caseload of community SLT services.
a. What were the temperament characteristics of the cohort at referral to SLT/ entry to the study?
b. Does the cohort's temperament differ from the normative temperament data at the start of the study?
c. What were the temperament characteristics of the cohort after 12 months (at T2)?
d. Does the cohort's temperament differ from the normative data after 12 months?
e. How stable are temperament features after 12 months?
3. To describe the temperament characteristics of the parents of the cohort.
a. What were the temperament characteristics of the parent cohort at entry to the study?
b. Does the parent cohort's temperament differ from the normative temperament data at the start of the study
c. What were the parent cohort's temperament characteristics after 12 months (at T2)?
d. Does the parent cohort's temperament differ from the normative data after 12 months?
e. How stable are temperament features after 1 year?
4. To investigate relationships between the temperament dimensions, which differ from normative expectations, auditory comprehension and expressive communication performance, and temperament variables associated with language differences from the literature.
a. Do adaptability and persistence at entry to the study (T1), along with T1 auditory comprehension scores, further develop the prediction of auditory comprehension scores after 12 months (T2)?
b. Do any temperament dimensions, along with T1 auditory comprehension scores, further develop the prediction of auditory comprehension scores after 12 months (T2)?
c. Do adaptability and persistence at entry to the study (T1), along with T1 auditory comprehension scores and T1 expressive communication scores, further develop the prediction of expressive communication scores after 12 months (T2)?

d. Do any temperament dimensions, along with T1 auditory comprehension, expressive communication, adaptability and persistence scores, further develop the prediction of expressive communication scores after 12 months (T2)?
5. **To investigate relationships between cohort auditory comprehension and expressive communication T2 outcomes and parent ratings of child manageability.**
a. What are parents' ratings of their child's manageability at entry to the study?
b. What are parents' ratings of their child's manageability after 12 months (T2)?
c. How stable are parents' ratings of their child's manageability over a 1 year period.
d. What is the change in manageability scores over 12 months?
e What is the relationship between T2 auditory comprehension scores and parents' T1 ratings of manageability?
f. What is the relationship between T2 expressive communication scores and parents' T1 ratings of manageability?
g. Is there a relationship between absolute change in auditory comprehension scores from T1 to T2 and change in manageability ratings from T1 to T2?
h. Is there a relationship between absolute change in expressive communication scores from T1 to T2 and change in manageability ratings from T1 to T2?
i. Do parental ratings of manageability at T1, along with T1 auditory comprehension scores, and T1 distractibility scores contribute to the prediction of auditory comprehension scores after 12 months (T2)?
j. Do parental ratings of manageability at T1, along with T1 auditory comprehension scores, T1 expressive communication scores and T1 adaptability and persistence scores contribute to the prediction of expressive communication scores after 12 months (T2)?
6. **To investigate relationships between biographical and demographic variables alongside any previously identified predictors of cohort auditory comprehension and expressive communication T2 outcomes.**

a. Do associations exist between biographical and demographic variables and T2 auditory comprehension and T2 expressive communication scores?
b. Do the addition of biographical and demographic variables improve the prediction of T2 auditory comprehension scores?
c. Do the addition of demographic and biographical variables improve the prediction of T2 expressive communication scores?

4.5.1 Research aim 1

To describe the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two time points, 12 months apart.

4.5.1.1 Did the children have a receptive language delay, as measured by a formal language test (the PLS3-UK) at entry to the study?

The mean auditory comprehension standard score for the cohort (*N* =80) at entry to the study was 87.98, with an *SD* of 17.97 and mode of 88, in comparison to the test manual mean of 100 and *SD* of 15.

Of the children, 47% had comprehension scores below 1*SD* of the test manual mean, 44.3% had scores within +/- 1*SD* of the mean and 8.7% of the children had scores 1*SD* or more above the mean. Using the PLS3-UK manual definitions for language impairment, this equated to 47% of the cohort having a measurable delay in their auditory comprehension (see Table 4.9).

Table 4.9 *Relationship between PLS3-UK scores and clinical categories*

Standard scores	Relation to mean	Description of ability	Distribution of cohort scores
116 and above	above 1 *SD*	Above average development	7 (9%)
115 - 85	-1 to +1 *SD*	Within expected development	37 (46%)
77- 84	-1 to -1.5 *SD*	Mild difficulty	14 (17.5%)
70 - 76	-1.5 to -2 *SD*	Moderate difficulty	6 (7.5%)
69 and below	Below 2 *SD*	Severe difficulty	16 (20%)

The distribution of the cohort data, it showed a small positive skew, 0.27 and negative kurtosis, -0.60, both of these lay within the twice the standard error cut-off limit for acceptability (Tabachnick and Fidell, 2013). Such deviations were expected within a standardised test administered to a cohort, which had attracted clinical concern. The KS test showed the data were suitable to be treated as normally distributed, $D(80) = .07$, $p = .200$

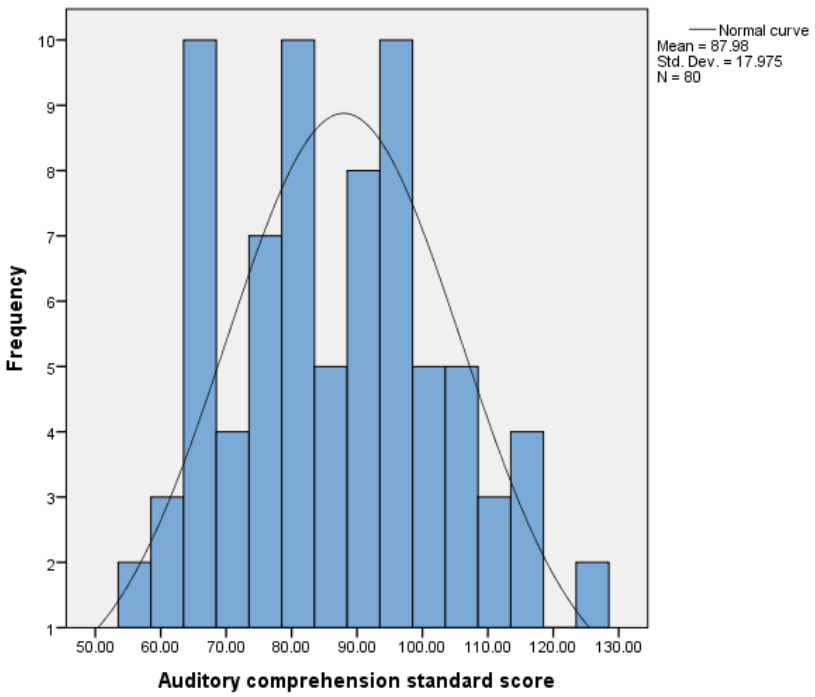


Figure 4.9. Distribution of Auditory Comprehension scores at T1.

Further inspection of comprehension scores by age band (see Table 4.11) showed that the youngest children obtained the highest comprehension scores, with a group mean (*n* =24) of 97.96. There was a noticeable trend of the standardised mean scores becoming lower for each age band. Smaller numbers of children populated these groups and are likely to have affected the means, though in unknown ways. Furthermore, raw scores increased with each age band but transformation to standard scores demonstrated that older children were falling behind relative to the normative population.

Table 4.10 *Cohort PLS3-UK auditory comprehension scores at T1*

		Auditory Comprehension					
Age	*N*	Mean raw score	Mean standard score	95% CI	Range	*SD*	Standard error
Full cohort	80	21.94	87.98	84.06 to 91.90	75 (56-131)	17.97	2.00
2;00–2;05	24 [3]	21.13	97.96	90.75 to 105.17	66 (65-131)	18.05	3.68
2;06–2;11	35 [3]	21.09	85.37	79.47 to 91.27	65 (59-124)	17.79	3.01
3;00–3;05	18 [1]	24.00	81.50	75.25 to 87.75	50 (56-106)	13.55	3.19
3;06–3;11	3 [1]	26	77.33	60.85 to 93.81	27 (67-94)	14.57	8.41
4;00–4;05	0	-	-	-	-	-	-
4;06–4;11	0	-	-	-	-	-	-

Note. [x]= number of children who completed T1 only

4.5.1.1.1 Auditory comprehension scores of T1 only children

Not all the participants completed the study and prior to looking at T2 scores, it was important to investigate how the non-completers may have affected the cohort. Their sample characteristics were presented in section 4.3.2. These children were also part of the whole T1 cohort data presented above in section 4.2.

The eight children who did not complete the study were distributed across the three youngest age bands at the initial point of data collection (see Table 4.11). Looking specifically at their auditory comprehension scores, their mean score was 77.13 (*SD* =14.81). This mean was lower than the whole cohort mean of 87.98 although the 95% CIs for the whole cohort and the non-completers did overlap.

Inspection of individual scores revealed that all eight scores fell within the range of the whole cohort, rather than at the edges of the distribution. It is likely that the differences shown by the descriptive statistics are the result of drawing such a small sample. However, although the range and *SD* is unaffected by the children who did not complete the study, their inclusion did reduce the raw score mean by 3.31 points and the standardised mean by 1.2, to 87.98. This is important to note in interpreting progress at T2, which may be slightly inflated due to the eight non-completer children having lower than mean scores at T1

Table 4.11 *PLS3-UK auditory comprehension scores for T1 whole cohort, study completers and study non-completers.*

		Auditory Comprehension					
	N	Mean raw score	Mean standard score	95% CI	Range	*SD*	Standard error
T1 Full cohort	80	21.94	87.98	84.06 - 91.90	75 (56-131)	17.97	2.00
T1 & T2 group	72	22.31	89.18	85.03 - 93.33	75 (56-131)	17.97	2.12
T1 only group	8	18.63	77.13	66.80 - 87.38	43 (59-102)	14.81	5.23

The T1 only (*n* =8) and the T1 +T2 (*n* =72) groups were investigated for normality of distribution. The KS test, chosen because of the sample size in the T1 and T2 group, showed the data were suitable to be treated as normally distributed; T1 only group *D*(8) =.16, *p* =.200 and the T1 & T2 group *D*(72) =.06, *p* =.200.

To establish the difference in standardised mean scores for the children who did and did not complete the study, an independent samples *t*-test was used; *t*(78) =2.13, bias

corrected and accelerated (BCa) bootstrapped 95% CI [0.01, 23.06, sample = 10.000], *p* =.070 (two tailed) (Bonett, 2009). This confirmed that auditory comprehension at T1 did not vary significantly between the children who did and did not complete the study at T2. This finding supports the use of data from the full cohort in analysis of T1 data, adding to the power of the sample.

4.5.1.2 Do the children have an expressive language delay, as measured by the PLS3-UK?

The mean expressive communication score for the cohort at entry to the study was 74.80, with an *SD* of 9.71 and mode of 69, in comparison to the test manual mean of 100 and *SD* of 15.

Within the cohort, 85% of the children had expressive communication scores 1*SD* or more below the test manual mean, 15% had scores within +/- 1*SD* of the mean and none of the children had scores 1*SD* or more above the mean. Using the PLS3-UK manual definitions for language impairment, this equated to 85% of the cohort having a measurable delay in their expressive communication (see Table 4.19).

The data distribution showed a significant positive skew, 0.84. This lay outside twice the standard error cut-off limit for acceptability (SE of skewness 0.27), z score of skew; 0.836 ÷ 0.269 = 3.108. Kurtosis was positive, 0.89, and lay within twice the SE. These deviations were expected within a standardised test administered to a cohort that had attracted clinical concern.

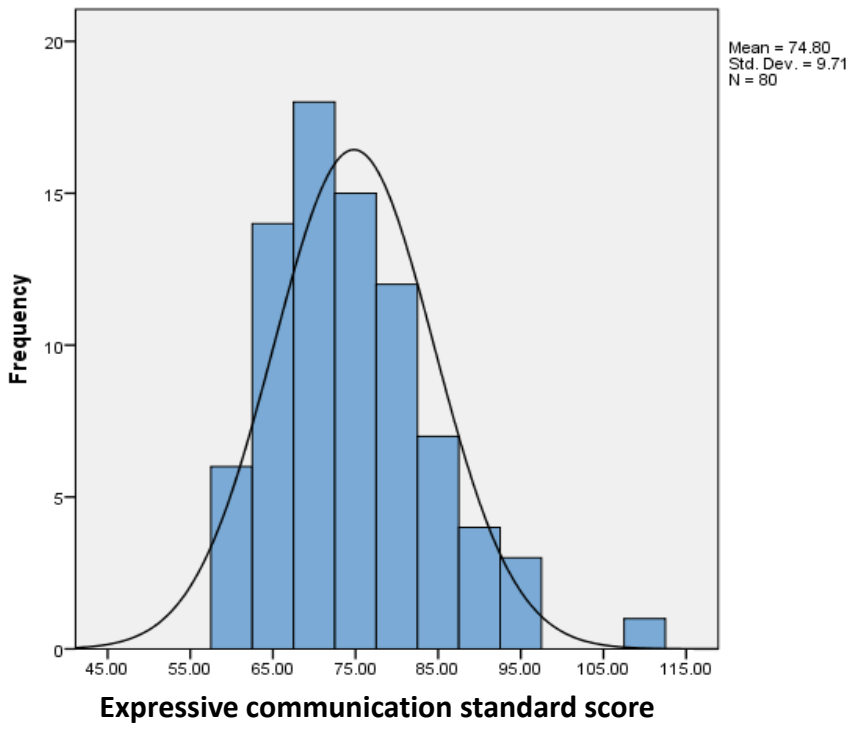


Figure 4.10. Distribution of Expressive Communication scores at T1.

The KS test showed that the data were not likely to be following a normal distribution, $D(80) = .10$, $p = .039$**.** This presented a difficulty in taking the data forward for parametric analysis since such analysis is predicated on the minimum assumption of normally distributed data, with specific tests each requiring additional assumptions to be met.

Therefore, the implications for further parametric tests depended on whether it was the data going forward for *further* analysis that was not distributed normally i.e. the data relating to participants who completed the study, rather than the whole T1 cohort. The KS test showed the T1 data relating to the participants who completed at T1 and T2 was not statistically significantly different from a normal distribution at 5% level $D(72) = .10$, $p = .096$. This suggests that although the data did clearly show a positive skew, they were generally acceptable for parametric analysis. The suitability of

the data was considered, prior to conducting specific parametric tests to ensure that all data assumptions were fulfilled.

Further inspection of expressive scores by age band (see Table 4.12 *PLS3-UK cohort expressive communication scores at T1*) showed that the youngest children obtained the widest range of scores (range =48), with the range reduced by half in the oldest age band represented (24). It is a noticeable feature that mean standardised scores show little variation across age bands. This is likely to reflect that the cohort have been referred to SLT services because of concern about their language development.

4.5.1.2.1 Expressive communication scores of T1 only children

Not all the participants completed the study and prior to looking at scores from T2 data collection it was important to investigate how the non-completers may have affected the remaining cohort. The sample characteristics of the non-completers is presented in section 4.3.2. These children are also part of the whole cohort data presented above.

The eight children who did not complete the study at T2 were distributed across the three youngest age bands at the initial point of data collection (see Table 4.12). Looking specifically at their expressive communication scores, the mean score for the children was 70.25 (*SD* =4.03). This mean was lower than the whole cohort mean of 74.80, although the 95% CIs for the whole cohort and the non-completers did involve overlap (see Table 4.12).

Inspection of individual scores revealed that all eight scores fell within the range of the whole cohort rather than at the edge of the distribution. It is likely that the differences shown by these descriptive statistics are the result of the small sample. The *SD* and range for the T1 only group was small suggesting these eight children had similar expressive communication scores to each other. The inclusion of the T1 only group as part of the whole cohort did reduce the standardised mean by 0.50, to 74.80. This was important to be aware of when interpreting progress at T2, which may have been slightly inflated due to the eight non-completer children having lower than mean scores at T1.

The T1 only (n =8) and the T1 & T2 (n =72) groups were investigated for normality of distribution. The KS test, chosen because of the T1 & T2 group size, showed the data were suitable to be treated as normally distributed; T1 only $D(8) = .21$, $p = .200$; T1 & T2 $D(72) = .10$, $p = .096$.

Table 4.12 *PLS3-UK cohort expressive communication scores at T1*

		Expressive Communication					
Age	*N*	Mean raw score	Mean standard score	95% CI	Range	*SD*	Standard Error
Full cohort	80	16.29	74.80	72.63 -76.96	49(60-109)	9.71	1.09
2;00–2;05	24 [3]	13.83	76.20	71.62 - 80.78	48(61-109)	11.44	2.34
2;06–2;11	35 [3]	16.09	73.46	71.07 - 75.85	26 (61-87)	7.24	1.22
3;00–3;05	18 [1]	18.61	74.61	71.98 -77.24	33 (60-93)	11.17	2.63
3;06–3;11	3 [1]	24.33	80.33	65.79 - 94.87	24 (71-95)	12.86	7.42
4;00–4;05	0	-	-	-	-	-	-
4;06–4;11	0	-	-	-	-	-	-

[n] = non-completers

Table 4.13 *PLS3-UK cohort expressive communication scores (whole T1 cohort, study completers and study non completers).*

		Expressive Communication				
	N	Mean standard score	95% CI	Range	*SD*	Standard error
Full cohort	80	74.80	72.63-76.96	49 (60-109)	9.71	1.09
T1 & T2	72	75.30	72.99–77.61	49 (60-109)	10.04	1.18
T1 only	8	70.25	67.47–73.03	12 (67-79)	4.03	1.42

Therefore, to establish the difference in standardised mean scores for the children who did and did not complete the study, an independent samples *t*-test was used. Levene's test for equality of variances identified that equality of variance could not be assumed for the mean difference in standard score, $t(78) = 2.73$, BCa bootstrapped 95% CI [1.27, 8.60], $p = .013$ (two tailed). This represented a moderate effect size, Cohen's $d = 0.65$ and confirmed that expressive communication at T1 was higher for the children who completed the study at T2.

The exclusion of the eight children who did not complete the study may have raised the expressive communication scores of the T2 group and thus added some positive bias to scores at T2. However, the literature (see section 2.8) identifies that variability characterises outcomes and so no firm conclusion can be drawn.

4.5.1.3 Do the children have a receptive language delay, as measured by a formal language test after 1 year?

At the second point of data collection, T2 (T2), the cohort included 72 children. The mean auditory comprehension score for the cohort at T2 was 100.49, with a *SD* of 20.73 and mode of 90, in comparison to the test manual mean of 100 and *SD* of 15.

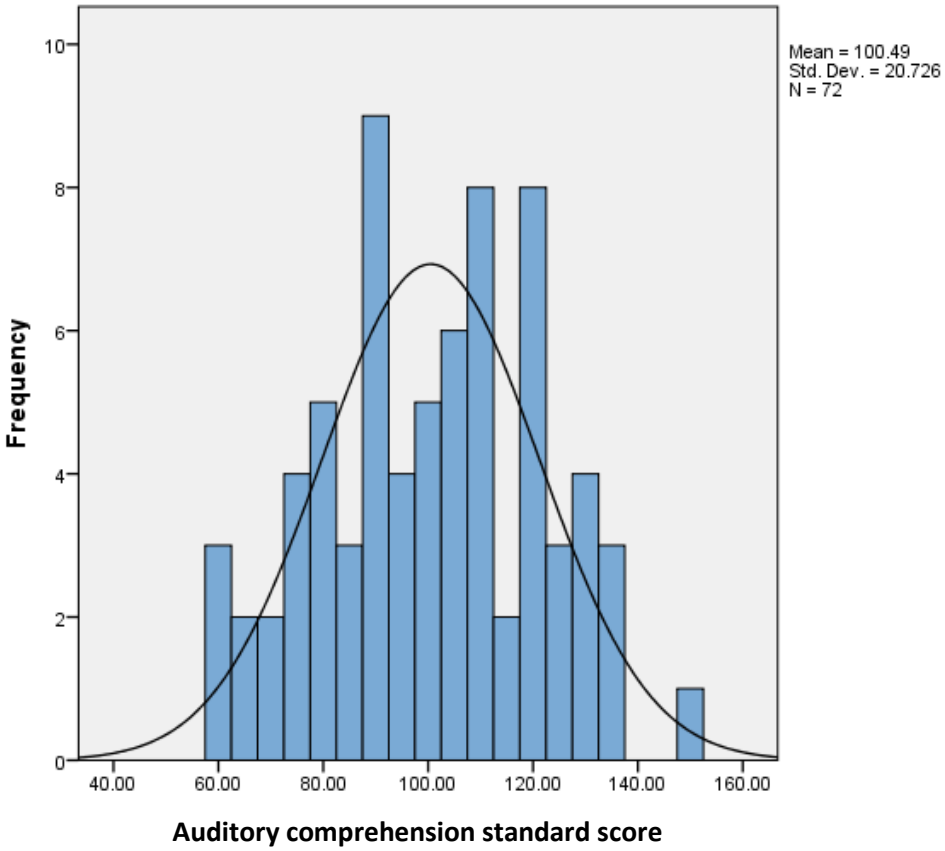


Figure 4.11. PLS3-UK cohort auditory comprehension scores at T2.

Twenty-five percent of the children had comprehension scores one 1*SD* or more below the test manual mean, 48.6% had scores within +/- 1*SD* of the mean and 26.39% of the children had scores 1*SD* or more above the mean. Using the PLS3-UK manual

definitions for language impairment, this equated to 25% of the cohort having a measurable delay in their auditory comprehension (see *Figure 4.24*) 12 months after their acceptance into SLT services.

The distribution of the cohort data showed a small negative skew, -0.07 and negative kurtosis, -0.67, both within acceptable limits. The KS test showed the data were suitable to be treated as normally distributed, $D(72) = .07$, $p = .200$.

Inspection of comprehension scores by age band (see Table 4.14) shows that the trend from T1 of the youngest children obtaining the highest comprehension scores, has been maintained, with mean scores becoming lower for each age band, however smaller numbers of children populate these older groups and this is likely to be affecting the means in unknown ways.

Table 4.14 *Cohort PLS3-UK auditory comprehension scores at T2*

		Auditory Comprehension					
Age	*N*	Mean raw score	Mean standard score	95% CI	Range	*SD*	Standard Error
Full cohort	72	35.64	100.49	95.71 - 105.27	88 (60-148)	20.73	2.44
2;00 – 2;05	-	-	-	-	-	-	-
2;06 – 2;11	-	-	-	-	-	-	-
3;00 – 3;05	18	34.63	108.39	98.45 – 118.33	86 (62-148)	21.52	5.07
3;06 – 3;11	33	35.56	101.82	94.94 – 108.70	73 (61-134)	20.18	3.51
4;00 – 4;05	18	36.28	92.28	83.34 – 101.22	68 (60-128)	19.35	4.56
4;06 – 4;11	3	39.00	87.67	72.89 – 102.45	25 (73-98)	13.05	7.54

4.5.1.4 Had the children made progress in receptive language skills after 1 year?

To establish the progress made in auditory comprehension over 12 months, a paired *t*-test was used on standardised scores: $t(71) = -8.86$, $p < .001$ (one tailed), confirming that auditory comprehension at T2 showed a statistically significant improvement. This represented a medium effect size; Cohens' $d = .58$, 95% CI [0.42, 0.73]. A one tailed test was selected, despite the use of standardised scores which account for age, due to the theoretical consensus in the literature that ELD resolves and so it was anticipated that children could make progress, such that they were able to 'catch up' with typically developing peers, in order to resolve their ELD.

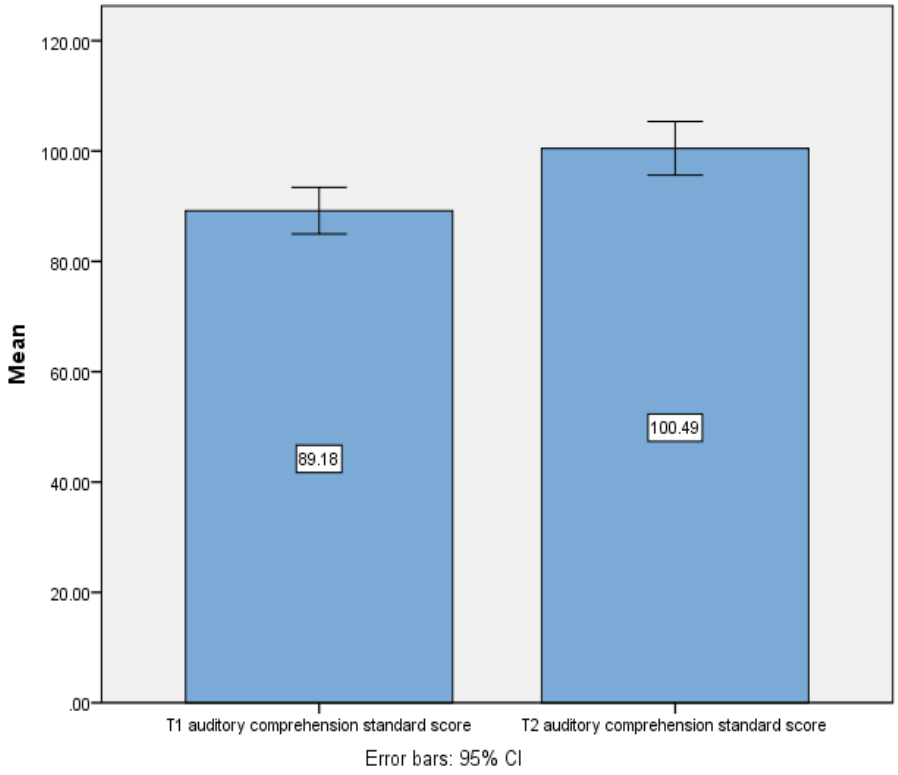
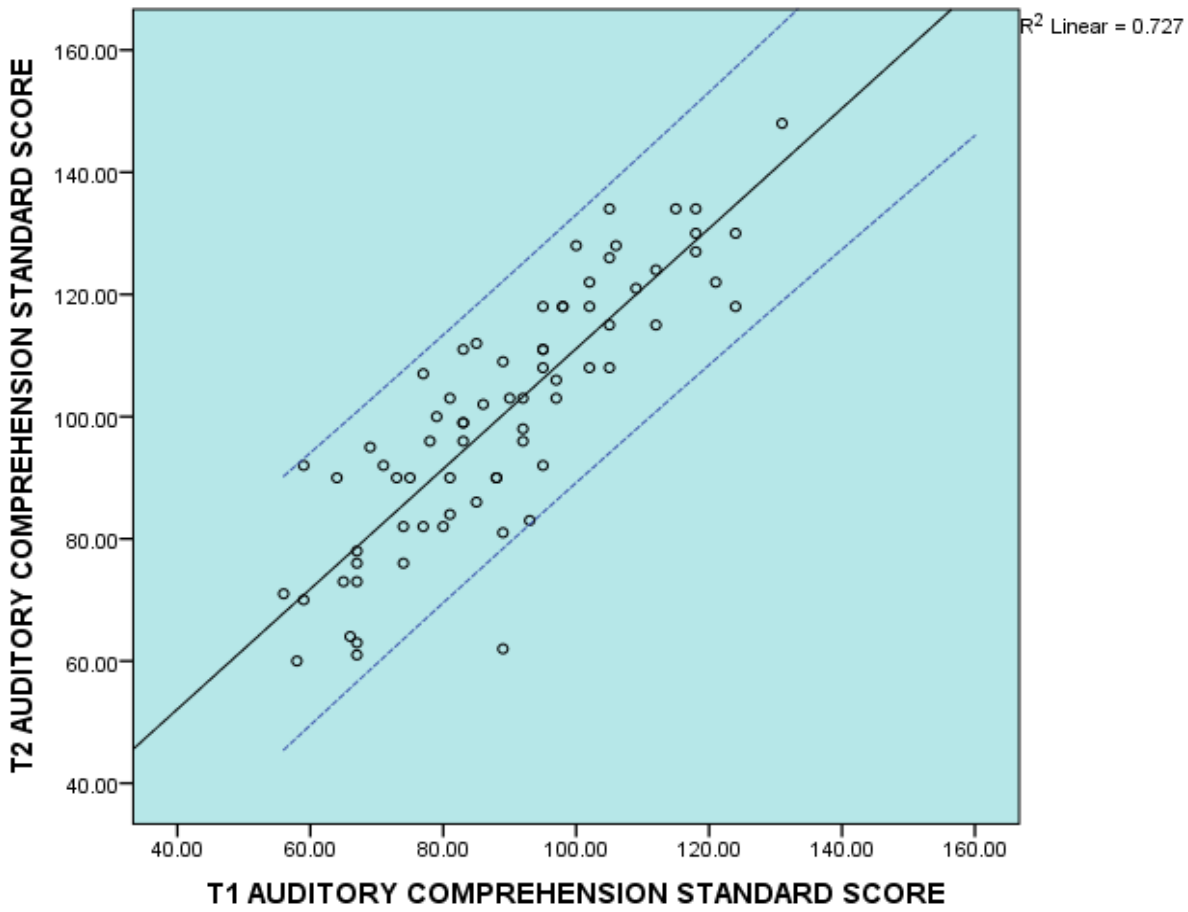


Figure 4.12. Difference of mean standard scores for auditory comprehension at T1 and T2.

The strength of the relationship between auditory comprehension scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (70) =.853, BCa 95% bootstrapped CI [.78, .91], $p < .001$.

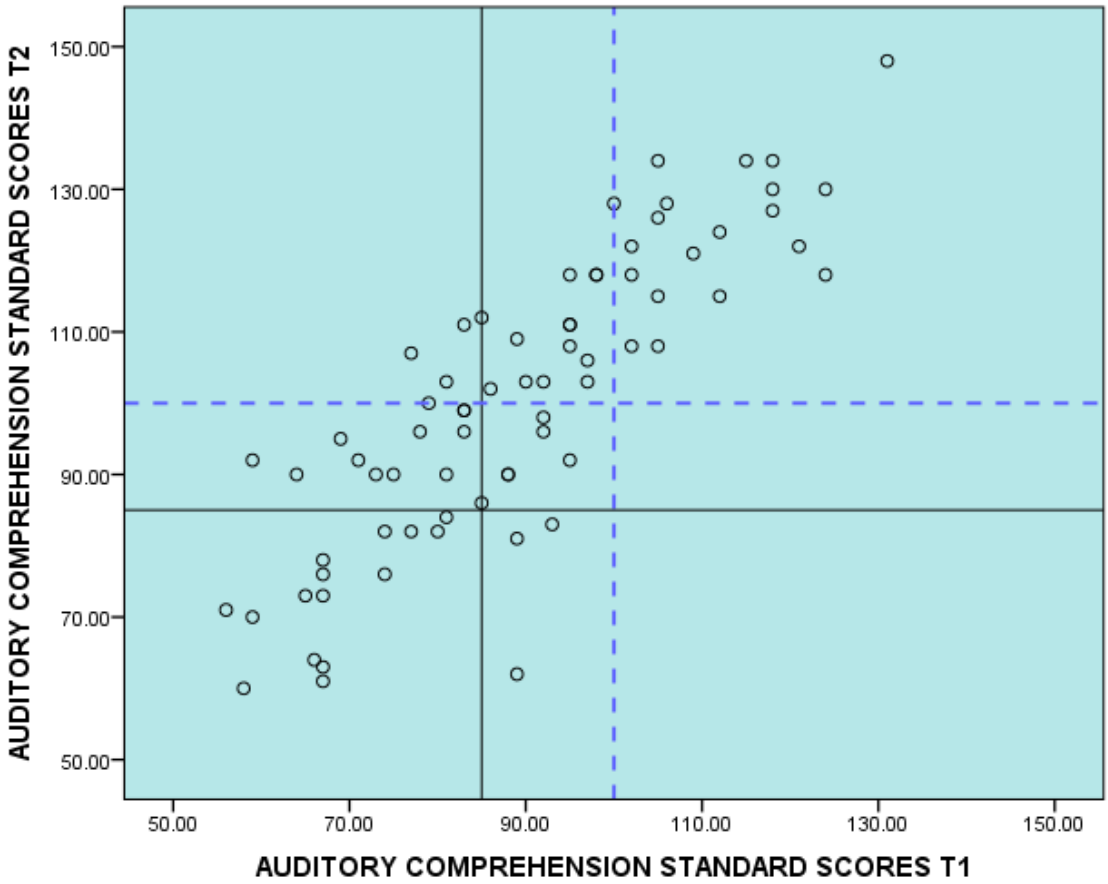


_____ = regression line ------- = 95% confidence interval

Figure 4.13. Scatterplot of auditory comprehension scores at T1 and T2.

Closer inspection of the T1 vs T2 relationship for auditory comprehension revealed that no children had *developed* auditory comprehension problems at T2. The majority of the cohort had maintained a relatively stable position which showed modest

improvement, represented by an average eleven point increase overall (where 15 =1*SD*), with a few children resolving their auditory comprehension difficulties by T2 (see *Figure 4.14*).



- - - - - = PLS3-UK manual mean (100), _____= PLS -1*SD* (85)

Figure 4.14. Scatterplot of auditory comprehension scores at T1 and T2.

4.5.1.4.1 Auditory comprehension change

To further investigate the change in auditory comprehension scores across the 12 month period, a value for the amount of change was calculated as:

T2 auditory comprehension standard score (T2AC) – T1 auditory comprehension standard score (T1AC) = AC change

The mean for the 'auditory comprehension change' variable was 11.38, 95% CI [8.99, 13.78]. There was a wide range in scores of 50 points [-17, 33], suggesting that some children made less than their expected developmental progress during the year whilst others accelerated in the development of their auditory comprehension. The data (see *Figure 4.15*) showed a negative skew of -0.22 and kurtosis, -0.17. These values fell within acceptability limits and the KS test confirmed a normal distribution, $D(70) = .06$, $p = .200$.

Figure 4.15. Distribution of change in auditory comprehension scores across T1 and T2.

For a majority of children, an increase in standard score over 12 months was seen (89%), though a minority of the group had no change evidenced in their standard scores (11%).

4.5.1.5 Do the children have an expressive language delay, as measured by a formal language test after 1 year?

At the second point of data collection, the cohort included 72 children. The expressive communication mean score for the cohort at T2 was 87.81, with a standard deviation of 18.72 and modes of 81 and 100, in comparison to the test manual mean of 100 and *SD* of 15.

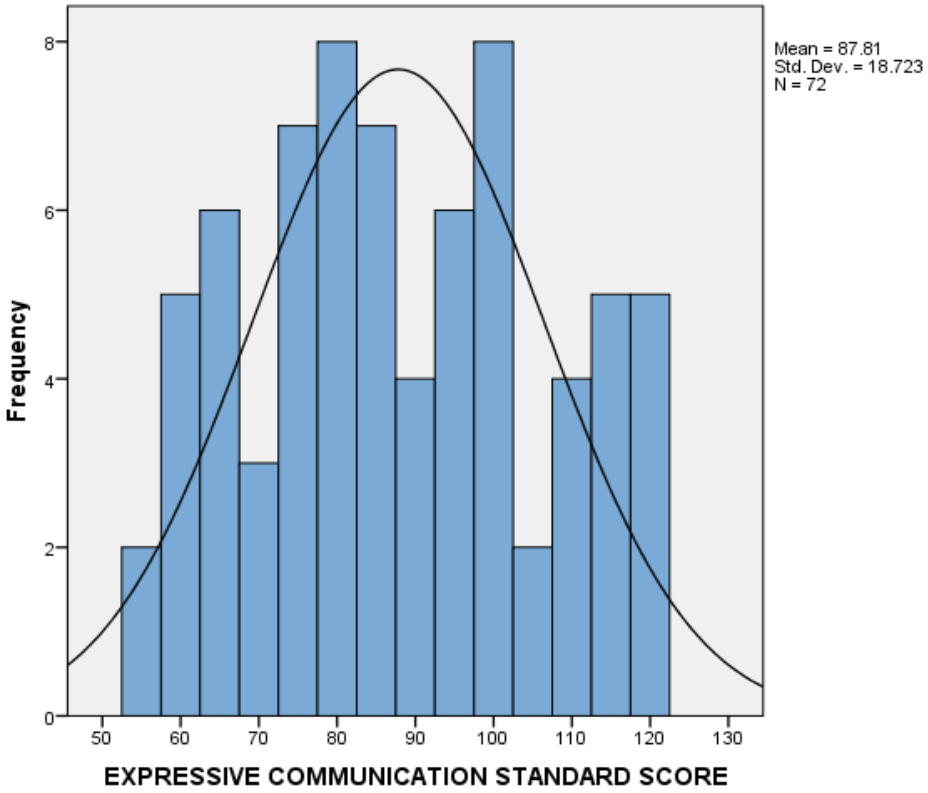


Figure 4.16. Distribution of Expressive Communication scores at T2.

Fifty percent of the children had expressive communication scores 1*SD* or more below the test manual mean, 38.9% had scores within +/- 1*SD* of the mean and 11.1% of the children had scores 1*SD* or more above the mean. Using the PLS3-UK manual definitions for language impairment, this equated to 50% of the cohort having a measurable delay in their expressive communication (Figure 4.16) 12 months after their acceptance into SLT services.

Looking at the distribution of the cohort data, it showed a small positive skew, 0.12 which was less than half the standard error (SE =0.28) and negative kurtosis, -0.97. The KS test showed the data were suitable to be treated as normally distributed, $D(72) = .07$, $p = .200$.

Further inspection of expressive scores by age band (see Table 4.15, below) showed that the trend from T1 of the mean scores being closely clustered across age bands, was maintained.

Table 4.15 *Cohort PLS3-UK expressive communication scores at T2*

		Expressive Communication					
Age	*N*	Mean raw score	Mean standard score	95% CI	Range	*SD*	Standard Error
Full cohort	72	28.11	87.81	83.48–92.14	66 (55-121)	18.72	2.21
2;00 – 2;05	-	-	-	-	-	-	-
2;06 – 2;11	-	-	-	-	-	-	-
3;00 – 3;05	18	26.37	94.89	86.05–103.73	62 (58-120)	19.15	4.51
3;06 – 3;11	33	27.44	87.30	81.24–93.36	60 (61-121)	17.73	3.09
4;00 – 4;05	18	29.89	82.22	73.18–91.26	58 (55-113)	19.56	4.61
4;06 – 4;11	3	35.67	84.33	64.91–103.75	34 (66-100)	17.16	9.91

4.5.1.6 How much progress do children make in expressive language skills after 1 year?

To establish the progress made in expressive communication during 12 months, a paired *t*-test was used: $t(71) = -6.85$, $p < .001$ (one tailed). This confirmed that expressive communication at T2 was significantly improved (see *Figure 4.17*) and represented a large effect size $d = 0.83$.

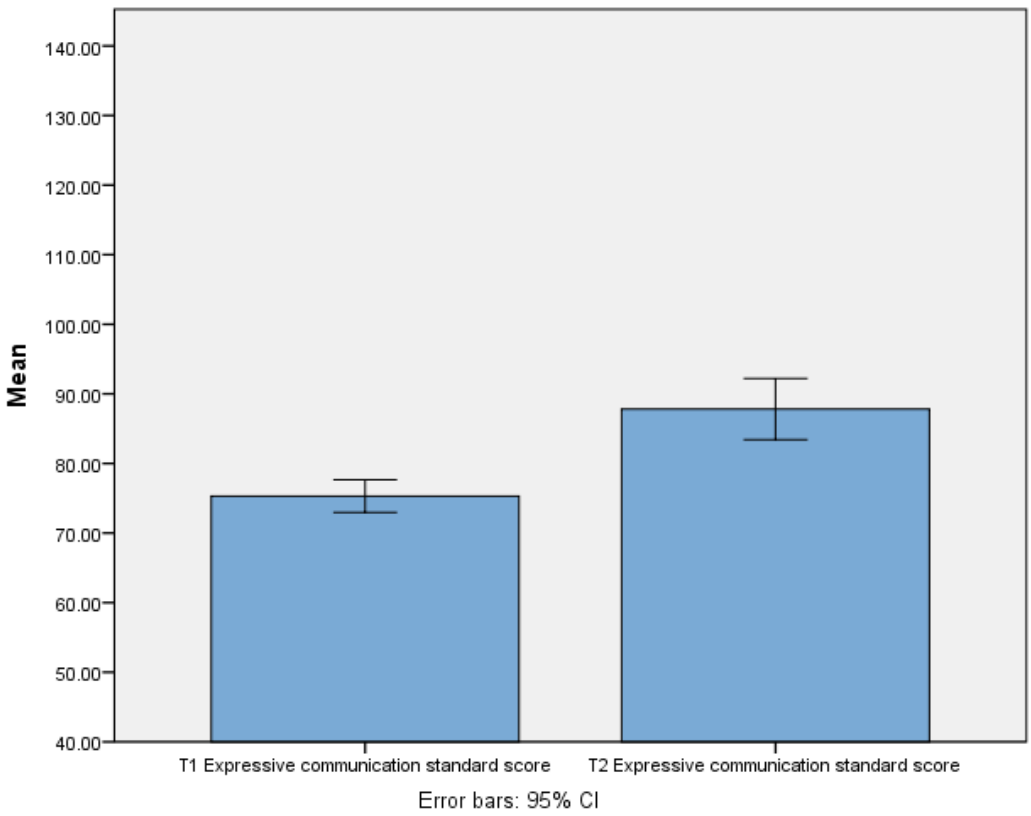
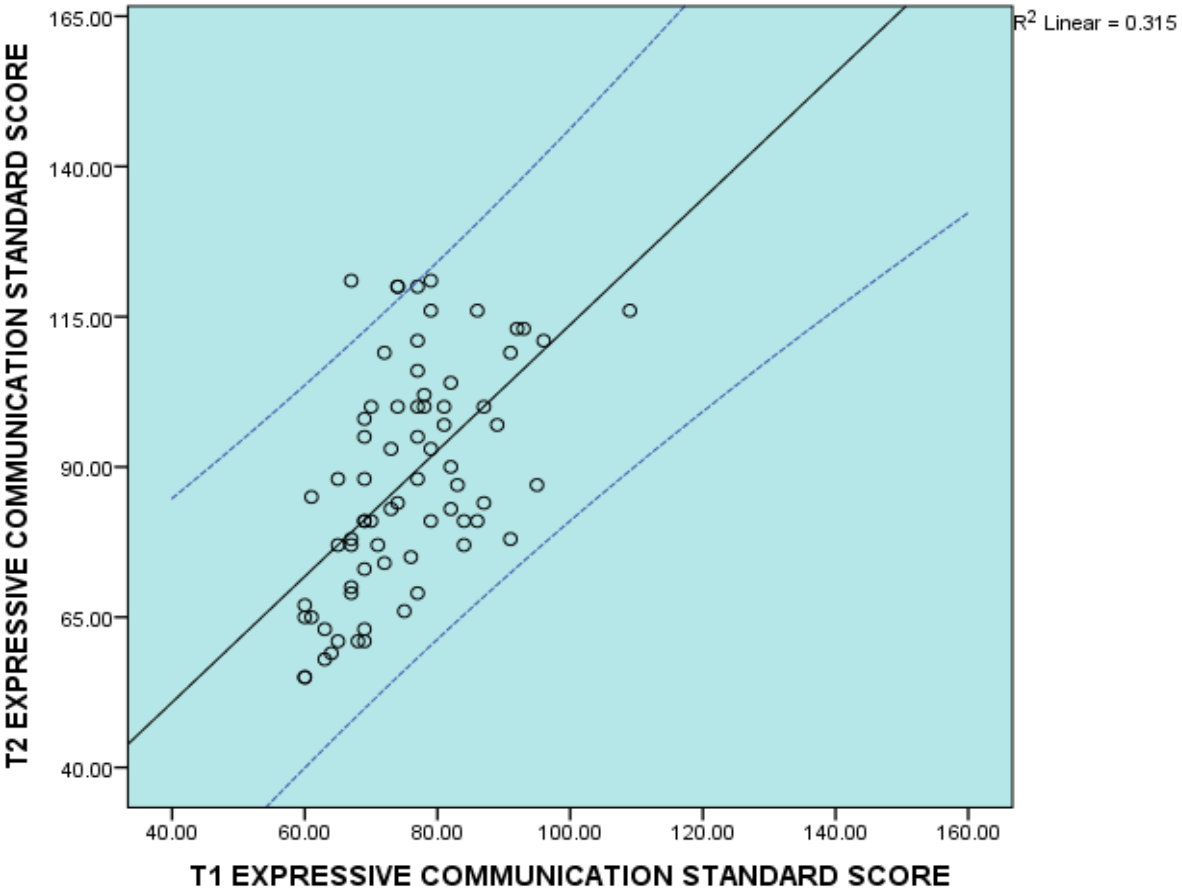


Figure 4.17. Difference between mean standard scores for expressive communication at T1 and T2.

The strength of the relationship between expressive communication scores at T1 and T2 showed a positive correlation: Pearson's $r(70) = .56$, BCa 95% CI [.38, .71], $p < .01$ (see *Figure 4.18*)

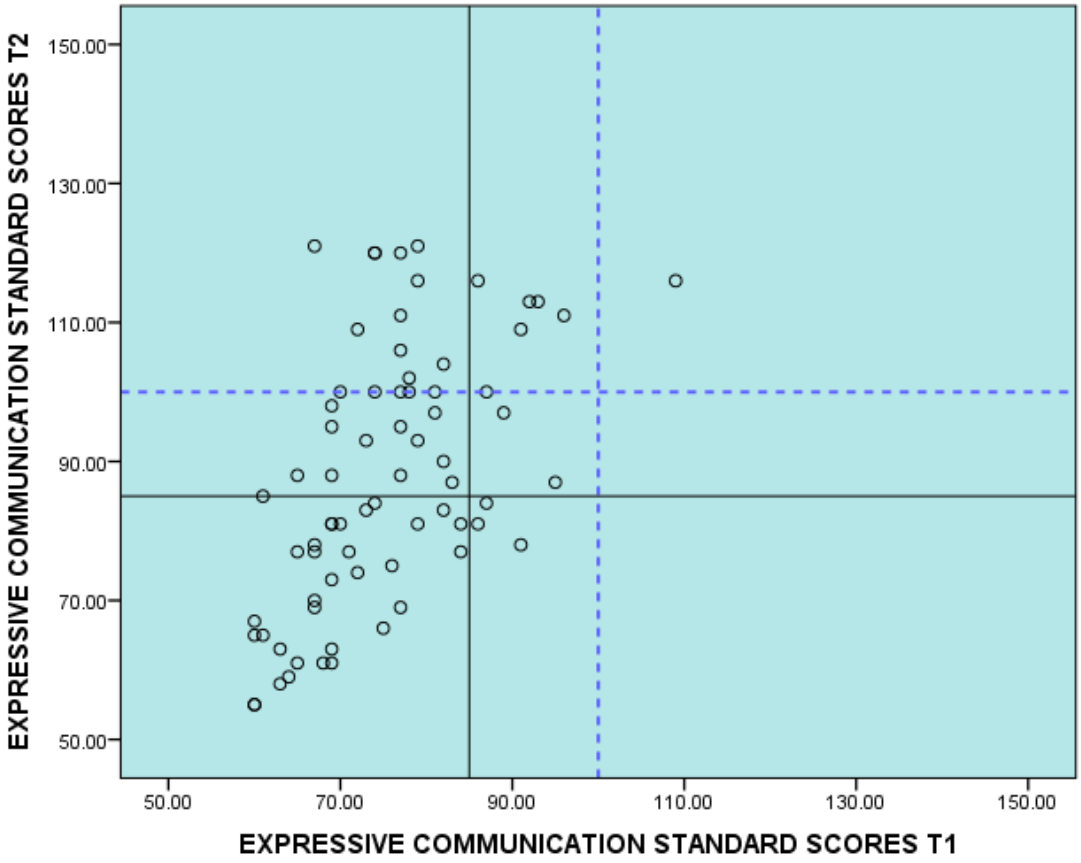


_____= regression line, - - - - - = 95% confidence interval

Figure 4.18. Scatterplot of expressive communication scores at T1 and T2.

4.5.1.6.1 The children's progress as a cohort.

Closer inspection of the T1 vs T2 relationship for expressive communication revealed that none of the children had developed new expressive communication problems by T2. Many of the cohort maintained a stable position with a similar number resolving their expressive communication difficulties by T2 (*Figure 4.19* below).



_____ = PLS -1*SD* (85) - - - - - = PLS manual mean (100),

Figure 4.19. Scatterplot of expressive communication scores at T1 and T2.

4.5.1.6.2 Expressive communication change

To further investigate the change in expressive communication scores across the 12 month period, a value for the amount of change was calculated as:

> T2 expressive communication standard score (T2EC) – T1 expressive communication standard score (T1EC) = expressive communication change

The mean for the 'expressive communication change' variable was 11.65, 95% CI [8.18, 15.25]. There was a wide range in scores of 67 points [-13, 54], suggesting that some children made less than their expected developmental progress during the year whilst

others accelerated in the development of their expressive communication skills. The data distribution showed a positive skew (0.67) and a negative kurtosis (-0.20) and the KS test confirmed a normal distribution, *D*(70) =.09, *p* =.200 (see *Figure 4.20*).

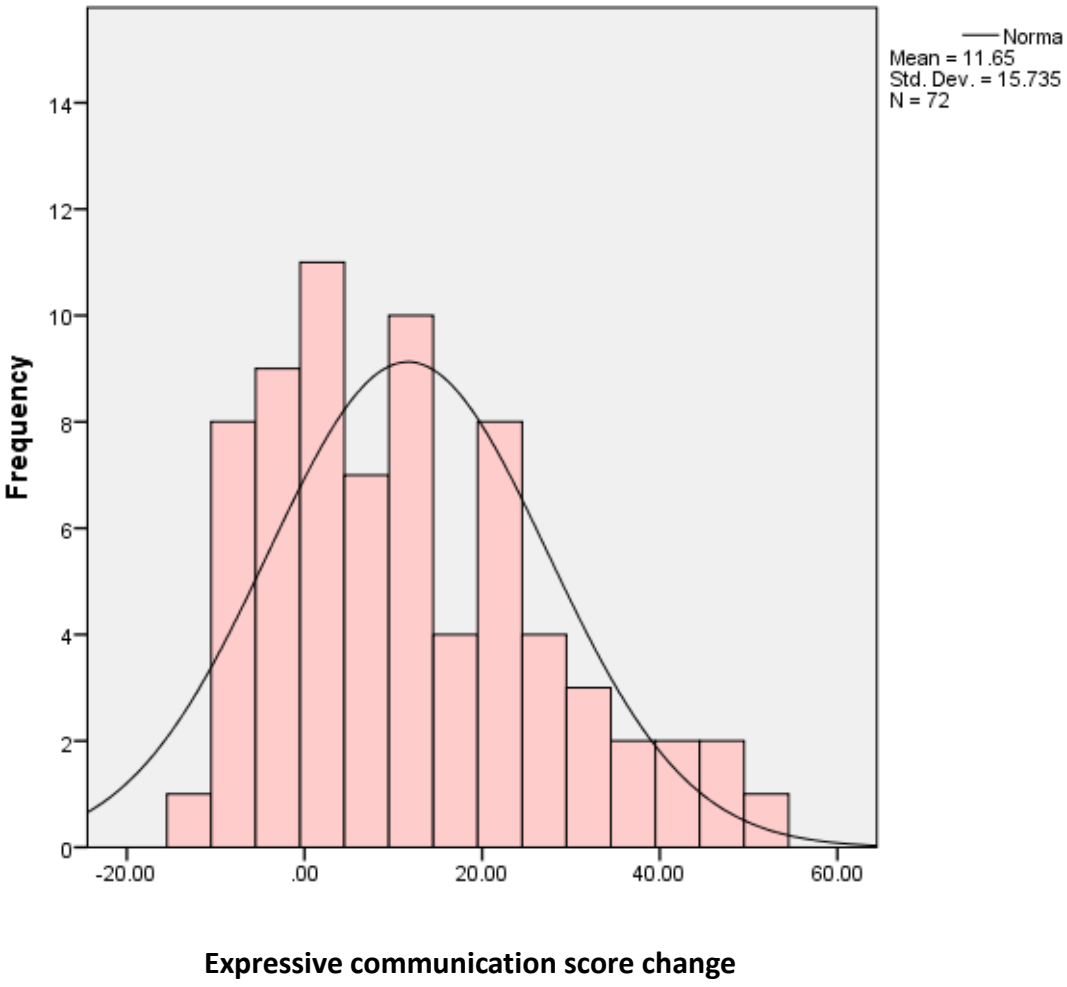
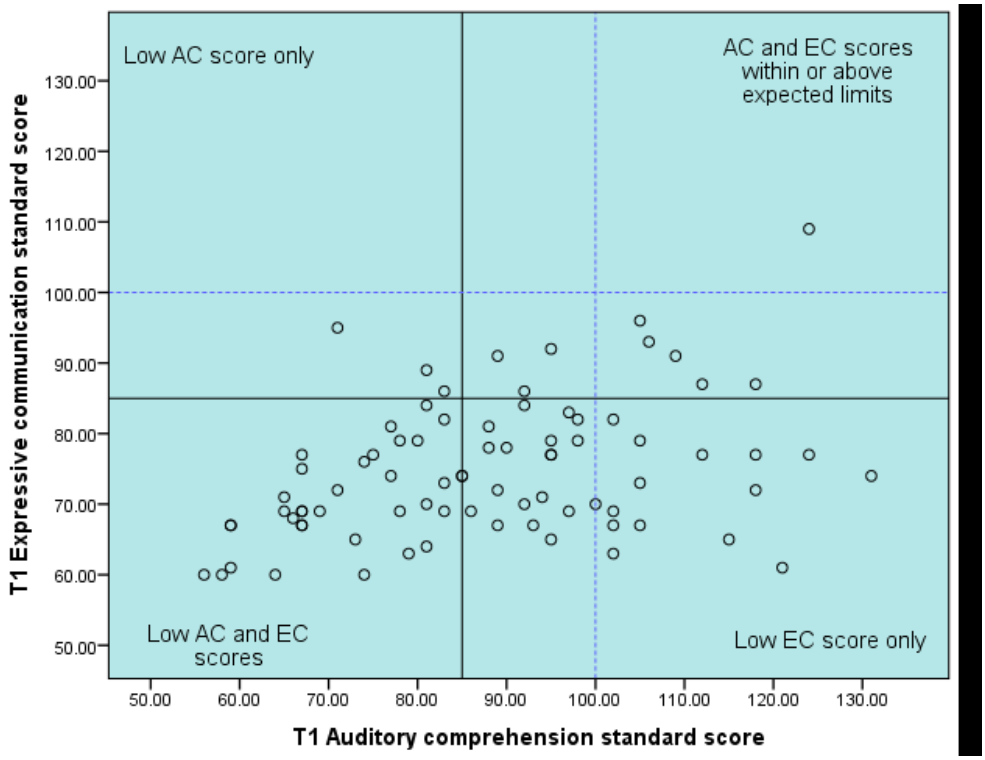


Figure 4.20. Change in expressive communication scores across T1 and T2.

For a majority of children, an increase in standard score over 12 months was seen (74%), though a minority of the group had no change evidenced in their standard scores (26%).

4.5.1.7 What is the relationship between receptive and expressive language skills after one year?

Results for the children's language scores so far have been presented separately for auditory comprehension and expressive communication. It is also useful to look at the way these combined areas are represented within the group. The children's T1 auditory comprehension and T1 expressive communication scores are displayed on the scatterplot below (*Figure 4.21*). This visual display revealed that nine children (11.25%) scored above -1*SD* on both auditory comprehension and expressive communication. Of these, one child scored above the PLS3-UK mean in both T1 auditory comprehension and T1 expressive communication too. Overall, there was a moderate positive correlation between T1 auditory comprehension and T1 expressive communication (*r* =.38).



- - - - - =PLS manual mean (100), = PLS -1*SD* (85)

Figure 4.21. Scatterplot of auditory comprehension vs expressive communication scores at T1.

The clinical language descriptions for the children at T1 are represented in *Figure 4.22* below. Seventy-two of the children met the PLS3-UK test manual criteria for the identification of language delay. Just two children had receptive language difficulties alone whilst thirty-four had expressive difficulties and thirty-six had mixed expressive-receptive language delay. Eight of the children did not have scores that indicated a language delay.

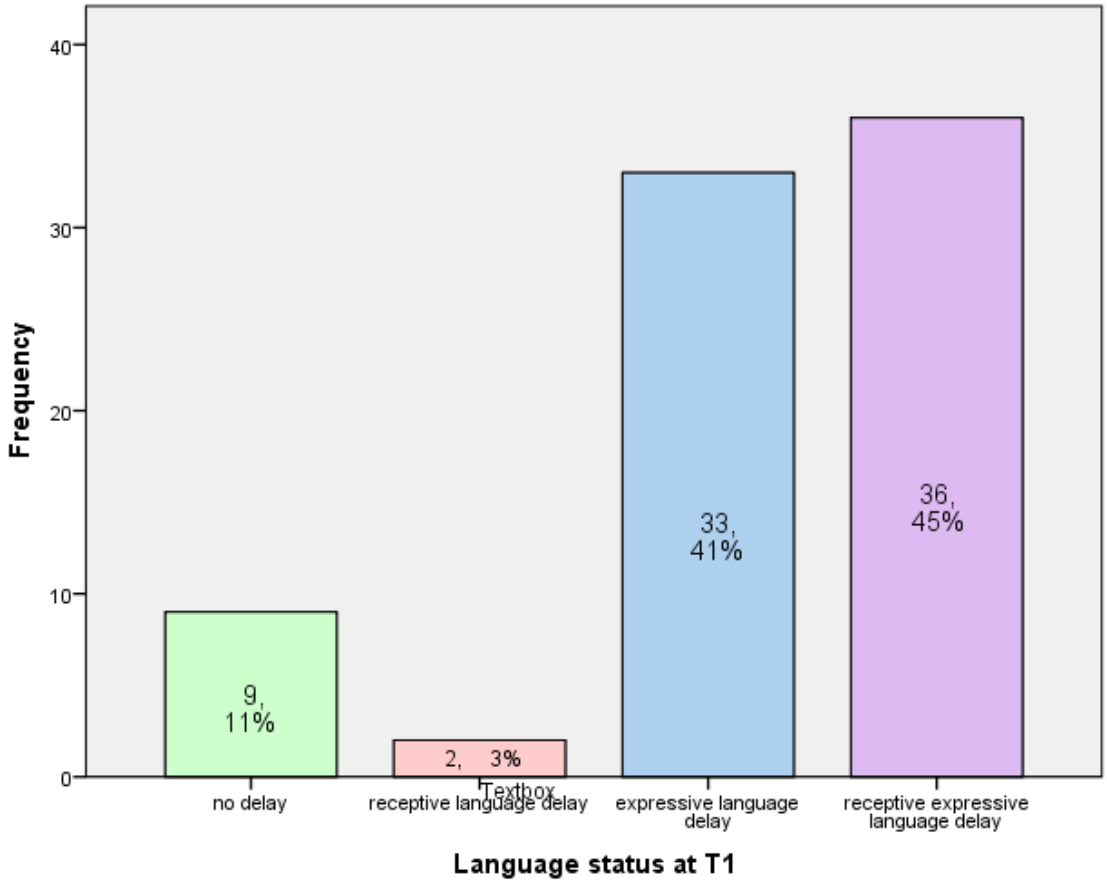
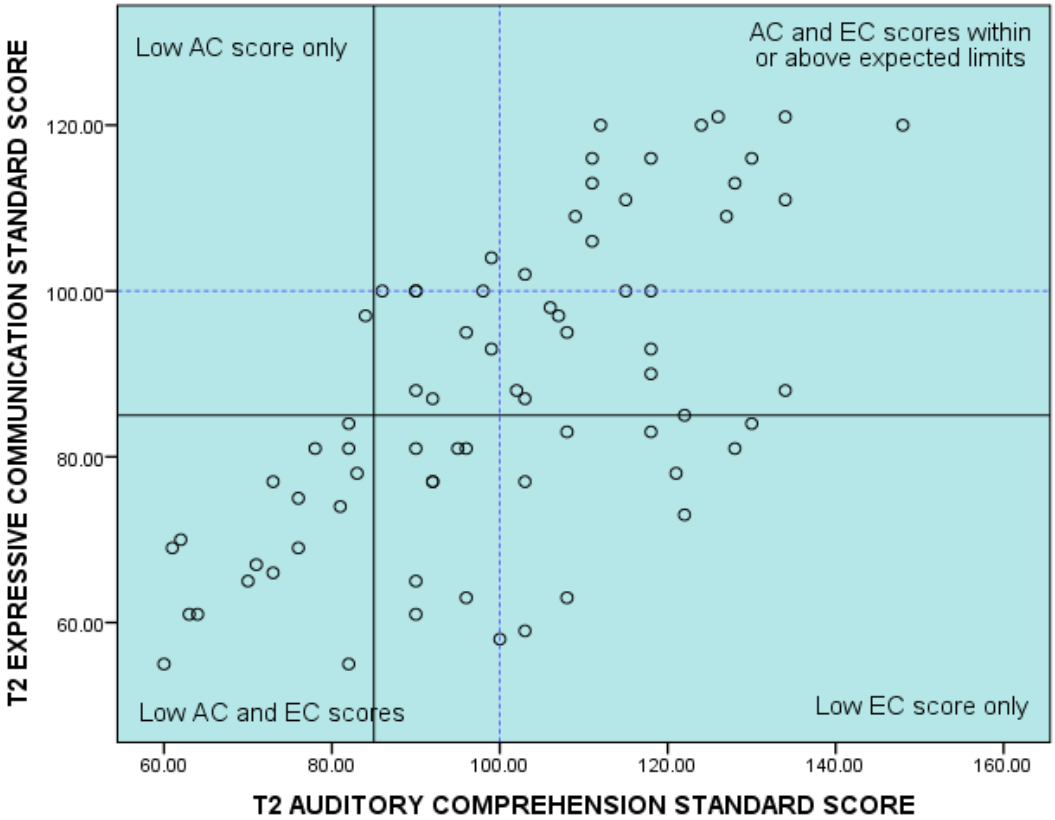


Figure 4.22. Clinical language status defined by the PLS3-UK at entry to the study.

At one year follow up, the children's T2 auditory comprehension and T2 expressive communication scores revealed that thirty-five children (48.61%) scored above -1*SD* on both auditory comprehension and expressive communication (see Figure 4.23). Eighteen children (25%) scored above the PLS3-UK mean in both T2 auditory comprehension and T2 expressive communication. Persisting difficulties in both auditory comprehension and expressive communication were present for seventeen children (23.6%)



- - - - - =PLS manual mean (100), _____ = PLS -1*SD* (85)

Figure 4.23. Scatterplot of auditory comprehension vs expressive communication scores after 12 months.

The clinical language descriptions for the children at one year follow up (T2) are represented in *Figure 4.24* below. Thirty-six of the children met the PLS3-UK test manual criteria for the identification of language delay. One child had receptive language difficulties alone, eighteen had solely expressive difficulties and seventeen had mixed expressive-receptive language delay. At T2, thirty-six of the children were

performing within expected limits and did not exhibit scores consistent with ELD.

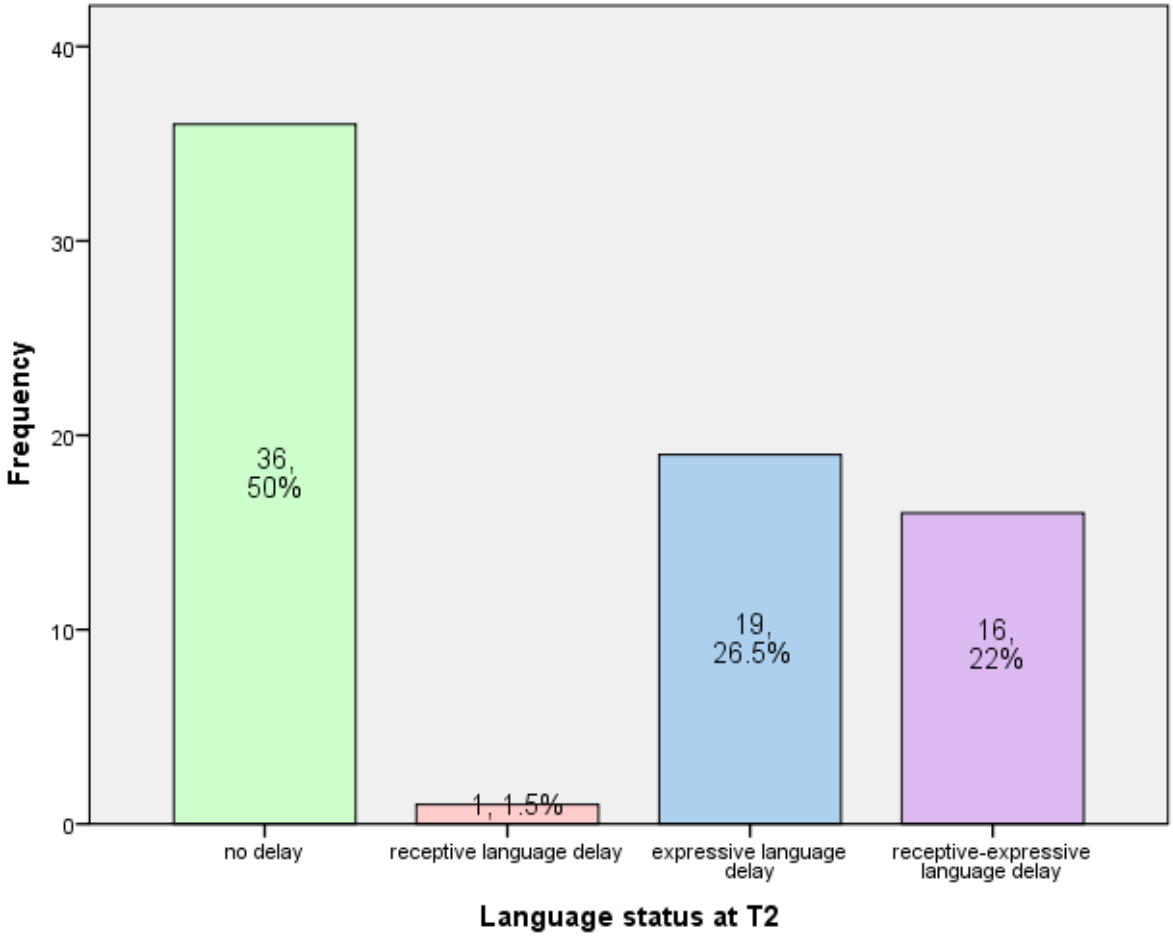


Figure 4.24. Clinical language status defined by the PLS3-UK at T2.

These relationships between auditory comprehension and expressive communication across the two time points are summarised below in Table 4.16 and show that there are significant robust associations between auditory comprehension and expressive language skills across both time points.

Table 4.16 *Correlation matrix for auditory comprehension and expressive communication at T1 and T2*

	T1AC	**T1EC**	**T2AC**	**T2EC**
T1 AC	1			
T1 EC	.38**	1		
T2 AC	.85***	.37**	1	
T2 EC	.58**	.56**	.66**	1

*** *p* < .05, ***p* < .01, ****p* < .001**

AC= auditory comprehension standardised score

EC = expressive communication standardised score

4.5.1.8 Do auditory comprehension and expressive communication scores at entry to the study (T1) predict auditory comprehension scores after 12 months (T2)?

A multiple linear regression was conducted to examine if both T1 auditory comprehension scores and T1 expressive communication scores predicted variance in T2 auditory comprehension scores for the cohort using the SPSS enter method, where all the variables were entered simultaneously. The data were distributed normally and therefore suitable for parametric analysis.

An analysis of standardised residuals identified one case (case 19) as a potential outlier (Standardised Residual =-3.41). This case did not strongly affect the regression

outcome, as assessed by Cook's distance (=.01) and Mahalanobis distance (=1.97), however the case was not included in the data analyses, since the intention was to build the regression models to have optimum general applicability and case 19 was a clear outlier. The regression model was run, without the outlier case 19.

Without case 19, the data (*N* =71) met the assumption of independent errors (Durbin-Watson value = 2.23). Within the regression model, the assumption of no multicollinearity was met for the T1 auditory comprehension standard score variable (Tolerance = .86, *VIF* =1.16) and the T1 expressive communication standard score variable (Tolerance = .86, *VIF* =1.16).

The standardised residuals histogram and P-P plot revealed a slightly positively skewed distribution. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated linearity and homogeneity of variance.

The multiple correlation coefficient *R* was .88, mirroring the Pearson's correlation, and showing that the addition of T1EC did not develop the regression model. R^2 was .77 (Adjusted R^2 =.76), indicating approximately 77% of the variance of the T2 auditory comprehension score could be accounted for by T1 auditory comprehension and T1 expressive communication scores. Within this, only T1 auditory comprehension made a statistically significant contribution (see Table 4.17).

The model significantly predicted T2 outcome scores, $F(2, 68) = 111.41$, $p < .001$. Only T1 auditory comprehension scores contributed to the model ($\beta = .86$, $t = 13.60$, $p < .001$).

T1 expressive communication scores did not significantly contribute to variance (β =.042, *t*=.67, *p* =.504).

Table 4.17 *Summary of regression analysis for variables predicting T2 Auditory Comprehension Standardised Scores (N =71)*

Model	*R*	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
				B	Standard error	Beta			Zero-order	Partial	Part
	.88	.77	.76								
Constant				8.46	9.44		.90	.373			
T1AC standard score				.97	.07	.86	13.60	.000	.87	.86	.80
T1EC standard score				.09	.13	.04	.67	.504	.36	.08	.04

4.5.1.9 Do auditory comprehension and expressive communication scores at entry to the study (T1) predict expressive communication scores after 12 months (T2)?

A multiple linear regression was conducted to examine if both T1 auditory comprehension scores and T1 expressive communication scores predicted variance in T2 expressive communication scores for the cohort (enter method).

The data (*N* =72) met the assumptions for normality and of independent errors (Durbin-Watson value =2.15).

Within the regression model, the assumption of no multicollinearity was met for the T1 auditory comprehension standard score variable (Tolerance =.86, *VIF* =1.16) and the T1 expressive communication standard score variable (Tolerance =.86, *VIF* =1.16).

The standardised residuals histogram and P-P plot revealed a somewhat non-normal (negatively skewed) distribution.

The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated linearity and homogeneity of variance.

Table 4.18 *Summary of regression analysis for variables predicting T2 Expressive Communication Standardised Scores (N =72)*

Model	*R*	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
				B	Standard error	Beta			Zero-order	Partial	Part
	.69	.48	.46								
Constant				-8.92	12.89		-.692	.491			
T1AC standard score				.45	.10	.44	4.67	.000	.58	.49	.41
T1EC standard score				.75	.17	.40	4.28	.000	.56	.46	.37

The multiple correlation coefficient, R^2 was .48, indicating approximately 48% of the variance of the T2 expressive communication score (Adjusted R^2 =.46) could be accounted for by T1 auditory comprehension and T1 expressive communication scores. This significantly predicted T2 outcome scores, $F(2, 69) = 31.78$, $p < .001$. Both T1 auditory comprehension scores and T1 expressive communication scores significantly contributed to the model. T1 auditory comprehension ($\beta = .44$, $t = 4.67$, $p < .001$) and T1 expressive communication scores ($\beta = .40$, $t = 4.28$, $p < .001$) were positively related to T2 expressive communication outcome (see Table 4.18).

4.5.1.10 Aim 1 summary

To describe the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two time points, 12 months apart.

Eighty children were referred to the study, at their entry to SLT services, 85% of them had expressive communication delay and 47% auditory comprehension delay as measured by the PLS3-UK (see Table 4.19).

All the study children had attracted concern such that a referral had been made and that referral accepted by the SLT service following initial informal assessment of the child.

At the second point of data collection, 50% of the children had expressive language delay and 25% auditory comprehension delay, as measured by the PLS3-UK.

Overall, language delay measured using the PLS3-UK at entry to the study was identified in 88.75% of the cohort (*N* =80) and this reduced to 51.39% (*N* =72) at the second point of data collection 1 year later.

Table 4.19 *PLS3-UK language scores at T1 and T2 in relation to test manual descriptions*

	No. of children (%)			
Description of ability	**Auditory comprehension**		**Expressive communication**	
	T1	T2	T1	T2
Above average *SS* 116 and above	7 (8.8%)	19 (26.4%)	0	8 (11.1%)
Average *SS* 115 - 85	37 (46.3%)	35 (48.6%)	12 (15%)	29 (40.3%)
Mild difficulty *SS* 77- 84	14 (17.5%)	7 (9.7%)	22 (27.5%)	16 (22.2%)
Moderate difficulty *SS* 70 - 76	6 (7.5%)	6 (8.3%)	16 (20%)	4 (5.6%)
Severe difficulty *SS* 69 and below	16 (20%)	5 (6.9%)	30 (37.5%)	15 (20.8%)

Outcome of auditory comprehension and expressive communication scores at T2 were significantly predicted by T1 scores. Regression analyses revealed that 76.6% of the variance in T2 auditory comprehension outcome was explained by T1 auditory comprehension score, whilst T1 expressive communication scores did not contribute to the model.

Less variance was explained in T2 expressive communication outcomes. A model that included both T1 auditory comprehension and T1 expressive communication explained 47.9% of the variance in T2 expressive communication outcome.

4.5.2 Research aim 2

To describe the temperament characteristics of a group of pre-school children accepted on to the caseload of community SLT services.

4.5.2.1 What were the temperament characteristics of the cohort at referral to speech and language therapy/ entry to the study?

There are nine dimensions of temperament derived from the Carey Temperament Scales. Two versions of the Scales were used for the children to reflect their ages: the TTS from 2;00 - 2;11 and the BSQ from age 3;00 - 6;11 (see section 3.6.2.2 for information about the scales).

Mean scores for each scale were calculated for the cohort and then scores were transformed to z scores to allow comparison across the two scales.

The cohort transformed mean scores (z scores) are presented for each dimension.

4.5.2.1.1 Activity

The mean for activity at T1 was 0.08, with *SD* of 0.92. Looking at the distribution of the cohort data, it showed a small positive skew, 0.14 and negative kurtosis, -0.38, both of these lay within the twice the standard error cut-off limit for acceptability (see *Figure*

4.25). The KS test, *D*(80) =.058, *p* =.200, showed that the data were suitable to be treated as normally distributed.

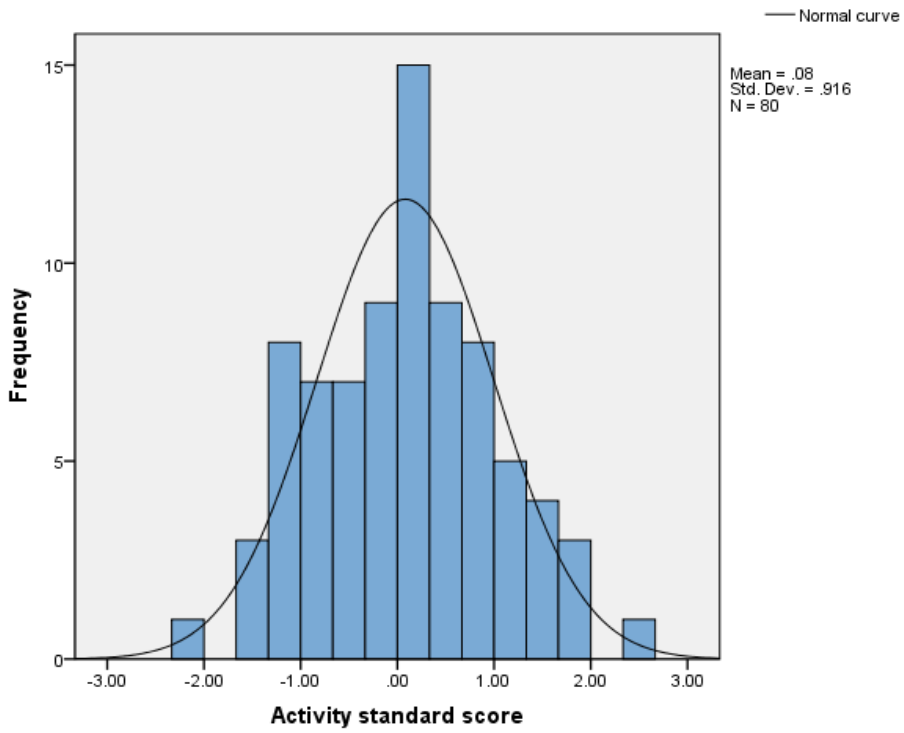


Figure 4.25. Distribution of z scores for Activity at T1.

4.5.2.1.2 Adaptability

The mean for adaptability at T1 was 0.63. The distribution of the cohort data showed a positive skew of 0.68 which was outside the twice the standard error cut-off limit for acceptability and positive kurtosis, 0.44, (see *Figure 4.26*). However, the KS test showed that the data were suitable to be treated as normally distributed, *D*(80) =.09, *p* =.084.

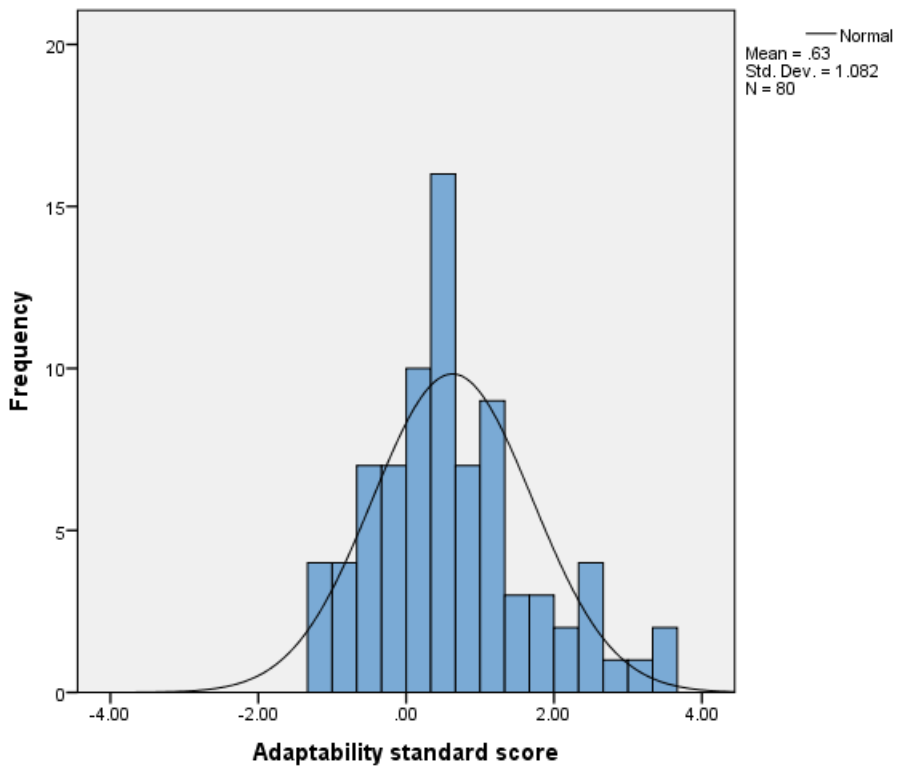


Figure 4.26. Distribution of z scores for Adaptability at T1.

4.5.2.1.3 Approach

The mean for approach at T1 was 0.22. The distribution of the data showed a slight positive skew, 0.07, and a positive kurtosis, 0.34, (see *Figure 4.27*), which lay within the limit for acceptability. The KS test showed the data were suitable to be treated as normally distributed, $D(80) = .06$, $p = .200$.

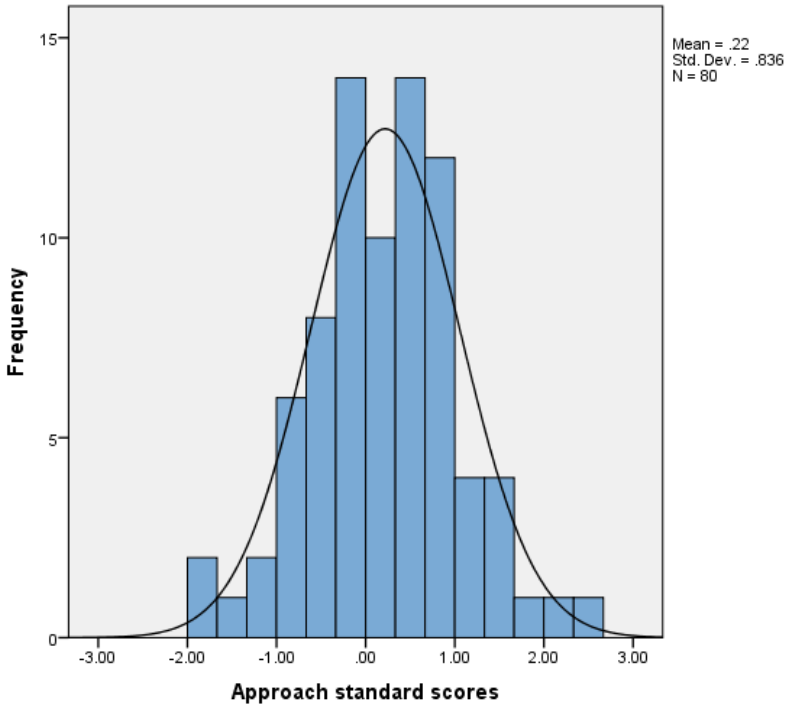


Figure 4.27. Distribution of z scores for Approach at T1.

4.5.2.1.4 Distractibility

The mean for distractibility at T1 was -0.34. The distribution of the data showed a slight negative skew, - 0.03 and a positive kurtosis, 0.13 (see *Figure 4.28*). There was one clear outlier with a score lying at -4.00, and this may have depressed the mean, however, the KS test showed that the data were suitable to be treated as normally distributed, $D(80) = .08$, $p = .200$. Given the sample size of eighty, this single outlier is within acceptable tolerances.

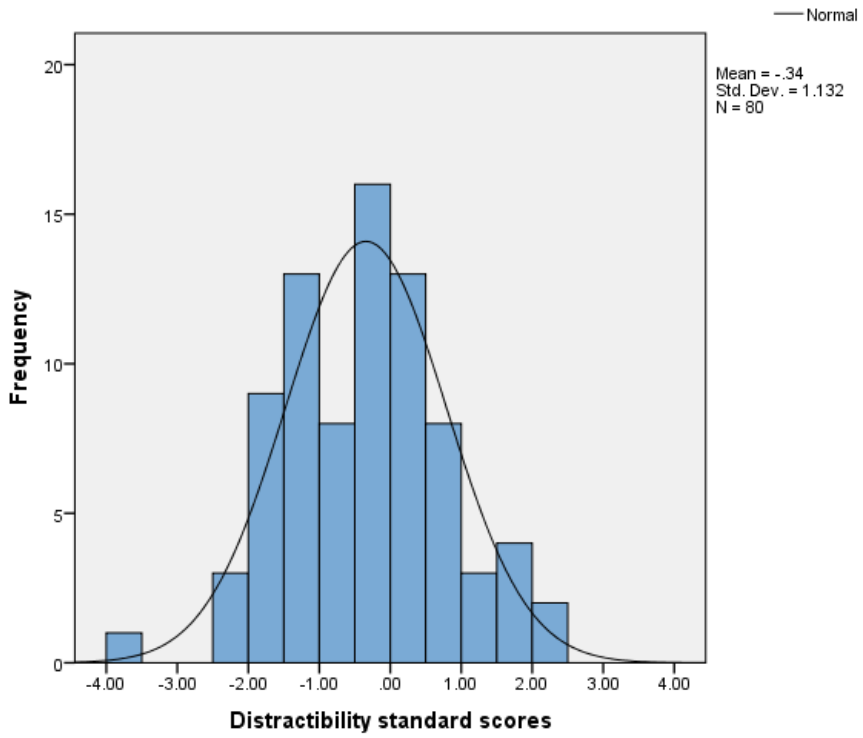


Figure 4.28. Distribution of z scores for Distractibility at T1.

4.5.2.1.5 Intensity

The mean for intensity at T1 was 0.00, whilst the distribution of the data showed a slight negative skew, - 0.10 and positive kurtosis, 0.01 (see *Figure 4.29*). The KS test showed the data were suitable to be treated as normally distributed, $D(80) = .06$, $p = .200$.

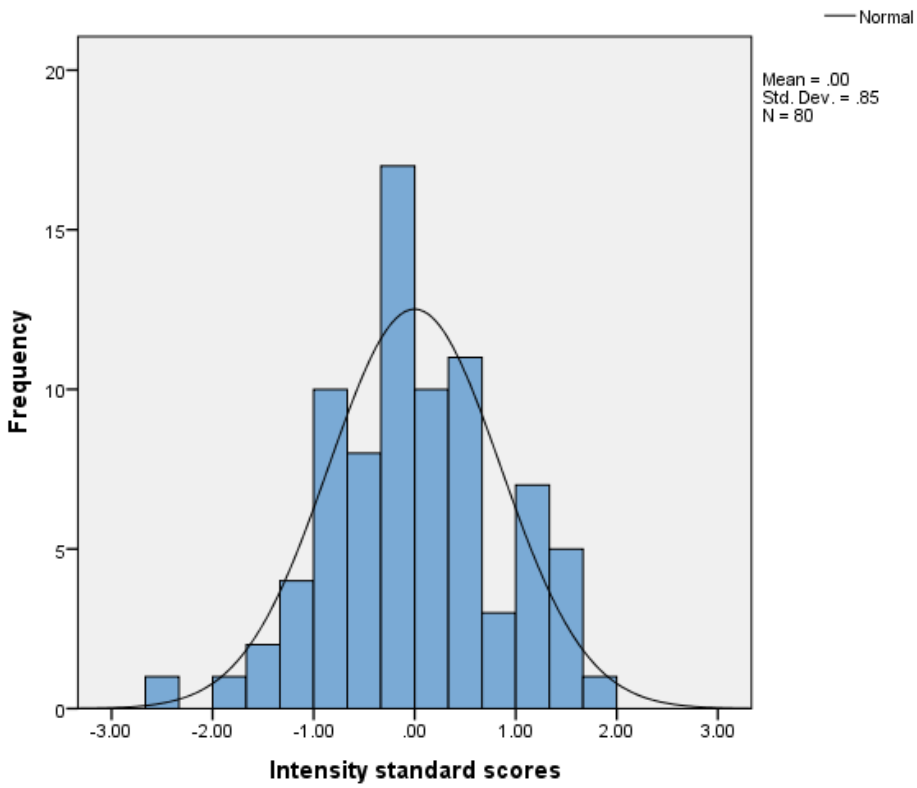


Figure 4.29. Distribution of z scores for Intensity at T1.

4.5.2.1.6 Mood

The mean for mood at T1 was 0.26. The distribution of the data showed a slight negative skew, - 0.04 and a negative kurtosis, -0.88. Skew and kurtosis values lay within the twice the standard error cut-off limit for (see *Figure 4.30*). The KS test showed the data as suitable to be treated as normally distributed, *D*(80) =.08, *p* =.200.

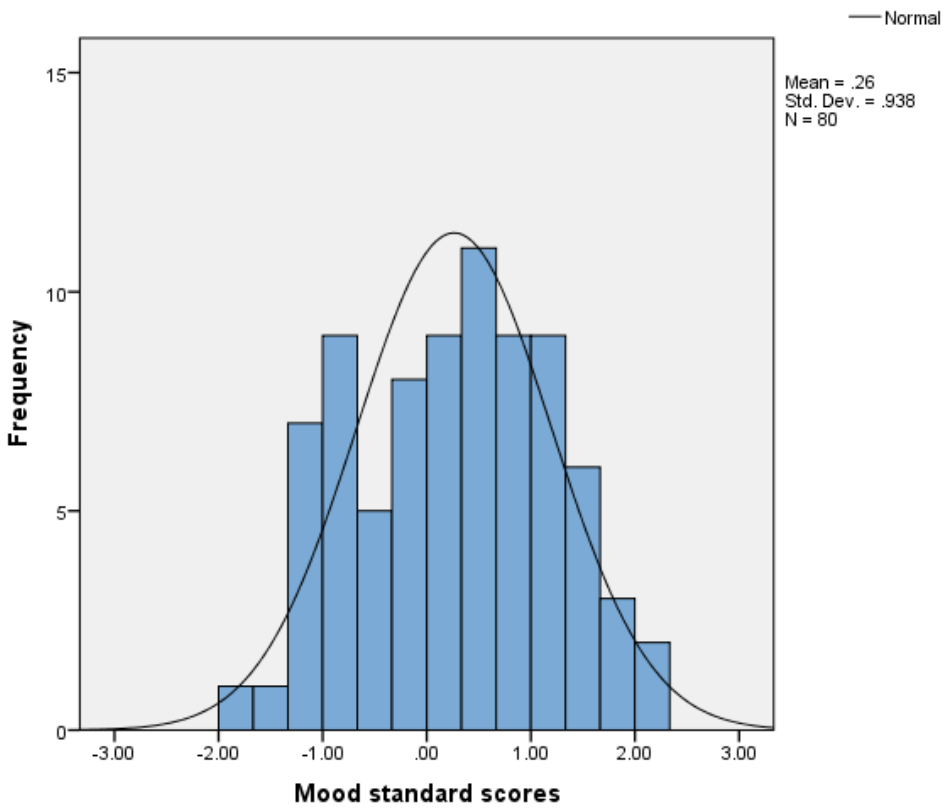


Figure 4.30. Distribution of z scores for Mood at T1.

4.5.2.1.7 Persistence

The mean for persistence at T1 was 1.01. The distribution of the cohort data was positively skewed, 0.65 and had a small positive kurtosis of 0.27. The skew value was outside the limit for acceptability and *Figure 4.31* demonstrates the presence of scores beyond three *SD*s from the mean. Further, the KS test showed the data were not suitable to be treated as normally distributed, $D(80) = .11$, $p = .020$.

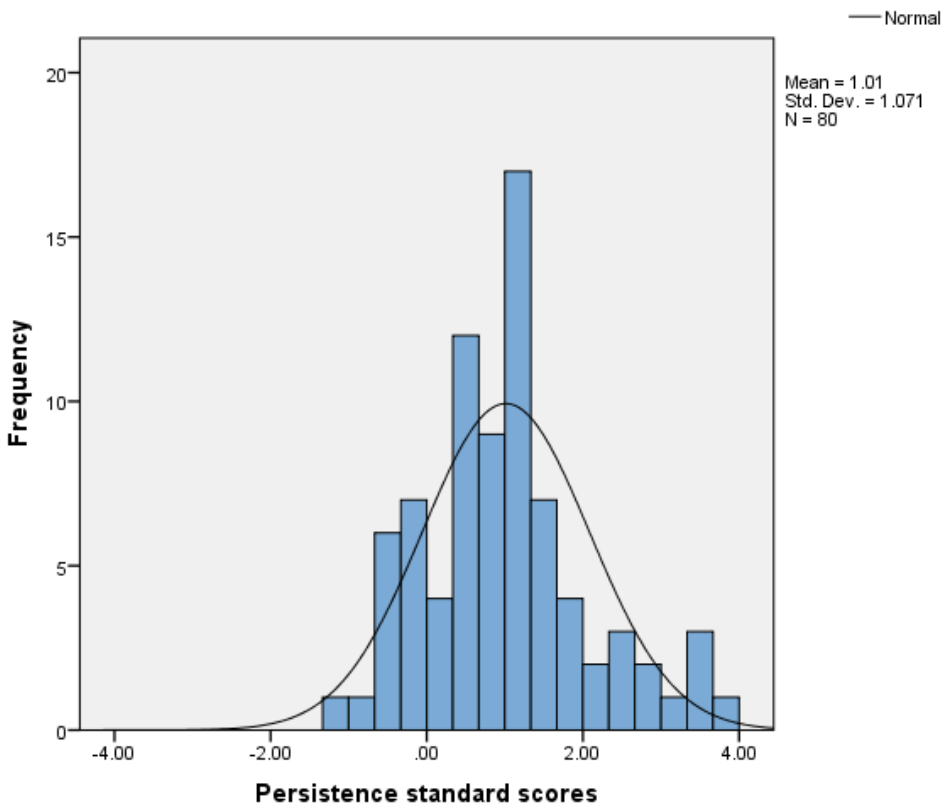


Figure 4.31. Distribution of z scores for Persistence at T1.

4.5.2.1.8 Rhythmicity

The mean for rhythmicity at T1 was 0.51. The distribution of the cohort data showed a positive skew, 0.79 and positive kurtosis, 1.27, both of these lay outside the twice the standard error cut-off limit for acceptability (see *Figure 4.32*). There was one clear outlier, with a score lying at 4.00, and this may have inflated the mean, however, the KS test showed that the data were suitable to be treated as a normal distribution, D(80) =.08, *p* =.200.

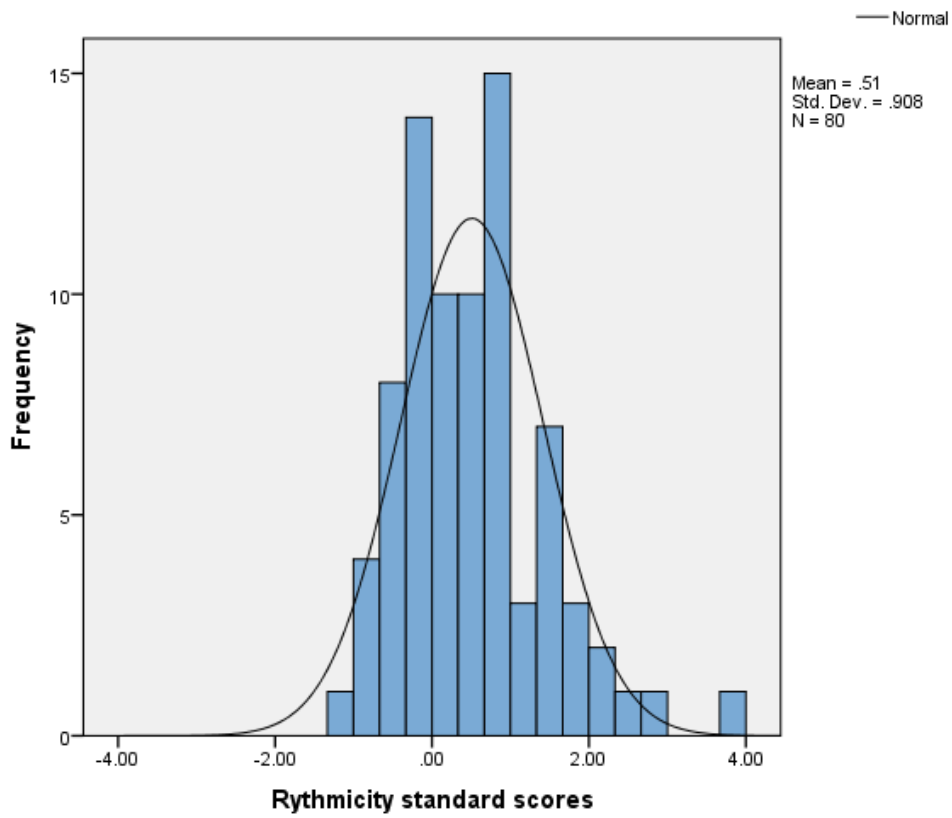


Figure 4.32. Distribution of z scores for Rhythmicity at T1.

4.5.2.1.9 Threshold

The mean for threshold at T1 was -0.39. The distribution of the data showed an acceptable slight negative skew, - 0.10 and a negative kurtosis, -0.65, (see *Figure 4.33*). The KS test showed that the data were suitable to be treated as normally distributed, $D(80) = .07$, $p = .200$.

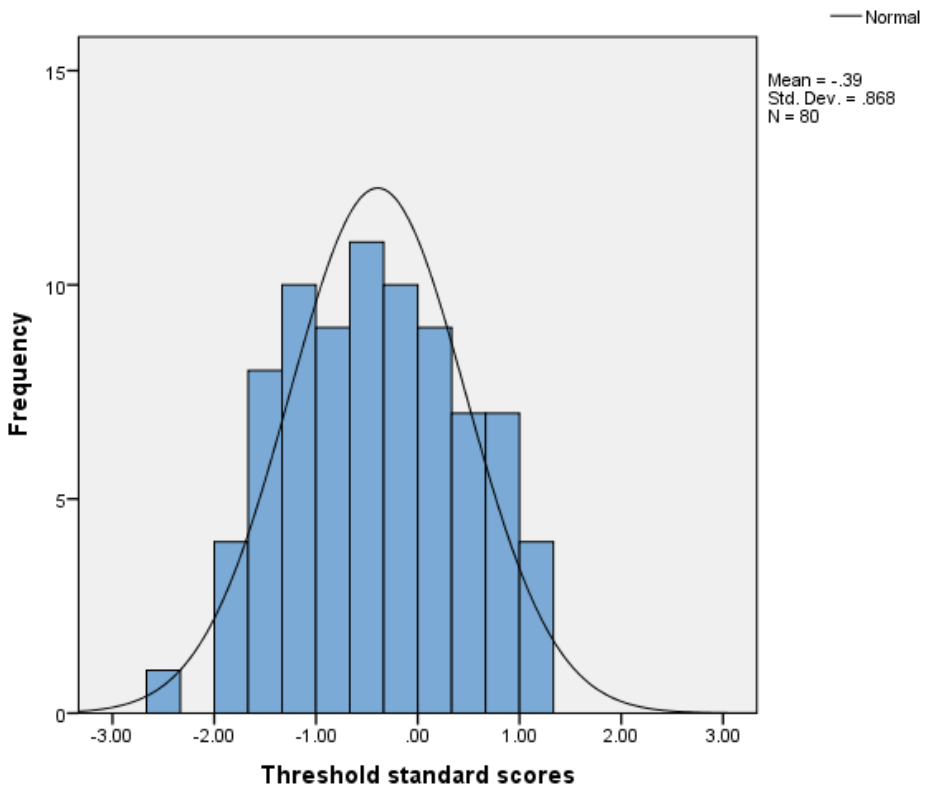


Figure 4.33. Distribution of z scores for Threshold at T1.

4.5.2.2 Did the cohort's temperament differ from the normative temperament data at the start of the study?

The T1 cohort temperament data showed some differences from the standard scores of the standardisation sample.

The 95% CIs for activity and intensity standardised scores both fell across the mean, suggesting that these scores are broadly representative of the normative sample.

However, the cohort was notably less persistent, less adaptable and less regular in body rhythms than the standardisation sample with each of these means being more

than 0.5 *SD* from the mean. The results across dimensions are summarised in Table 4.21 below.

Table 4.20 *Descriptive statistics for T1 dimensions of temperament*

Dimension *N* =80	Mean (*z* score)	95% BCa CI (10,000)	Standard error	*SD*	Range
Activity	.08	-0.17, .22	.10	0.92	4.36 (-2.02, 2.34)
Adaptability	.63	.37, .86	.12	1.08	4.95 (-1.32, 3.63)
Approach	.22	.07, .45	.09	0.84	4.41 (-1.84, 2.57)
Distractibility	-.34	-.64, -.09	.13	1.13	6.00 (-3.64, 2.37)
Intensity	-.00	-.21, .18	.10	0.85	4.34 (-2.47, 1.88)
Mood	.26	.04, .47	.10	0.94	4.02 (-1.74, 2.28)
Persistence	1.01	.76, 1.24	.12	1.07	4.97 (-1.09, 3.88)
Rhythmicity	.51	.31, .70	.10	0.91	5.07 (-1.27, 3.80)
Threshold	-.39	-.58, -.17	.10	0.87	3.88 (-2.65, 1.23)

These differences in movement from the standardised dimension means are displayed in *Figure 4.34* and showed that the cohort have similar scores to the standardisation sample in activity and intensity, whilst behaving very differently with respect to persistence, adaptability and rhythmicity.

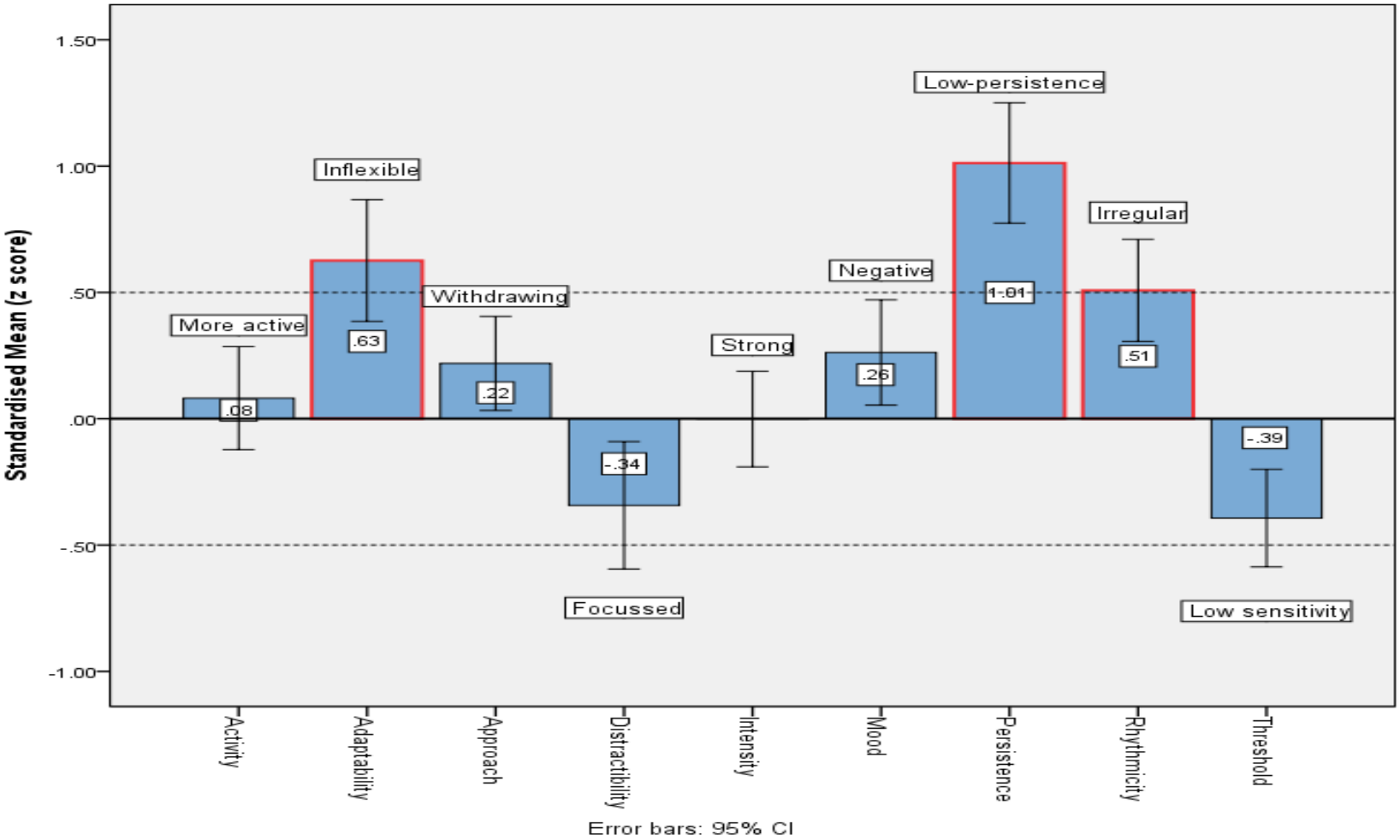


Figure 4.34. Temperament profiles at entry to the study (T1).

4.5.2.3 What were the temperament characteristics of the cohort after 12months (at T2)?

Of the T1 cohort, seventy-three of the children remained in the study at the second point of data collection (T2) with respect to temperament data. One of these children did not take part in language testing at the second point of data collection, he was still on the SLT caseload and as such was likely to be meeting service criteria, but the family withdrew before T2 language data was obtained. His data is included here since the focus of the analysis at this point is to identify the characteristics of stability and change in temperament of children with delayed language development.

The BSQ was exclusively used at T2 as all the children were aged three years and above. Mean scores for each scale were calculated for the cohort and then scores were transformed to z scores to allow comparison across the two data collection points, T1 (where both the BSQ and TTS were used) and T2.

The cohort transformed mean scores are presented for each dimension of temperament.

4.5.2.3.1 Activity

The mean for activity at T2 was 0.48. Looking at the distribution of the cohort data, it showed a small positive skew, 0.03 and negative kurtosis, -0.29, which were within acceptability limits (see *Figure 4.35*). The KS test showed that the data were suitable to be treated as normally distributed, $D(73) = .07$, $p = .200$

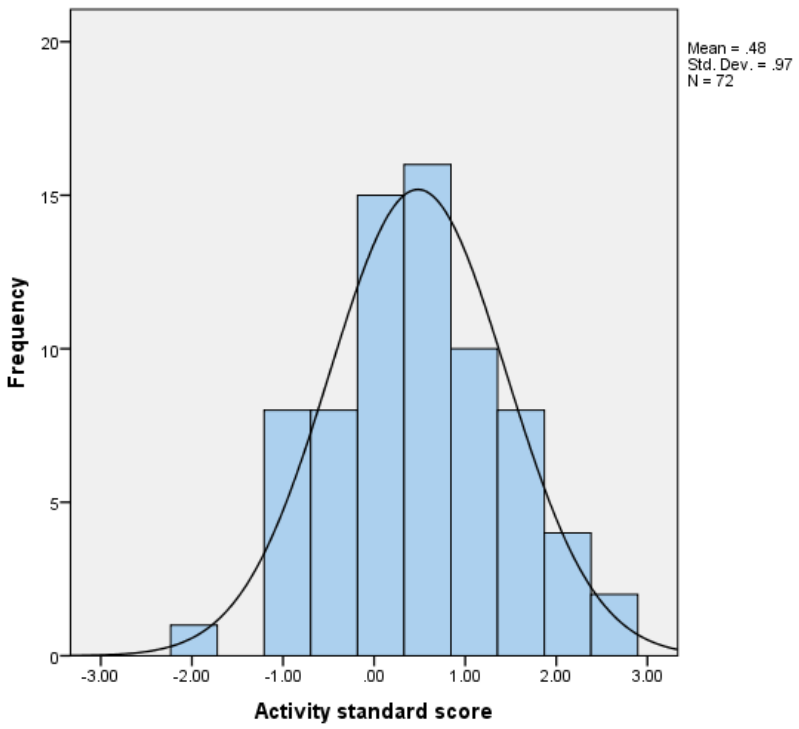


Figure 4.35. Distribution of z scores for Activity at T2.

4.5.2.3.2 Adaptability

The mean for T2 adaptability was 0.95. The data showed a positive skew, 0.17 and positive kurtosis, 0.11, both within the acceptable range (see *Figure 4.36*). There was one clear outlier with a score lying at 4.00, and this may have inflated the mean, however, the KS test showed the data were suitable to be treated as normally distributed, D(73) =.07, *p* =.200.

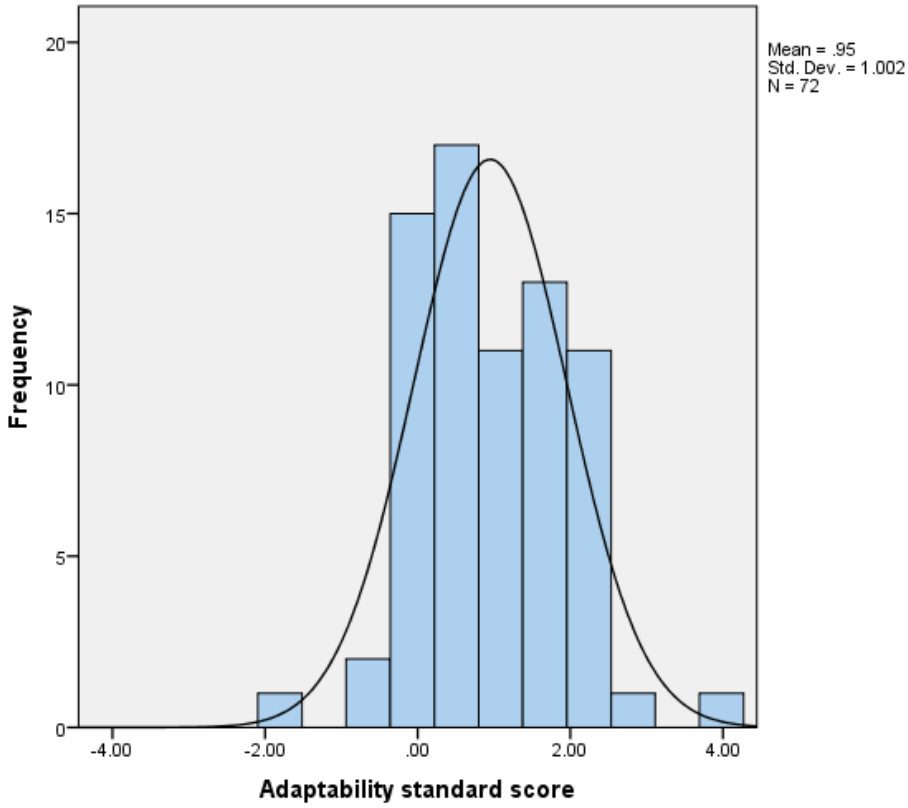


Figure 4.36. Distribution of z scores for Adaptability at T2.

4.5.2.3.3 Approach

The mean for T2 approach was 0.38. The distribution of the data showed small acceptable skew (0.26) and kurtosis (-0.50) as displayed in *Figure 4.37*. Further, the KS test showed the data were suitable to be treated as normally distributed, $D(73) = .08$, $p = .200$.

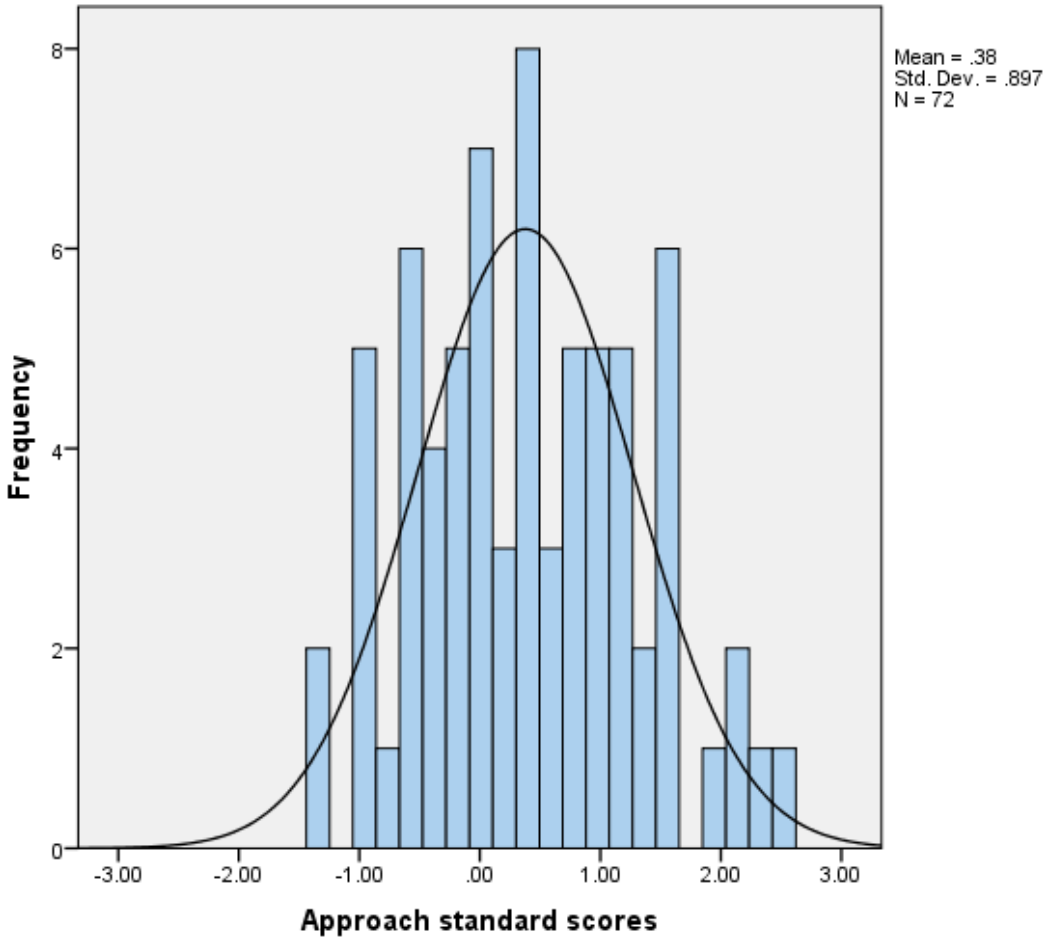


Figure 4.37. Distribution of z scores for Approach at T2.

4.5.2.3.4 Distractibility

The mean for T2 distractibility was -0.04. The distribution of the data showed a small acceptable skew (0.15) and kurtosis (-0.30), (see *Figure 4.38*). The KS test showed the data were suitable to be treated as normally distributed, $D(73) = .06$, $p = .200$.

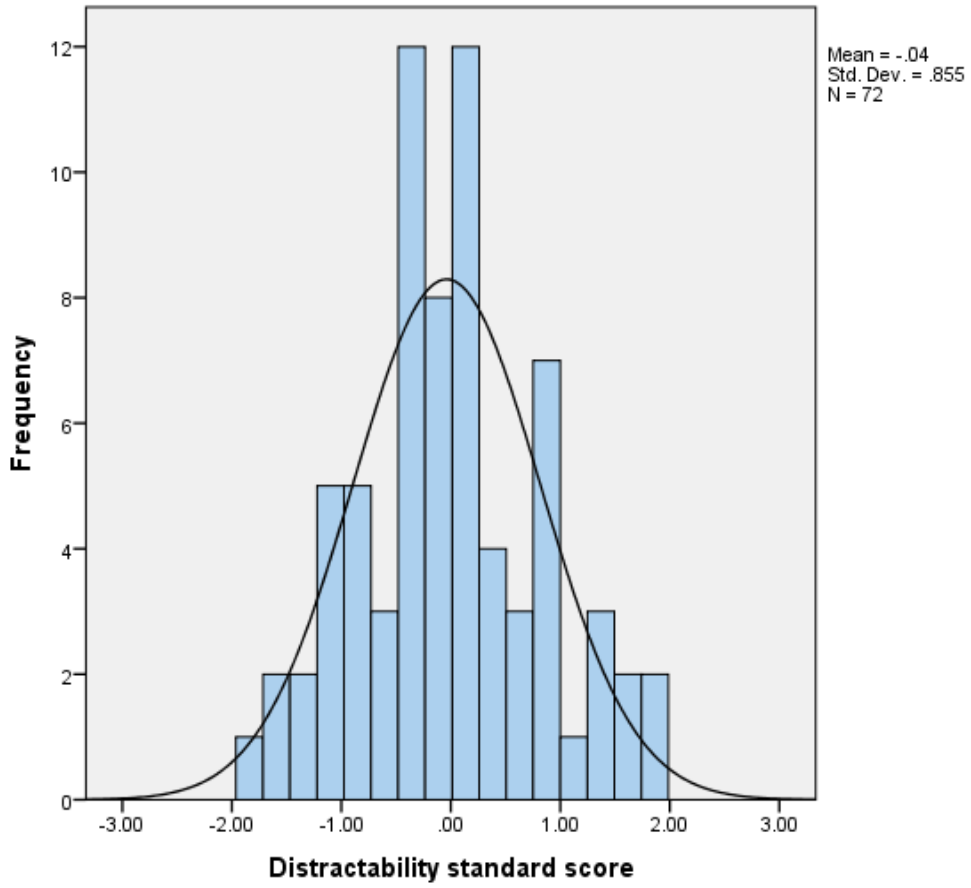


Figure 4.38. Distribution of z scores for Distractibility at T2.

4.5.2.3.5 Intensity

The mean for T2 intensity was -0.23. The distribution of the data showed a slight skew, of 0.04, and kurtosis, of 0.39, as seen in *Figure 4.39*. The KS test confirmed the data as suitable to be treated as normally distributed, $D(73) = .07$, $p = .200$.

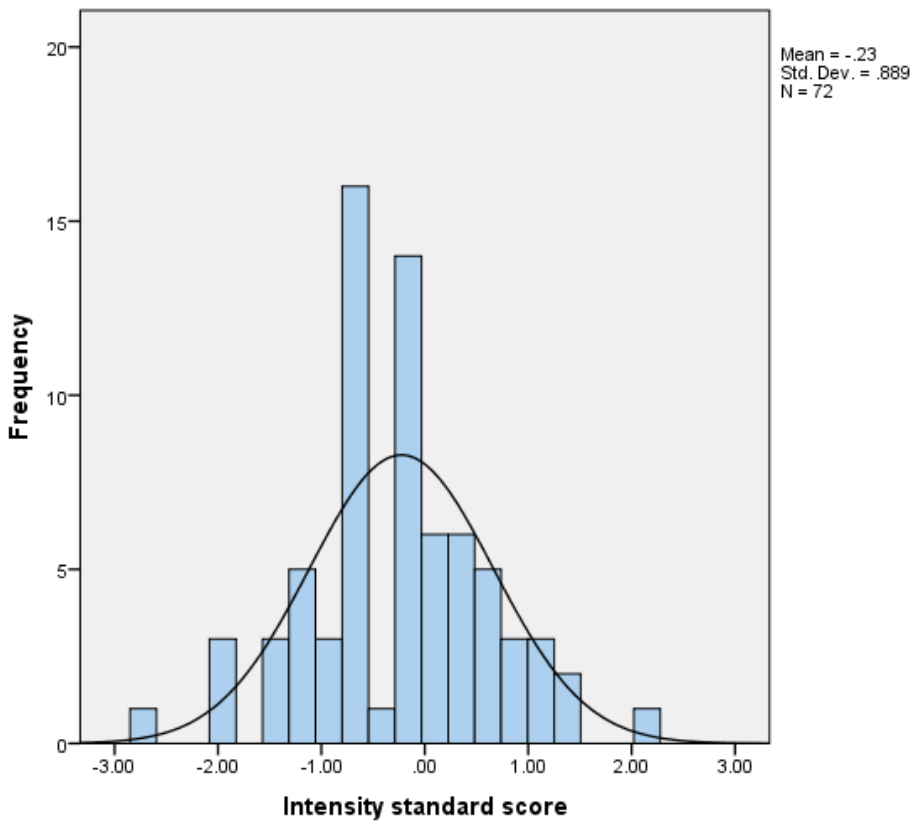


Figure 4.39. Distribution of z scores for Intensity at T2.

4.5.2.3.6 Mood

The mean for T2 mood was 0.05. The data distribution showed a slight positive skew of 0.15 and a negative kurtosis, -0.74. These were within limits for acceptability (see *Figure 4.40*). The KS test showed the data were suitable to be treated as normally distributed, $D(73) = .09$, $p = .200$.

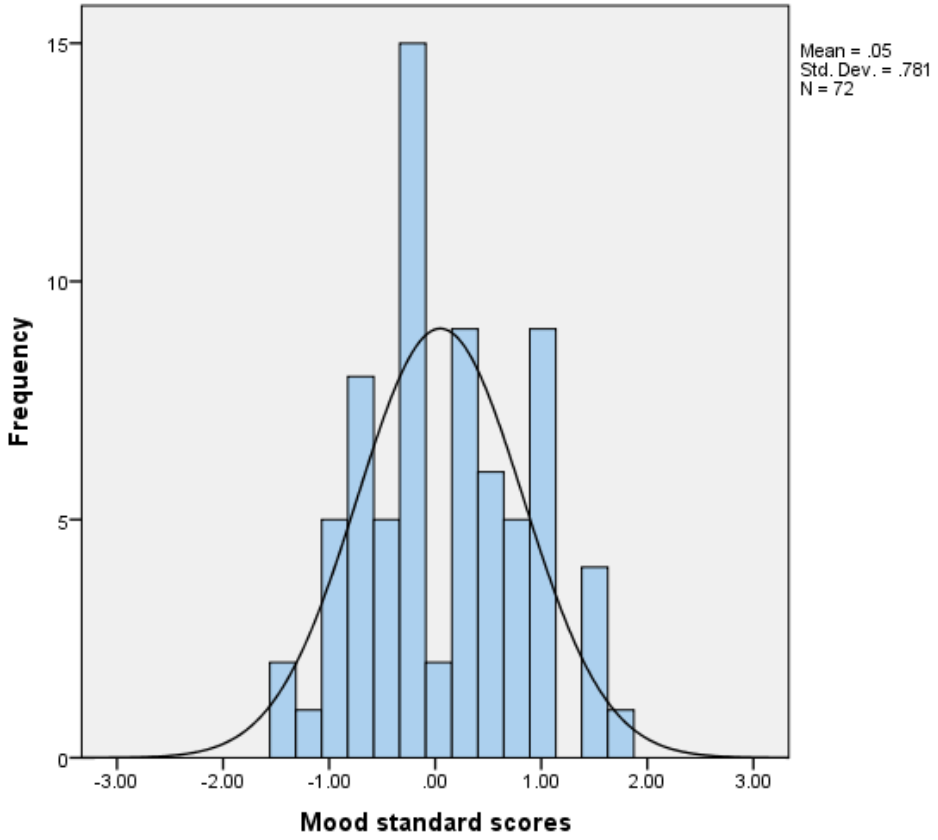


Figure 4.40. Distribution of *z* scores for Mood at T2.

4.5.2.3.7 Persistence

The mean for persistence at T2 was 0.92. Looking at the distribution of the cohort data, it shows a positive skew, 0.70 and positive kurtosis, 0.62. The skew value lay outside the twice the standard error cut-off limit for acceptability (see *Figure 4.41*). There were two outliers with scores lying above 3*SD* of the mean, and this may have depressed the mean. The KS test showed the data were not suitable to be treated as normally distributed, $D(73) = .12$, $p = .013$

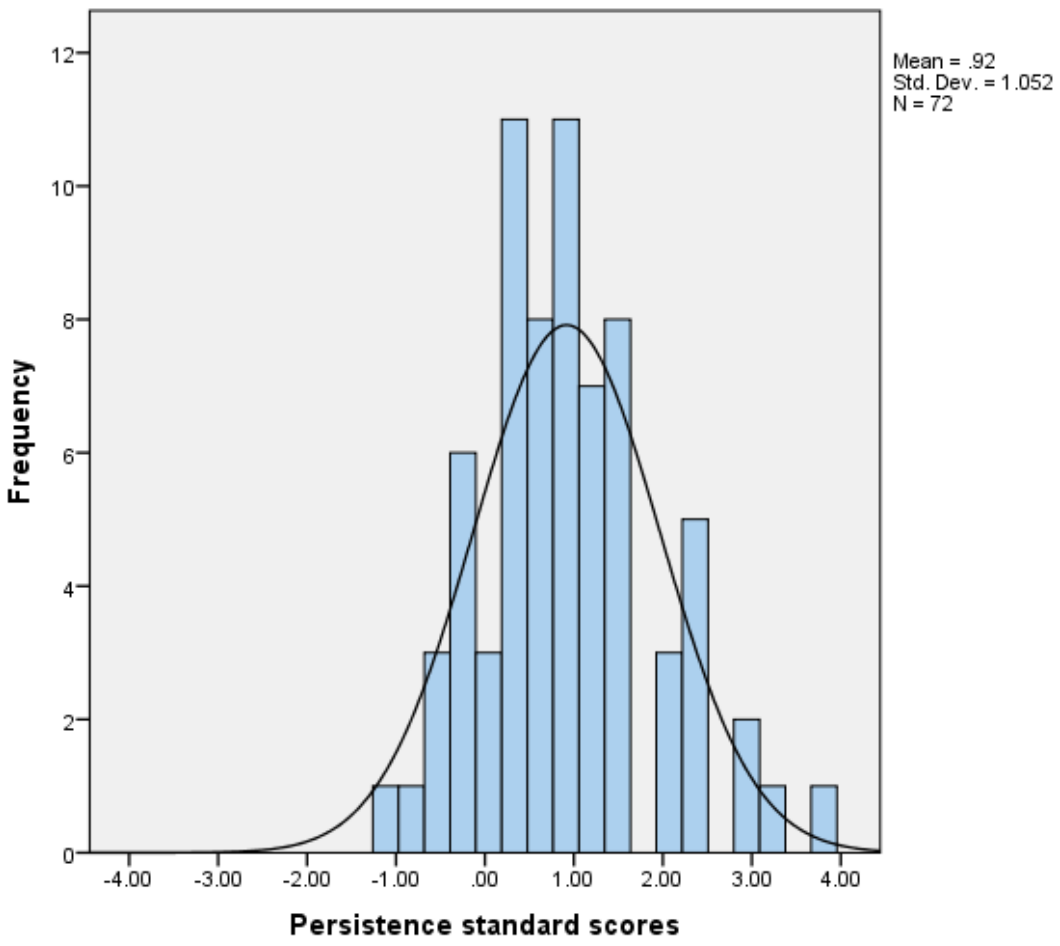


Figure 4.41. Distribution of z scores for Persistence at T2.

4.5.2.3.8 Rhythmicity

The mean for rhythmicity at T2 was 0.41. Looking at the distribution of the cohort data, there was a negative skew, - 0.14 and negative kurtosis of -0.64, These values were both outside the twice the standard error cut-off limit for acceptability (see *Figure 4.42*), however the KS test showed these data were suitable to be treated as normally distributed, D(73) =.07, *p* =.200

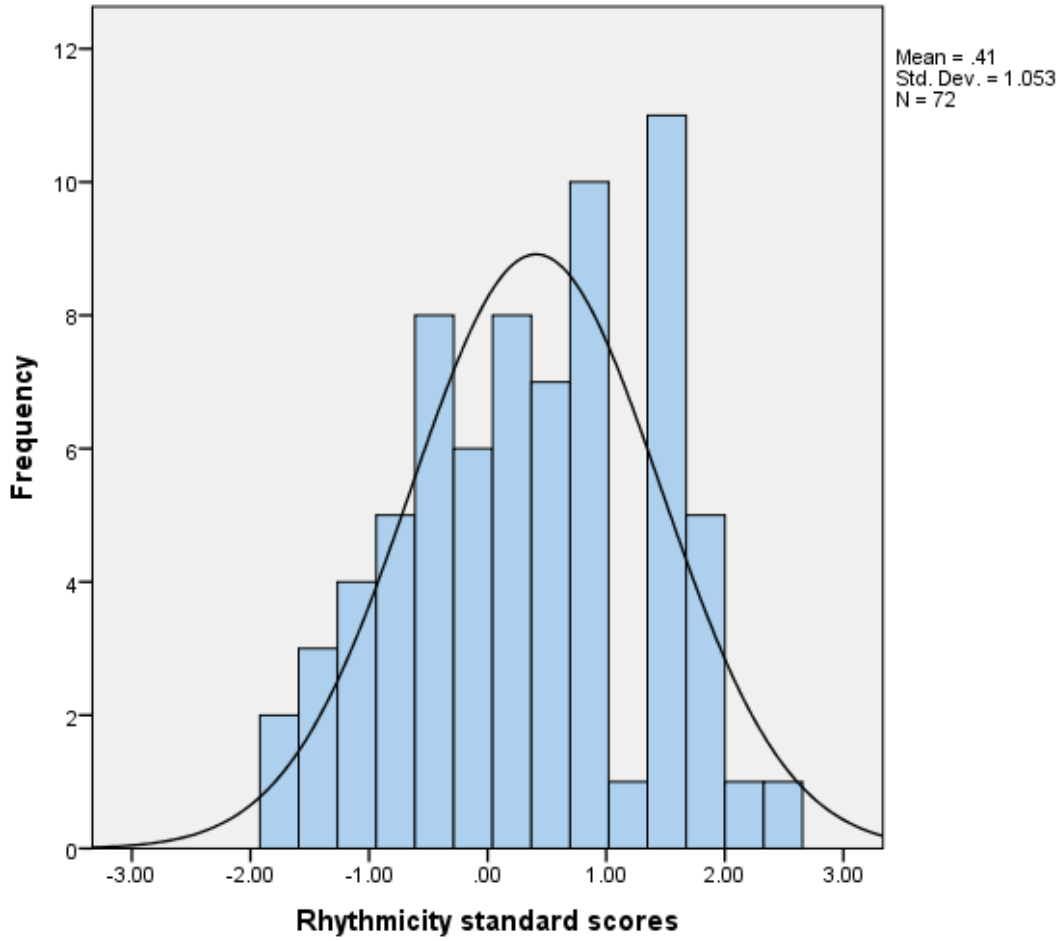


Figure 4.42. Distribution of z scores for Rhythmicity at T2.

4.5.2.3.9 Threshold

The mean for threshold at T2 was - 0.32. The distribution had a negative skew (- 0.53) and positive kurtosis (0.85), shown in *Figure 4.43*. However, the KS test showed that these data were not suitable to be treated as normally distributed, $D(73) = .11$, $p = .025$

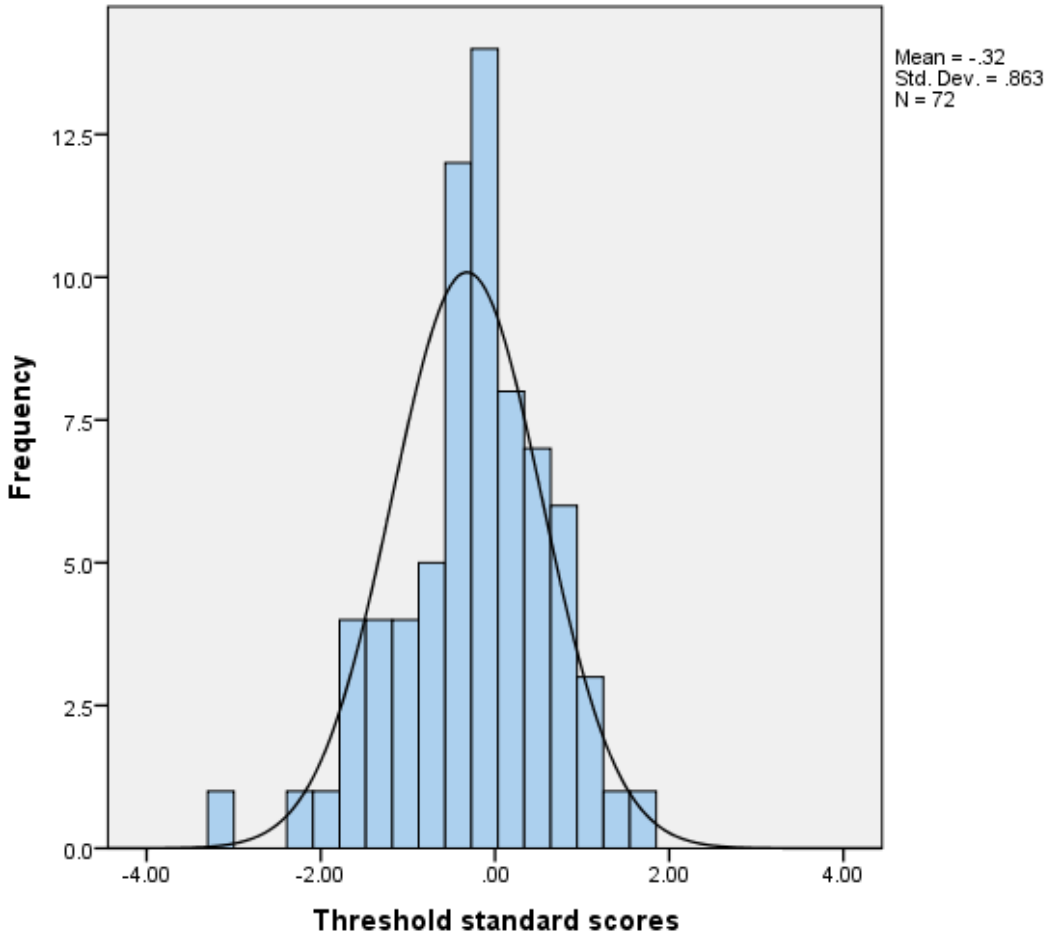


Figure 4.43. Distribution of z scores for Threshold at T2.

4.5.2.3.10 Summary

The results across dimensions are summarised in Table 4.21 below.

Table 4.21 Descriptive statistics for T2 dimensions of temperament

Dimension *N*=73	Mean (*z* score)	95% BCa CI (10,000)	Standard error	*SD*	Range	Data distribution
Activity	.49	.27, .70	.11	0.96	4.62 (-1.98, 2.64)	Normal
Adaptability	.95	.37, .86	.12	1.00	5.67 (-1.81, 3.87)	Normal
Approach	.40	.19, .61	.11	0.91	3.77 (-1.34, 2.43)	Normal
Distractibility	-.02	-.22, .17	.10	0.86	3.70 (-1.84, 1.86)	Normal
Intensity	-.22	-.43, -.02	.10	0.88	4.87 (-2.72, 2.15)	Normal
Mood	.06	-.11, .24	.09	0.79	3.31 (-1.44, 1.87)	Normal
Persistence	.90	.68, 1.13	.12	1.05	5.07 (-1.12, 3.96)	Not normal
Rhythmicity	.44	.19, .69	.13	1.08	4.58 (-1.76, 2.82)	Normal
Threshold	-.32	-.53, -.12	.10	0.86	4.85 (-3.15, 1.70)	Not normal

4.5.2.4 Does the cohort's temperament differ from the normative data after 12 months?

The T2 cohort temperament data show some differences from the standard scores of the standardisation sample as can be seen in *Figure 4.44*.

The 95% CIs for distractibility and mood standardised mean scores both fell across the mean, suggesting that these scores were broadly representative of the normative sample.

However, the cohort was notably, less adaptable and less persistent than the standardisation sample with each of these means being further than 0.5*SD* from the standardised mean and the 95% CI bands falling more than 0.5 *SD* away from the mean.

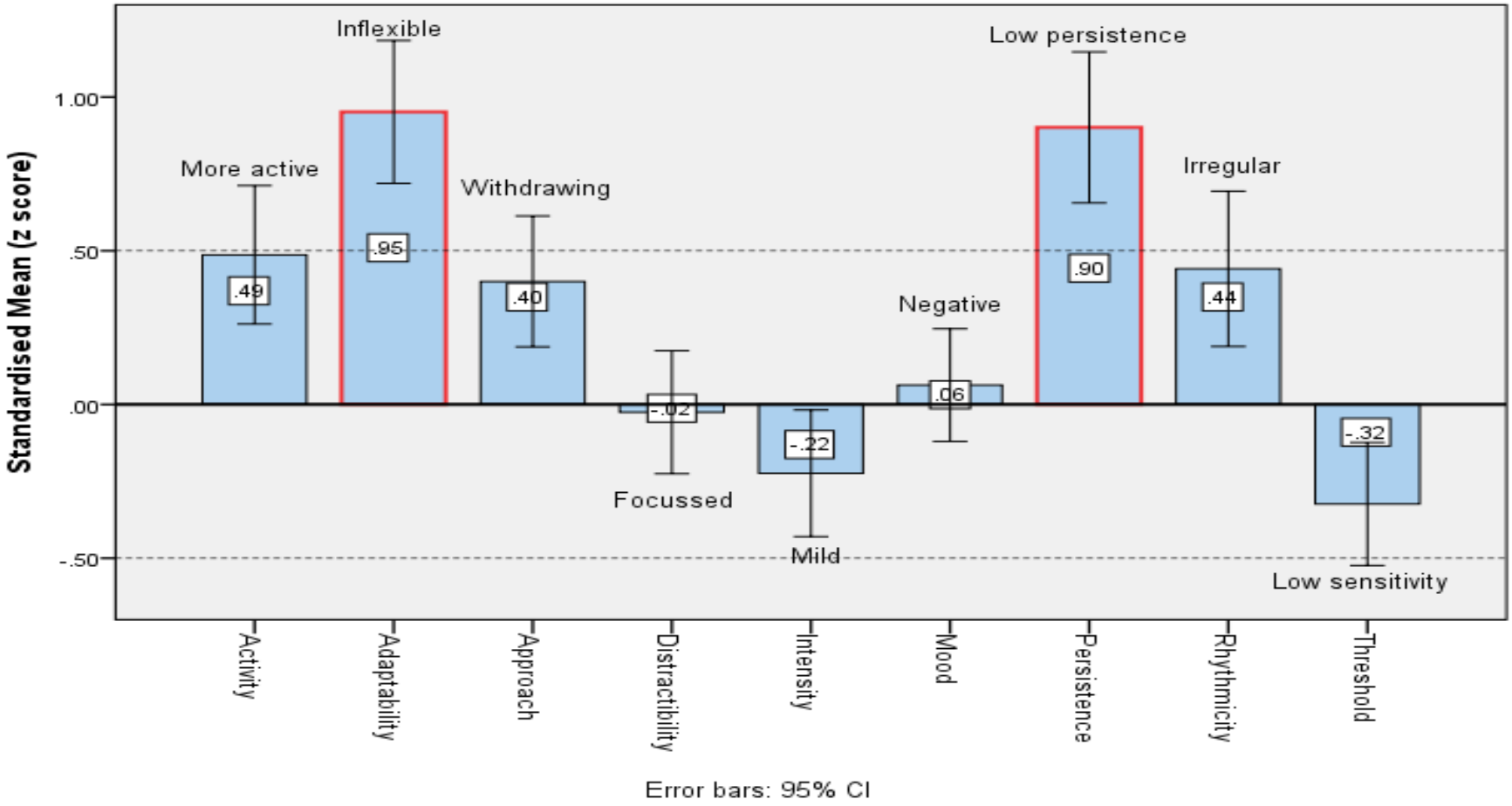


Figure 4.44. Temperament profiles after 12 months (T2).

4.5.2.5 How stable are temperament features after 1 year?

To look at the stability of the cohort's temperament features, a series of paired *t*-tests were used to compare the cohort mean scores for each dimension, whilst Pearson's correlation were conducted to examine the strength of any relationships. The data met the assumptions for these tests with the exception of T1 persistence, T2 persistence and T2 threshold. Since T1 children who completed T2 would be involved in these tests, the T1 persistence tests of normality were re-run for those children who completed T2 data only.

Using data from these seventy-three children who completed the study, T1 persistence had a mean of 0.98. Looking at the distribution of the cohort data, it showed a positive skew, 0.75 and positive kurtosis, 0.40, The skew value fell outside the twice the standard error cut-off limit for acceptability (see *Figure 4.45*.). The KS test showed the data were not suitable to be treated as a normal distribution, D (73) =.13, *p* =.007.

To address this for the *t*-tests, bootstrapped bias corrected accelerated 95% CIs were calculated and the bias statistics reported for non-normally distributed dimensions i.e. persistence (T1 and T2) and threshold (T2).

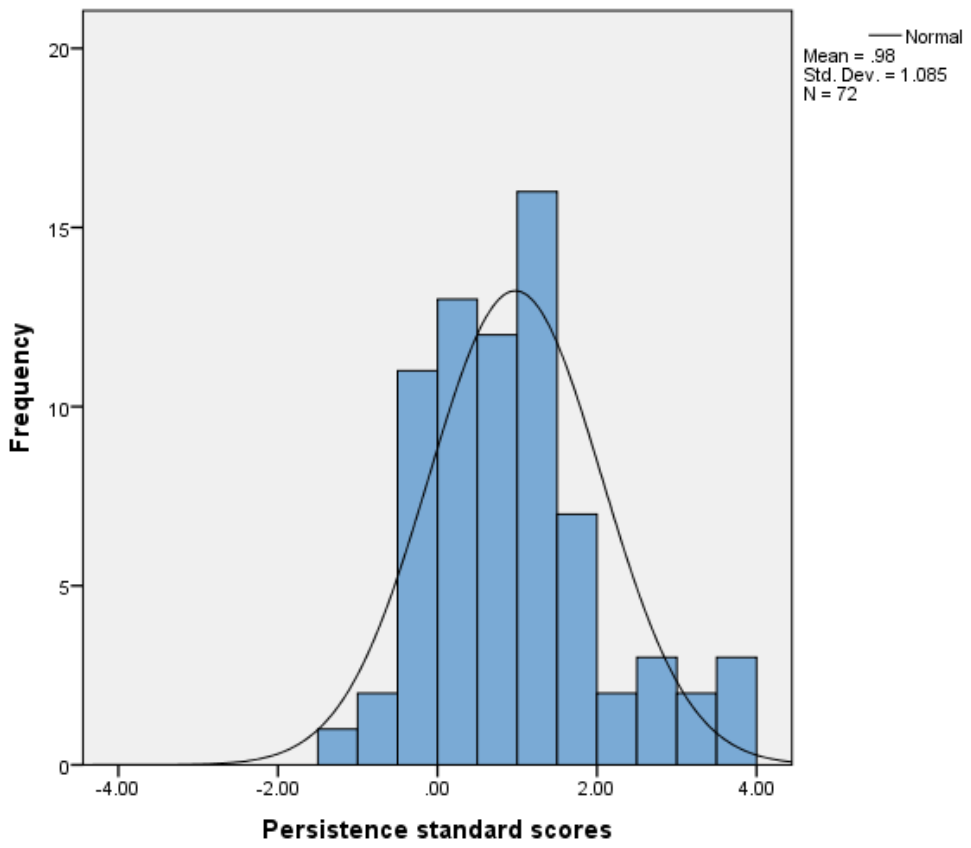


Figure 4.45. Distribution of *z* scores for Persistence at T1 for children who completed the study (*N*=73).

4.5.2.5.1 Stability of the activity dimension

To establish the stability of the activity dimension over 12 months, a paired *t*-test was used: $t(72) = -5.73$, BCa 95% bootstrapped CI [-.63, -.30], $p < .001$ (two tailed). This confirmed that the means at T1 and T2 were significantly different. This represented a medium effect size; Cohen's $d = 0.51$.

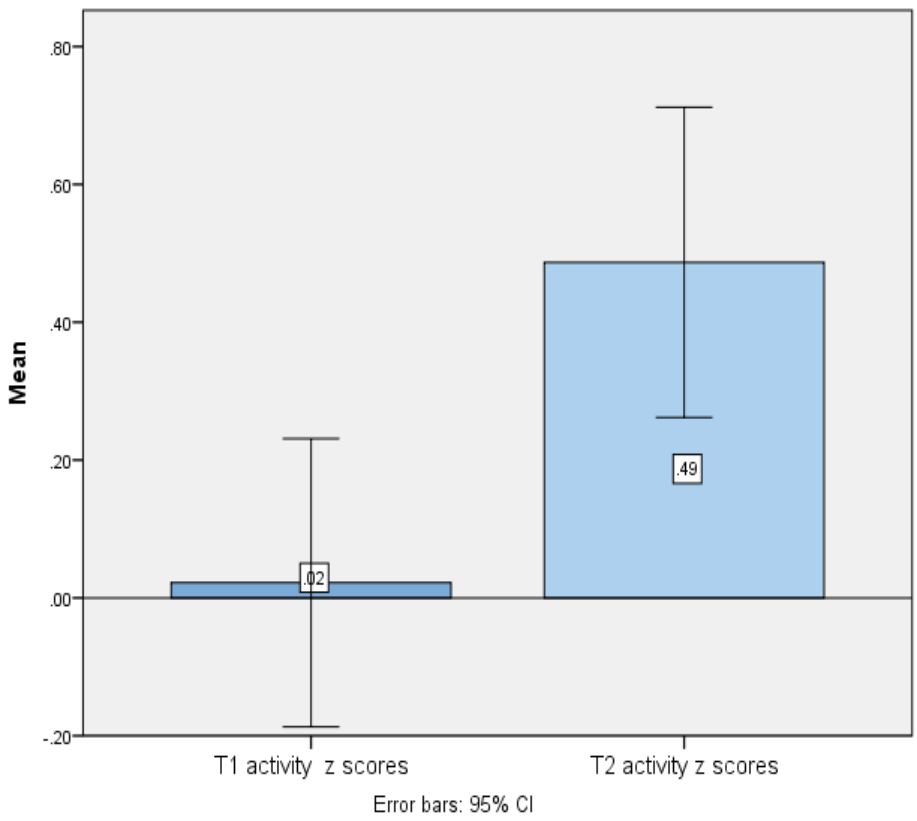
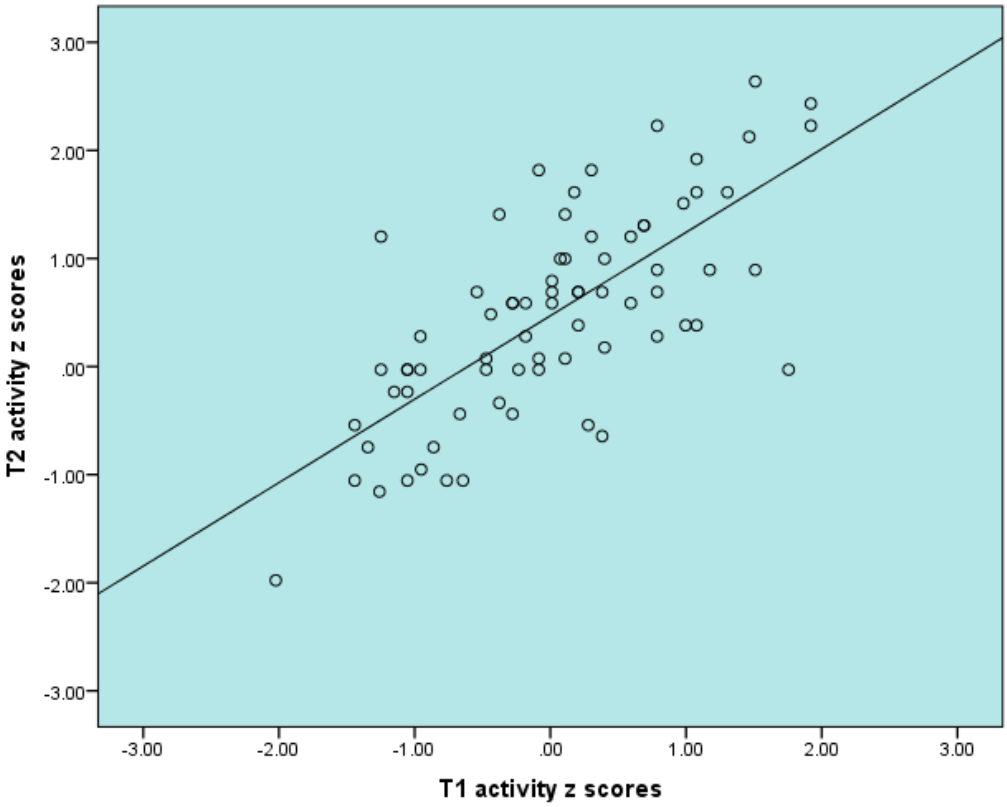


Figure 4.46. Difference in mean standard scores for activity at T1 and T2.

The strength of the relationship between activity scores at T1 and T2 showed a very strong positive correlation: Pearson's *r* (73) =.72, BCa 95% bootstrapped, CI [.56, .83], *p* <.001.



= regression line

Figure 4.47. Scatterplot of activity scores at T1 and T2.

4.5.2.5.2 Stability of the adaptability dimension

To establish the stability of the adaptability dimension over 12 months, a paired *t*-test was used: $t(71) = -3.03$, BCa 95% bootstrapped CI of the difference [-.55, -.13], $p = .003$ (two tailed). This confirmed that the means at T1 and T2 were significantly different. This represented a small effect size; Cohen's $d = 0.32$.

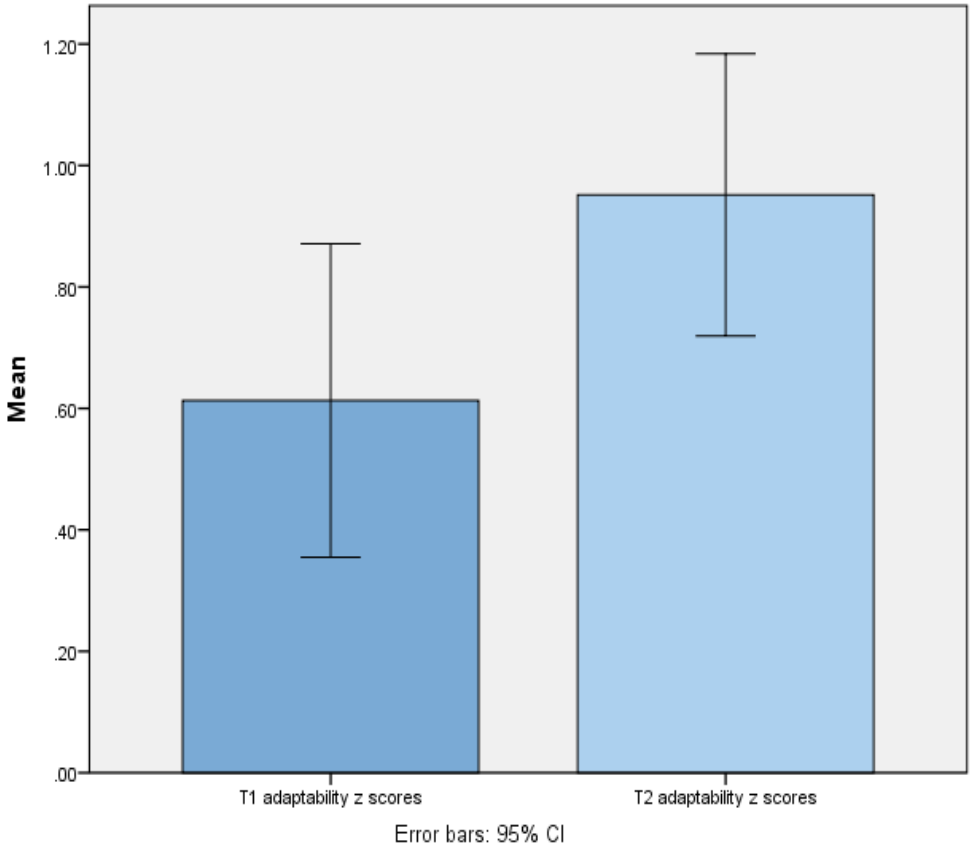


Figure 4.48. Difference in mean standard scores for adaptability at T1 and T2.

The strength of the relationship between adaptability scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (71) =.59, BCa 95% bootstrapped, CI [.41, .72], *p* <.001.

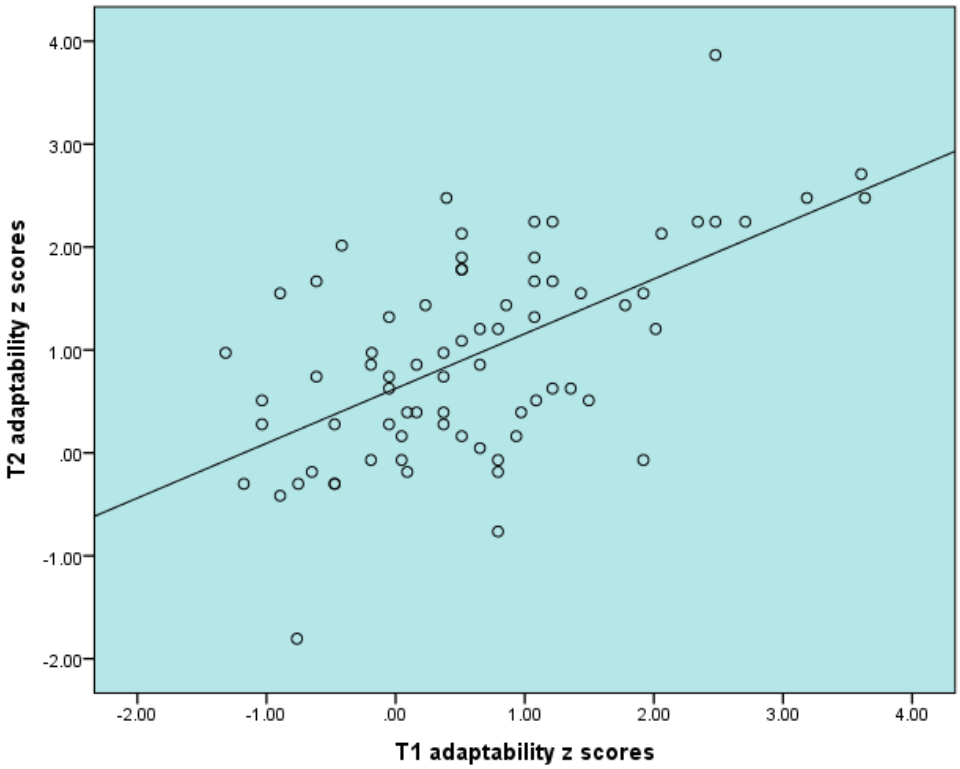


Figure 4.49. Scatterplot of adaptability scores at T1 and T2.

4.5.2.5.3 Stability of the approach dimension

To establish the stability of the approach dimension over 12 months, a paired *t*-test was used: $t(71) = -1.53$, BCa 95% bootstrapped CI of the difference [-.32, -.05], $p = .138$ (two tailed). This confirmed that there was no significant difference between the means at T1 and T2.

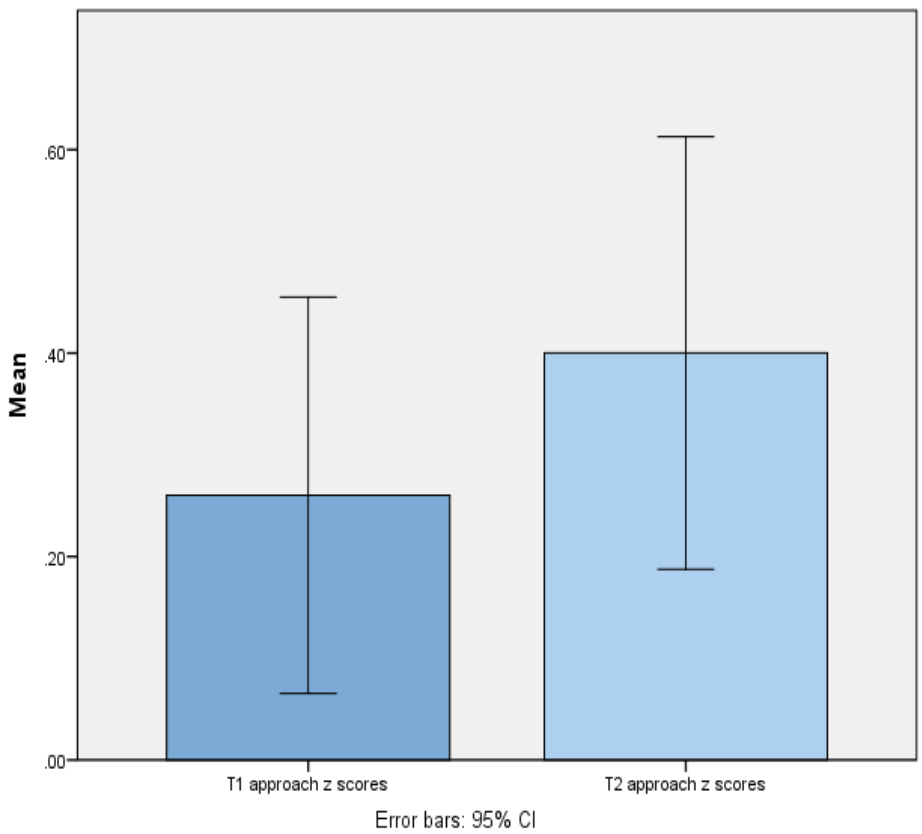


Figure 4.50. Difference in mean standard scores for approach at T1 and T2.

The strength of the relationship between approach scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (71) =.60, BCa 95% bootstrapped, CI [.44, .73], *p* <.001.

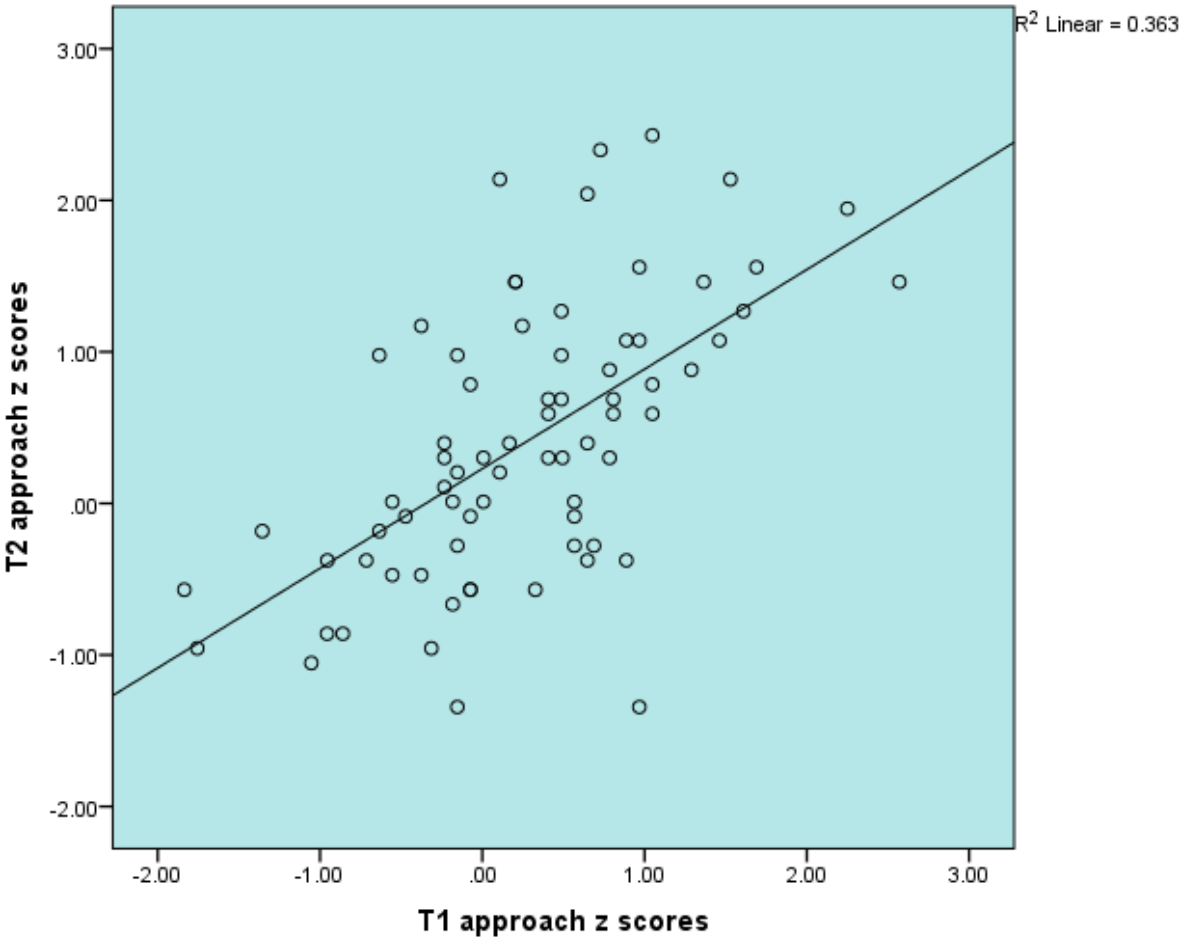


Figure 4.51. Scatterplot of approach scores at T1 and T2.

4.5.2.5.4 Stability of the distractibility dimension

To establish the stability of the distractibility dimension over 12 months, a paired *t*-test was used: $t(71) = -2.42$, BCa 95% bootstrapped CI of the difference [-.60, -.06], $p = .021$ (two tailed). This confirmed that the means at T1 and T2 were significantly different. This represented a small effect size; Cohen's $d = 0.33$.

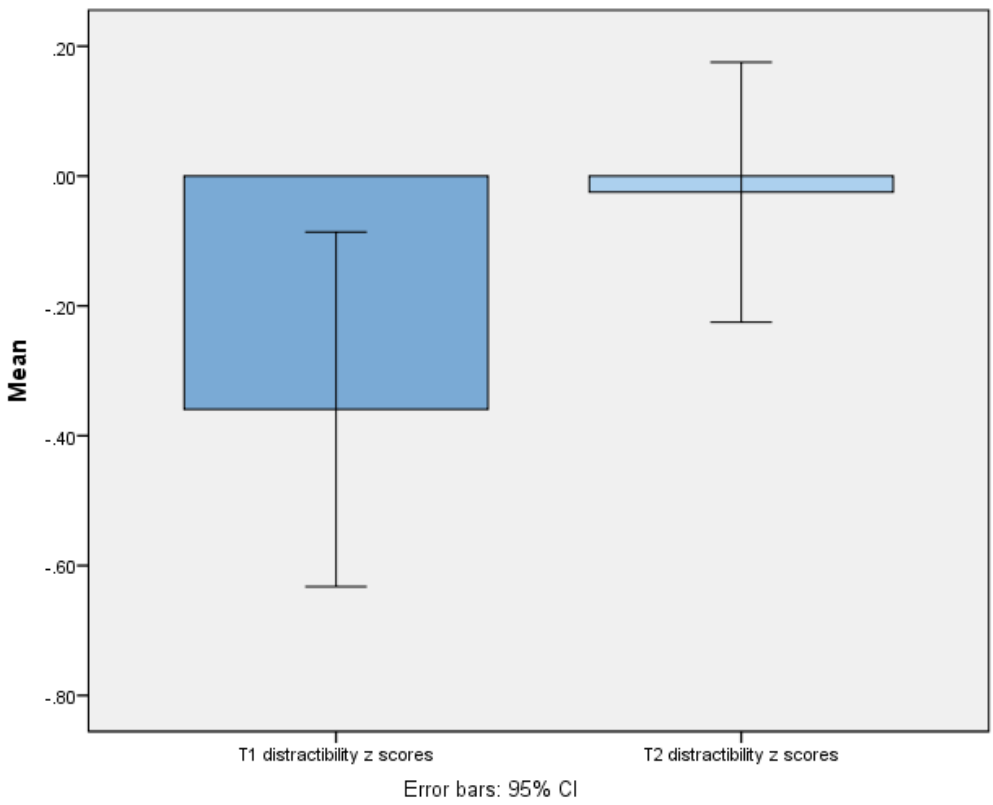


Figure 4.52. Difference in mean standard scores for distractibility at T1 and T2.

The strength of the relationship between distractibility scores at T1 and T2 showed a moderate positive correlation: Pearson's *r* (71) =.33, BCa 95% bootstrapped, CI [.10, .53], *p* =.004.

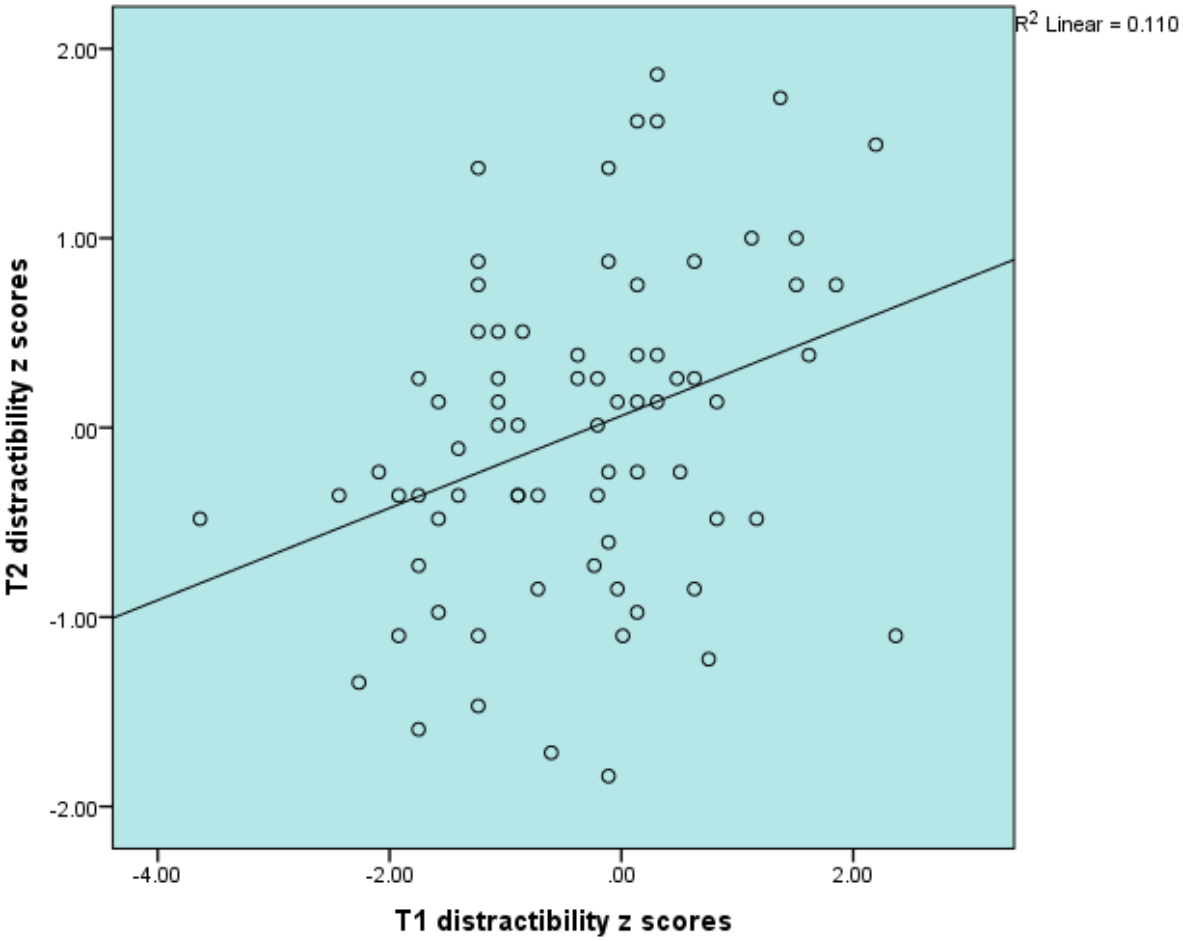


Figure 4.53. Scatterplot of distractibility scores at T1 and T2.

4.5.2.5.5 Stability of the intensity dimension

To establish the stability of the intensity dimension over 12 months, a paired *t*-test was used: $t(71) = 1.59$, BCa 95% bootstrapped CI [-.05, .46], $p = .107$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different.

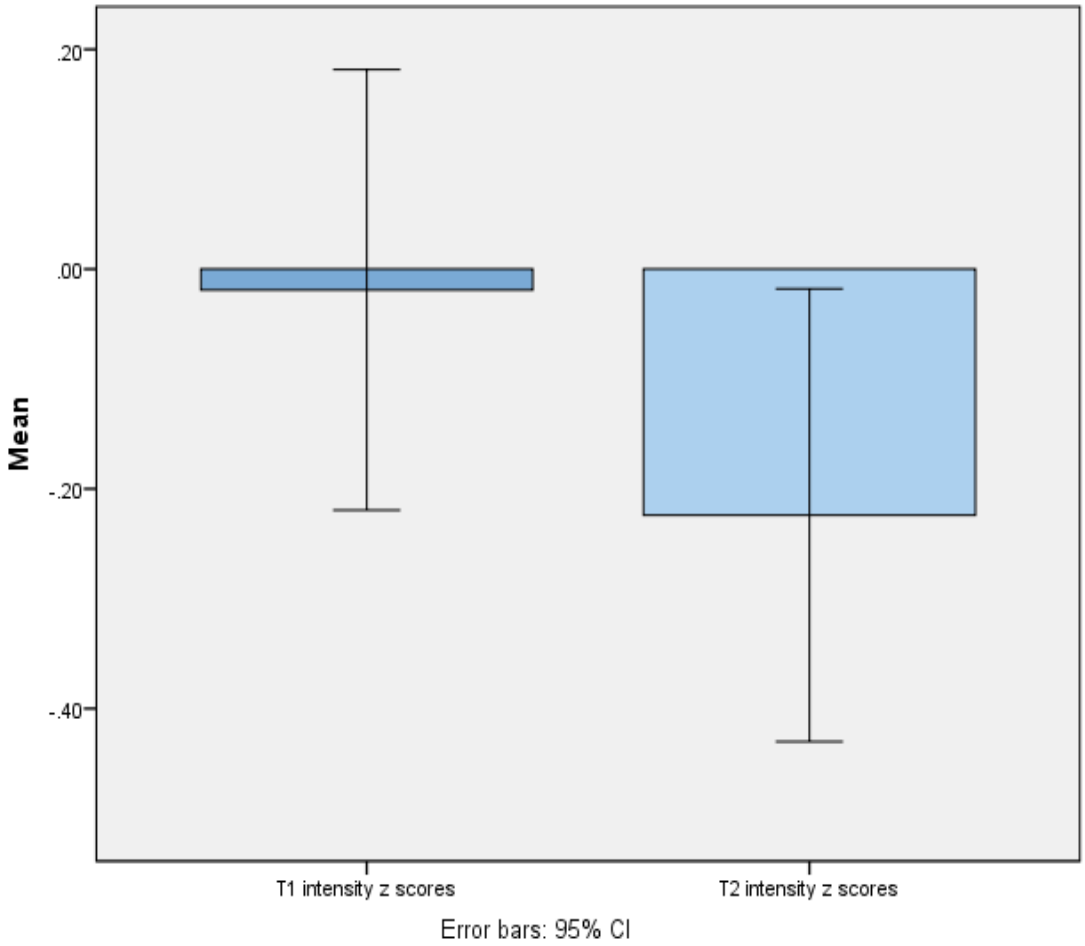


Figure 4.54. Difference in mean standard scores for intensity at T1 and T2.

The strength of the relationship between intensity scores at T1 and T2 showed a weak positive correlation: Pearson's *r* (71) =.24, BCa 95% bootstrapped, CI [-.01, .46], *p* =.041.

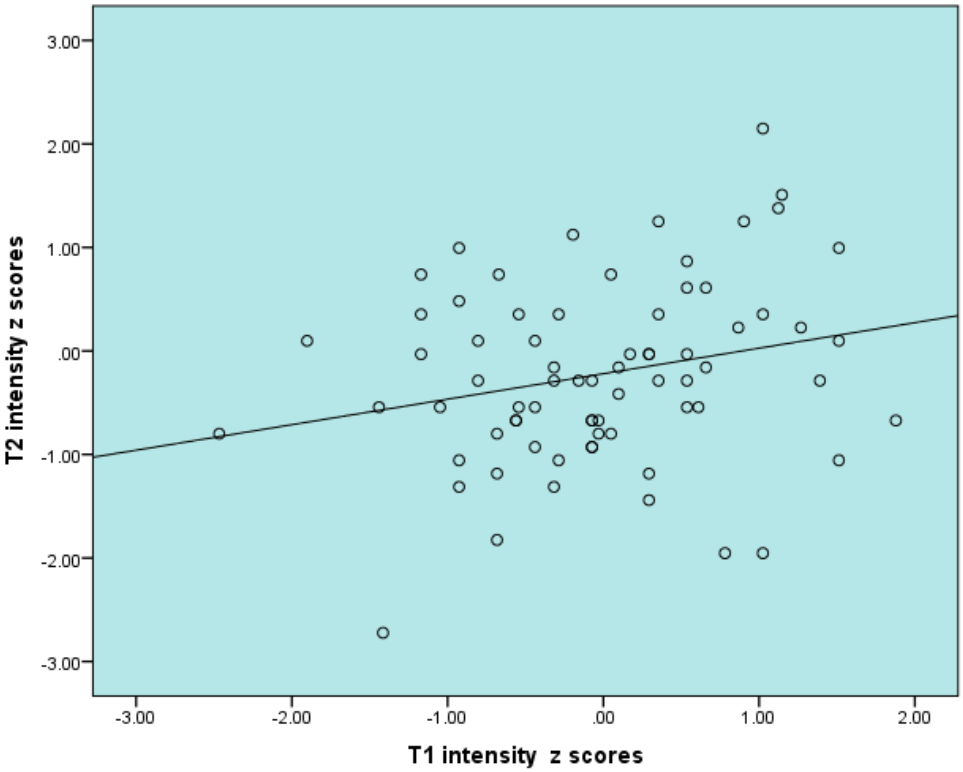


Figure 4.55. Scatterplot of intensity scores at T1 and T2.

4.5.2.5.6 Stability of the mood dimension

To establish the stability of the mood dimension over 12 months, a paired *t*-test was used: $t(71) = 1.63$, BCa 95% bootstrapped CI of the difference [-.04, .43], $p = .107$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different. This represented a small effect size; Cohen's $d = 0.22$.

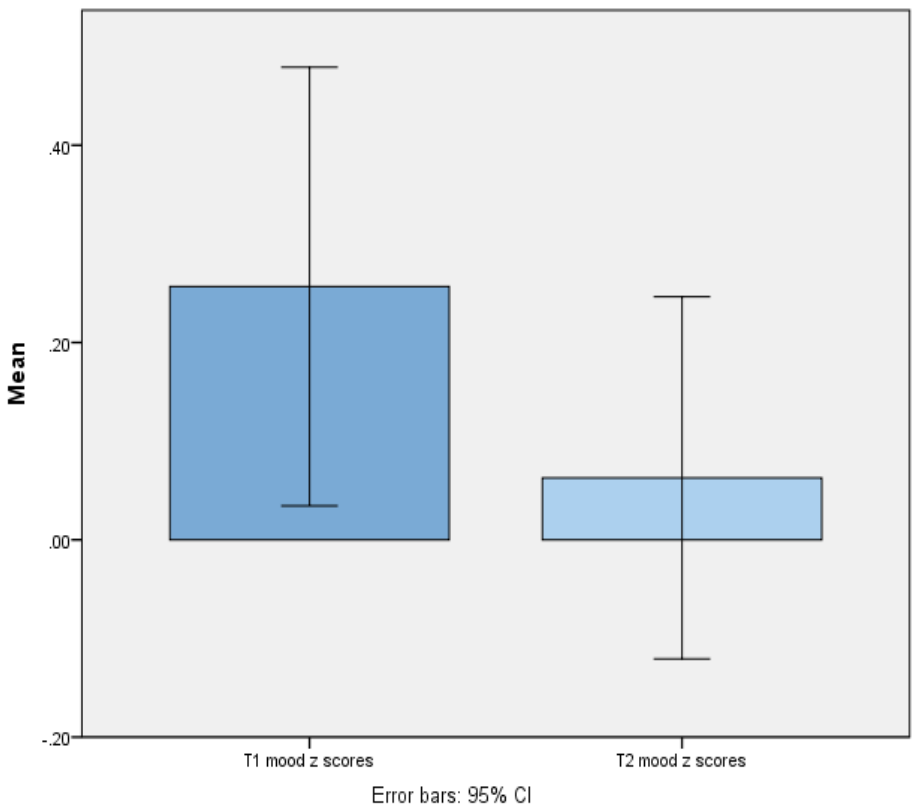


Figure 4.56. Difference in mean standard scores for mood at T1 and T2.

The strength of the relationship between mood scores at T1 and T2 showed a small positive correlation: Pearson's *r* (71) =.33, BCa 95% bootstrapped, CI [.01, .55], *p* =.004.

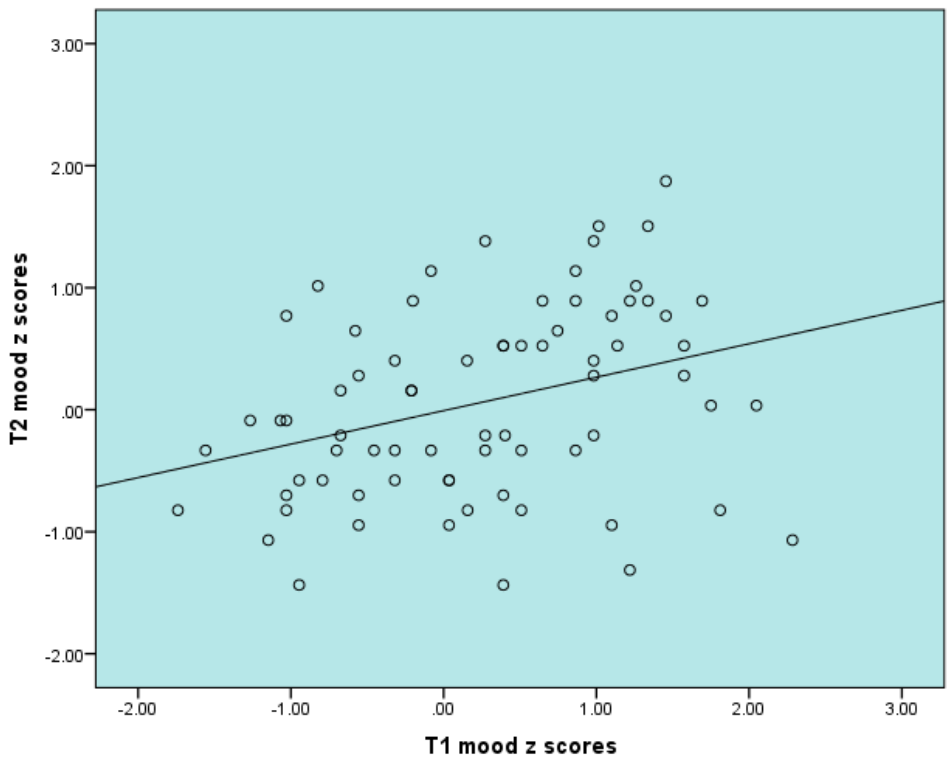


Figure 4.57. Scatterplot of mood scores at T1 and T2.

4.5.2.5.7 Stability of the persistence dimension

To establish the stability of the persistence dimension over 12 months, a paired *t*-test was used: *t*(71) =0.78, BCa 95% bootstrapped CI of the difference [-.14, .32], *p* =.437 (two tailed). This confirmed that the means at T1 and T2 were not significantly different. It was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 persistence the bias was -.001, indicating that the non-normality of the distribution was not having an effect on the t-test. This represented a negligible effect size; Cohen's *d* =0.09

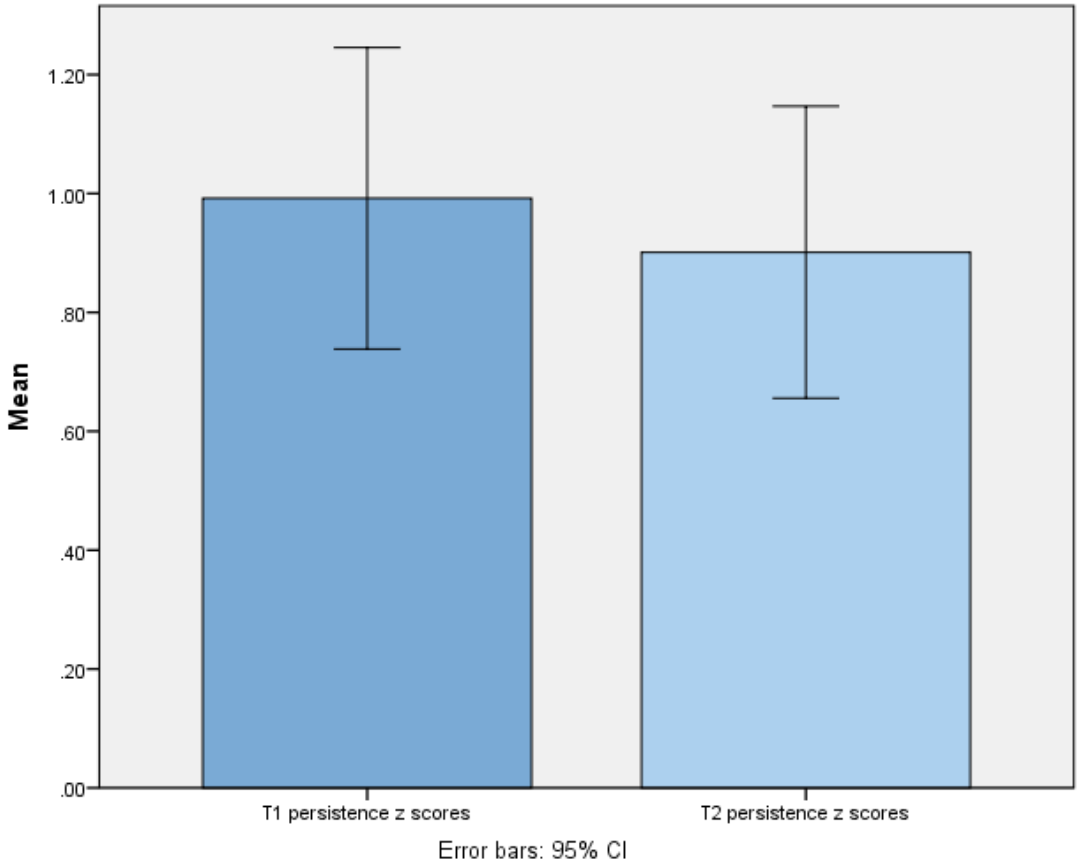


Figure 4.58. Difference in mean standard scores for persistence at T1 and T2.

The strength of the relationship between persistence scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (71) =.57, BCa 95% bootstrapped, CI [.36, .73], *p* <.001, bias =-.006.

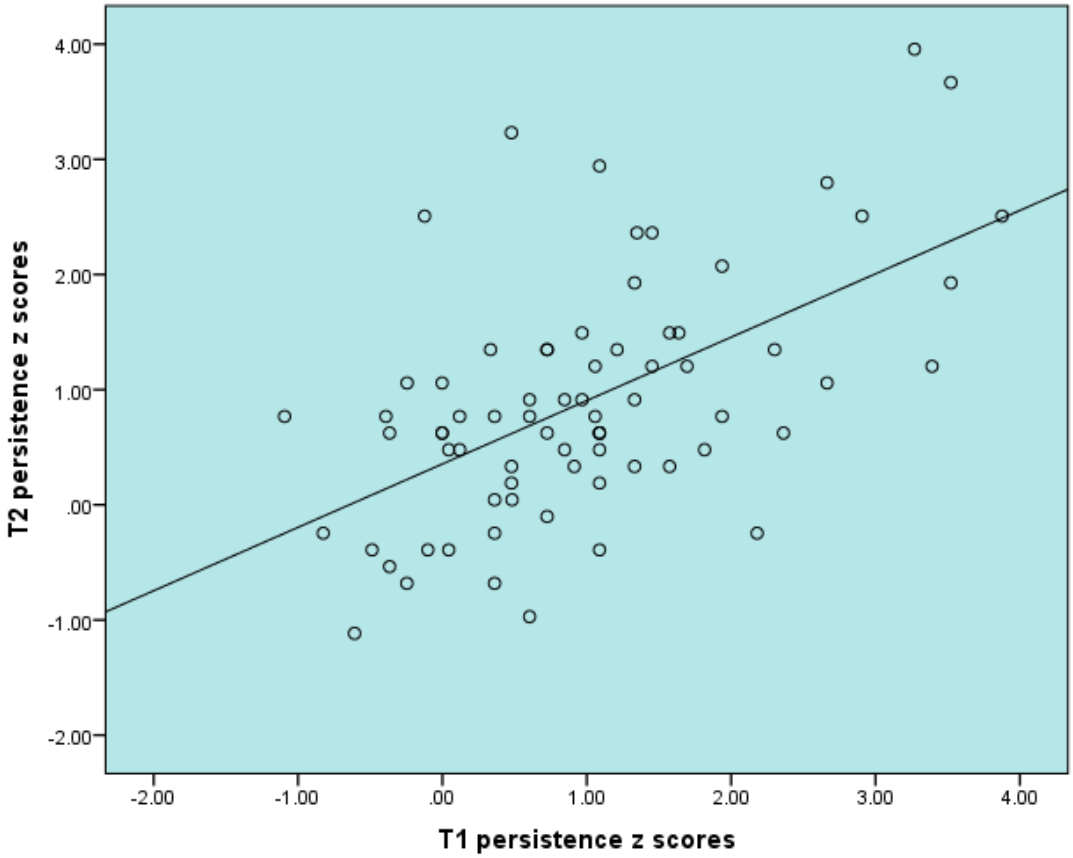


Figure 4.59. Scatterplot of persistence scores at T1 and T2.

4.5.2.5.8 Stability of the rhythmicity dimension

To establish the stability of the rhythmicity dimension over 12 months, a paired *t*-test was used: $t(71) = 0.52$, BCa 95% bootstrapped CI of the difference [-.17, .29], $p = .603$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different. This represented a negligible effect size; Cohen's $d = 0.6$.

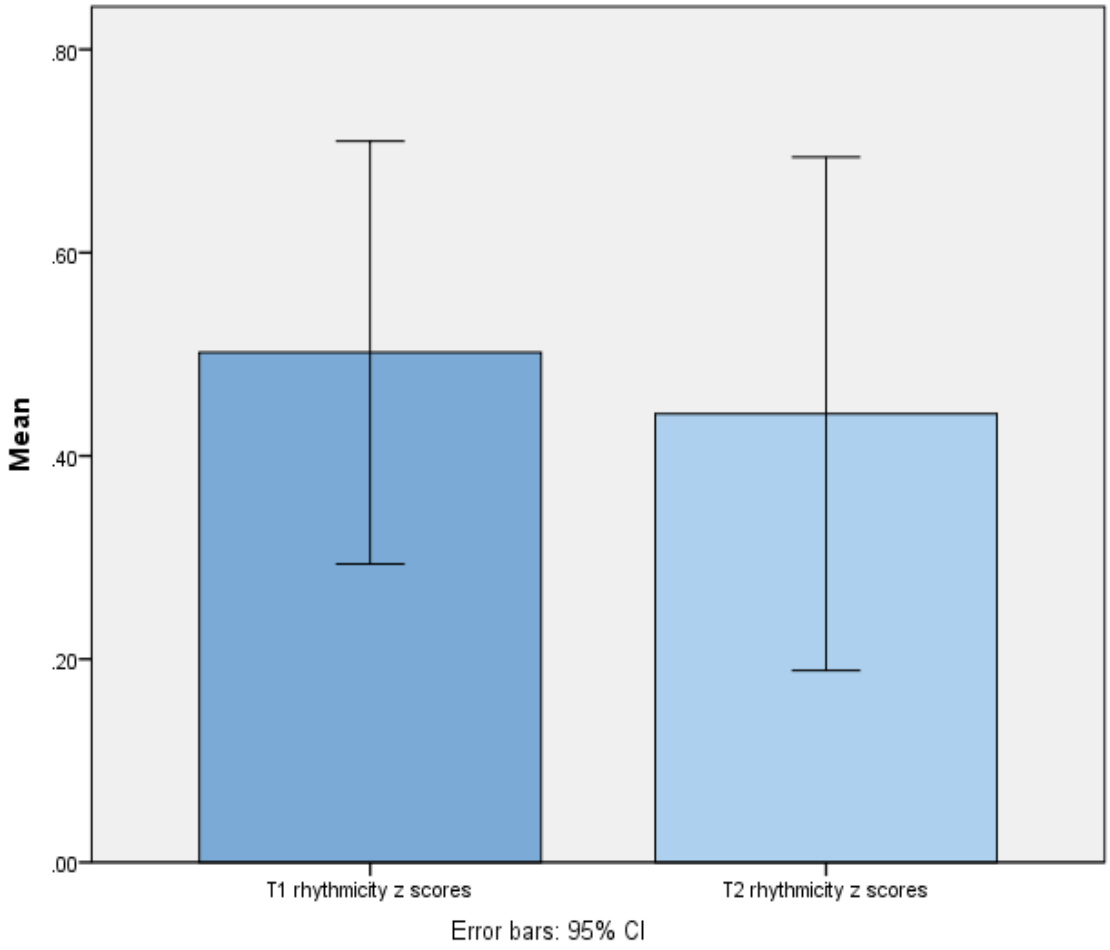


Figure 4.60. Difference in mean standard scores for rhythmicity at T1 and T2.

The strength of the relationship between rhythmicity scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (71) =.52, BCa 95% bootstrapped, CI [.32, .68], *p* <.001.

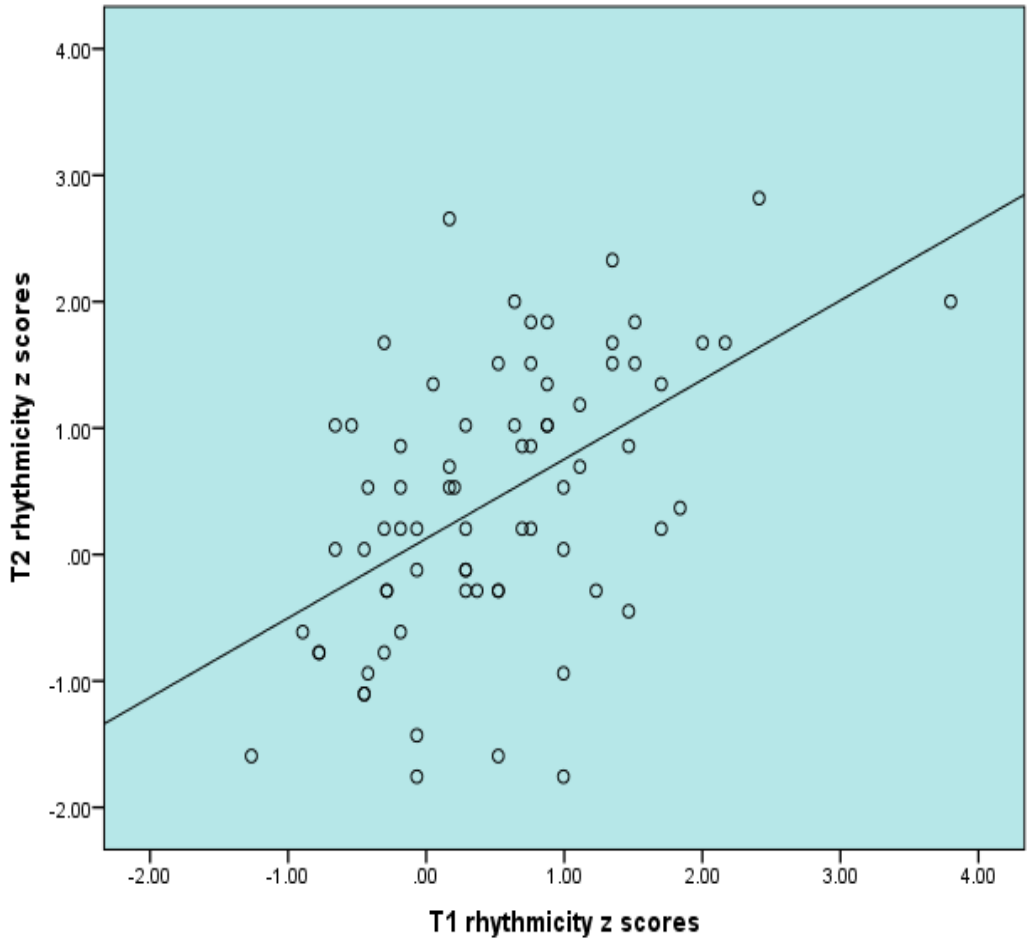


Figure 4.61. Scatterplot of rhythmicity scores at T1 and T2.

4.5.2.5.9 Stability of the threshold dimension

To establish the stability of the threshold dimension over 12 months, a paired t-test was used: $t(71) =- 0.38$, BCa 95% bootstrapped CI of the difference [-.30, .19], $p =.703$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different. Effect size was negligible, Cohen's $d =0.06$.

It was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 threshold, the bias was -.002, indicating that the non-normality of the distribution was not having an effect on the t-test.

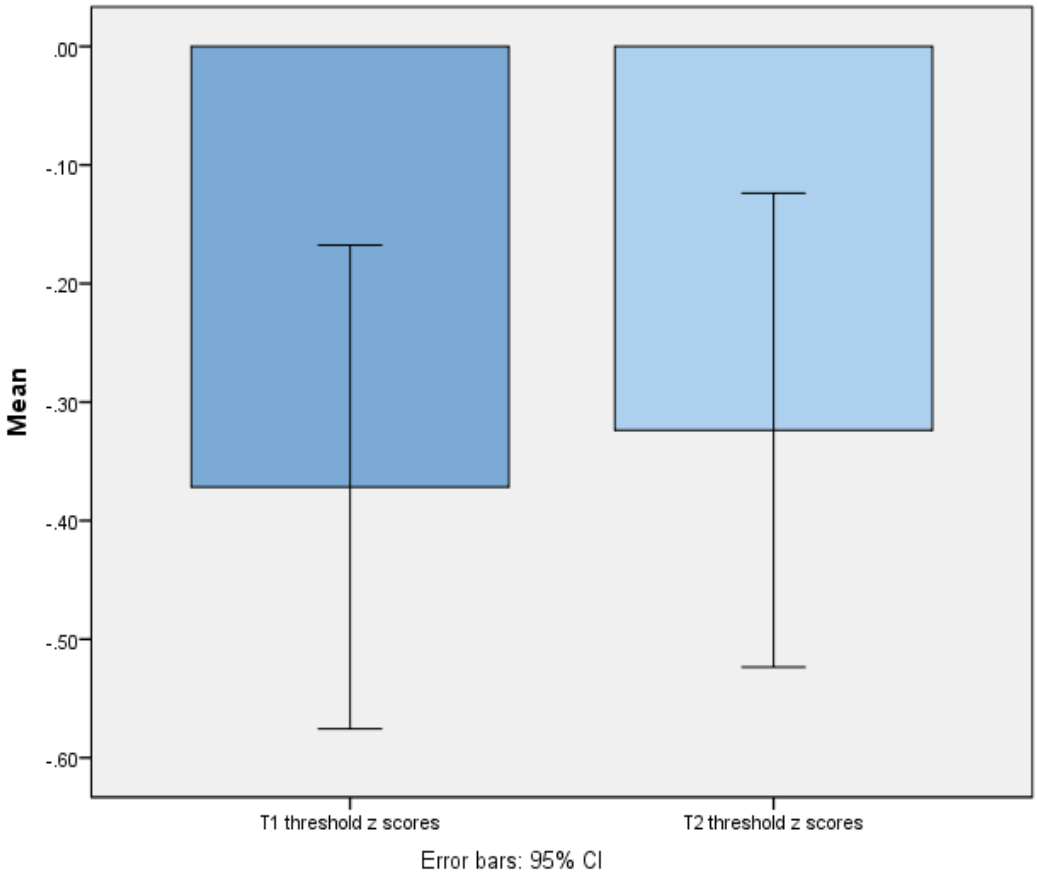


Figure 4.62. Difference in mean standard scores for threshold at T1 and T2.

The strength of the relationship between threshold scores at T1 and T2 showed a weak positive correlation: Pearson's *r* (71) =.23, BCa 95% bootstrapped, CI [-.04, .48], *p* =.05, bias =.003.

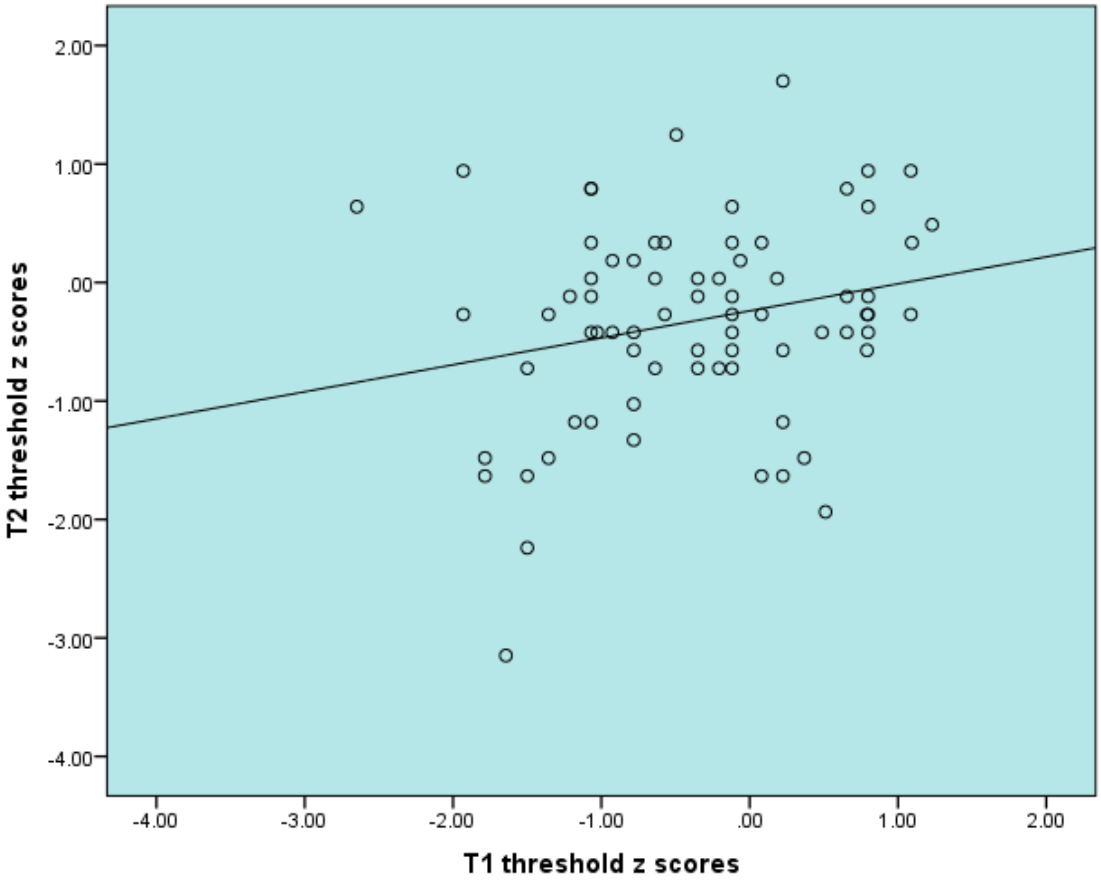


Figure 4.63. Scatterplot of threshold scores at T1 and T2.

4.5.2.6 Aim 2 Summary

To describe the temperamental characteristics of a group of pre-school children accepted on to the caseload of community SLT services

I have considered whether the mean scores for the cohort children's temperament showed similarity to that of the standardisation sample. Specific differences in the cohort's temperament profile at entry to the study related to lower persistence, adaptability and rhythmicity.

At 12 month retest, lower persistence and adaptability remained as notable differences from the standardisation sample whilst rhythmicity had moved closer to the mean.

A series of dependent *t*-tests (two tailed) identified that there was a significant difference in the T1 vs T2 means for three dimensions; activity, adaptability and distractibility where the means showed a significant increase at T2. This change signalled a movement further away from the standardisation sample for activity and adaptability but a movement to within the normative mean for distractibility. There was no significant difference (p =.05) for the other six dimensions indicating stability across the twelve month period.

Pearson's correlation was used to establish the strength of relationships between T1 and T2 dimension standardised scores. These were significant across all dimensions though they varied in strength, with intensity and threshold showing only weak positive correlations.

Overall, these data suggest that temperament across 12 months was relatively stable for the children. These results are summarised in Table 4.22.

Table 4.22 *t* test and correlation for temperament (test-retest) over 12 months

	Children's temperament T1 vs T2					
	Dependent *t* test			Paired Samples Correlations		
N =73	*t* test	BCa 95% CI	Sig. (two tailed)	Pearson's r	BCa 95% CI	Sig. (two tailed)
Activity	-5.75	-.63, -.30	<.001	.718	.56, .83	<.001
Adaptability	-3.03	-.55, -.13	.003	.591	.41, 72	<.001
Approach	-1.53	-.32, -.05	.138	.602	.44, .73	<.001
Distractibility	-2.38	-.60, -.06	.021	.332	.10, .53	.004
Intensity	1.63	-.05, .46	.107	.240	-.01, .46	.041
Mood	1.63	-.04, .43	.107	.332	.01, .55	.004
Persistence	0.78	-.14, .32	.437	.568	.36, .73	<.001
Rhythmicity	0.52	-.17, .29	.603	.517	.32, .68	<.001
Threshold	-0.38	-.30, .19	.703	.232	-.04, .48	.048

4.5.3 Research aim 3

To describe the temperament characteristics of the parents of the study cohort.

4.5.3.1 What were the temperament characteristics of the parent cohort at entry to the study?

There are nine dimensions of temperament derived from the Carey Temperament Scales. The Adult Temperament Questionnaire was used as the measurement tool for both time points of data collection (see 3.6.2.2.3 for information about the ATQ).

Mean scores for each scale were calculated for the cohort and then scores were transformed to z scores to allow comparison across the two scales used for the children.

The cohort transformed mean scores (z scores) are presented for each dimension.

4.5.3.1.1 Activity

The mean for activity at T1 was 0.42, with an *SD* of 1.21. The distribution of the data showed a very slight positive skew, 0.19 and a negative kurtosis, -0.74, both within the limits for acceptability (see *Figure 4.64*). The KS test confirmed that the data were suitable to be treated as normally distributed, $D(80) = .08$, $p = .200$.

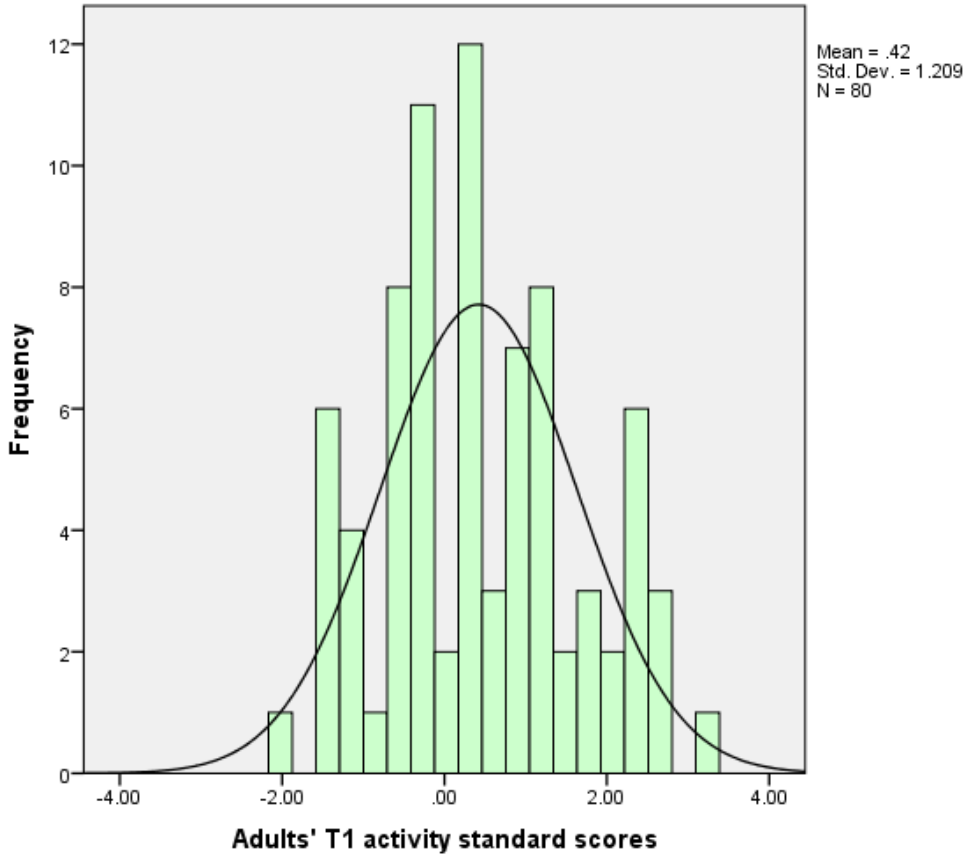


Figure 4.64. Distribution of z scores for adults' activity at T1.

4.5.3.1.2 Adaptability

The standardised mean for adaptability at T1 was 0.43. The distribution of the cohort data showed a positive skew of 1.11 and positive kurtosis, 1.51, both of which lay outside the twice the standard error cut-off limit for acceptability (see *Figure 4.65*). The KS test identified that the data were unsuitable to be treated as normally distributed, $D(80) = .18$, $p < .001$.

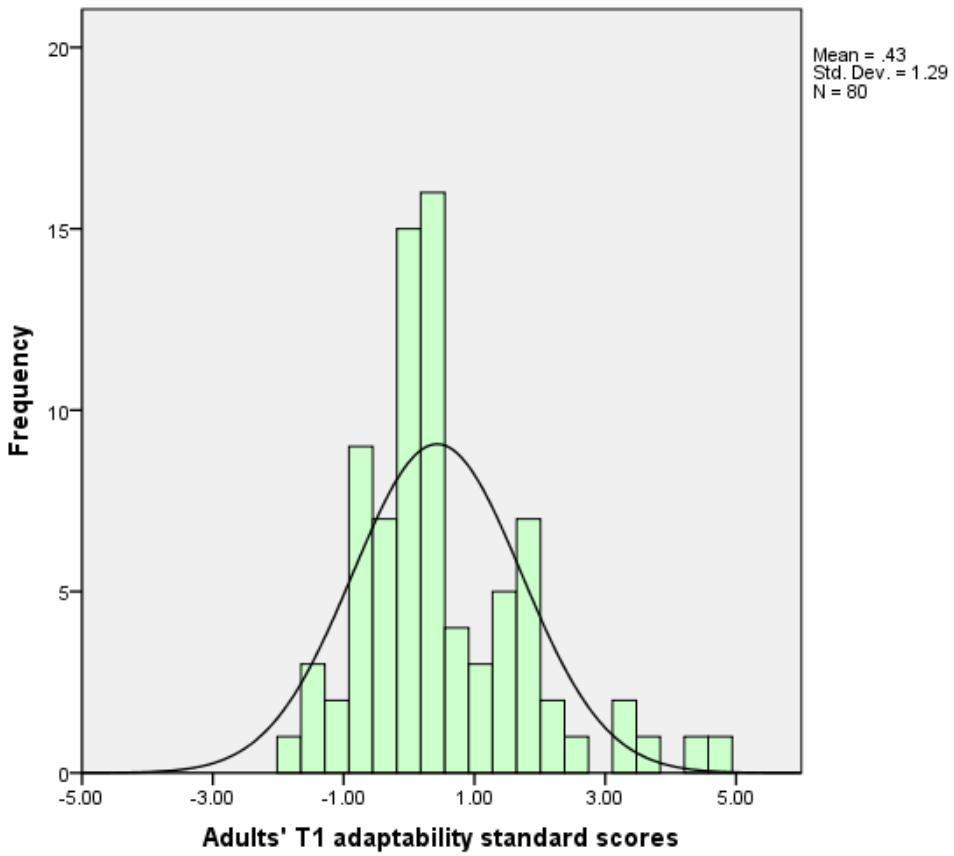


Figure 4.65. Distribution of z scores for adults' adaptability at T1.

Viewing the histogram, there are several outliers with scores reflecting slowness to adapt.

4.5.3.1.3 Approach

The mean for approach at T1 was 0.48. The distribution of the data showed a slight positive skew, 0.11, and a negative kurtosis, -0.26, within the cut-off limit for acceptability (see *Figure 4.66*). The KS test showed the data were suitable to be treated as normally distributed, $D(80) = .07$, $p = .200$.

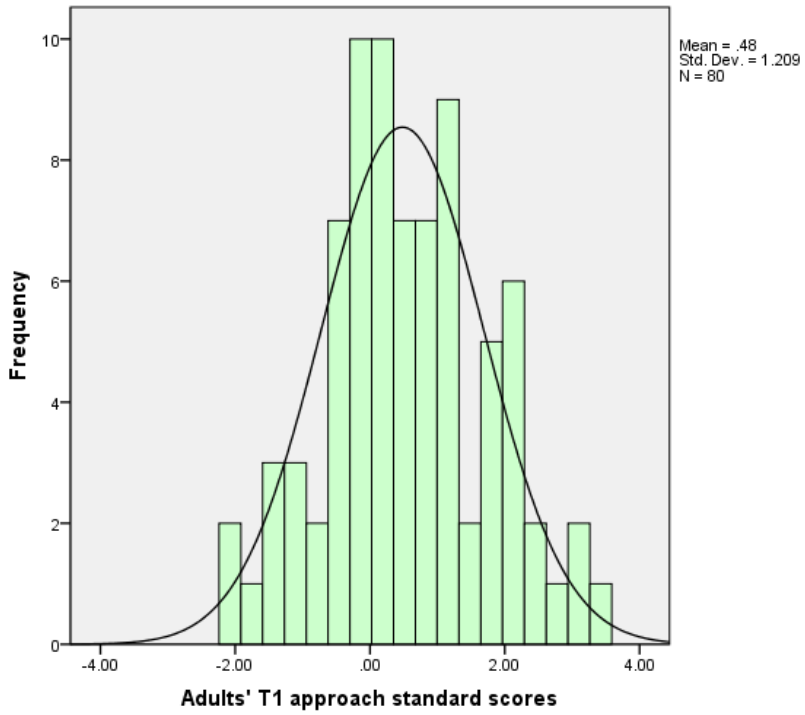


Figure 4.66. Distribution of z scores for adults' approach at T1.

4.5.3.1.4 Distractibility

The mean for distractibility at T1 was 0.54. The distribution of the data showed a slight negative skew, - 0.19 and a positive kurtosis, 0.81, which lay within the cut-off limit for acceptability (see *Figure 4.67*). The KS test confirmed that the data were suitable to be treated as normally distributed, $D(80) = .08$, $p = .200$.

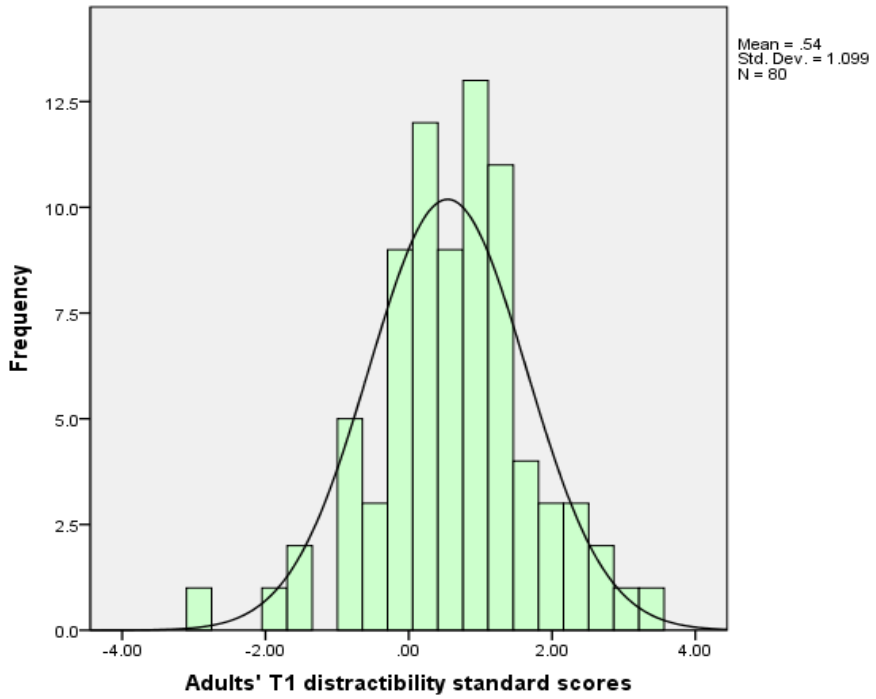


Figure 4.67. Distribution of z scores for adults' distractibility at T1.

4.5.3.1.5 Intensity

The mean for intensity at T1 was -0.09, whilst the distribution of the data showed a slight positive skew, - 0.14 and had positive kurtosis, 0.93 both within acceptable limits (see *Figure 4.68*). The KS test showed the data were suitable to be treated as normally distributed, $D(80) = .08$, $p = .200$.

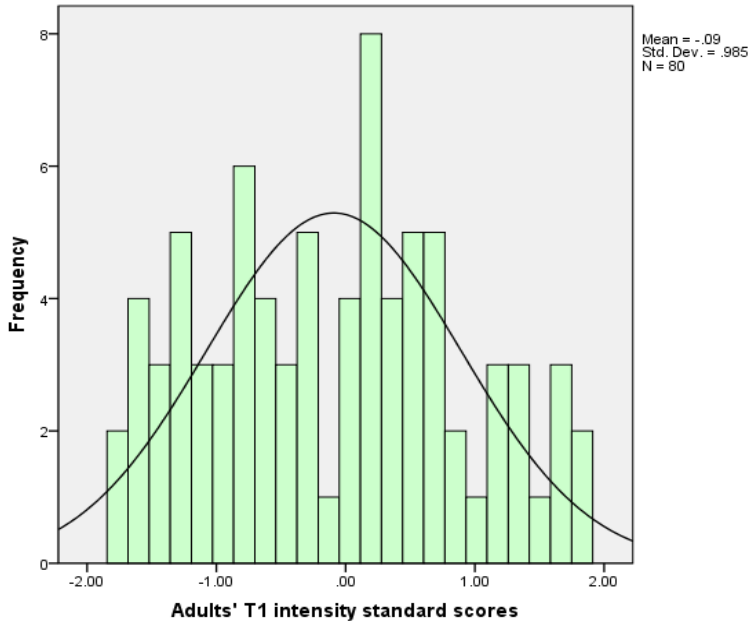


Figure 4.68. Distribution of z scores for adults' intensity at T1.

4.5.3.1.6 Mood

The mean for mood at T1 was -0.02. The distribution of the data showed a positive skew, 0.23 and kurtosis, 0.18. These values both lay within the cut-off limit for acceptability (see *Figure 4.69*). The KS test showed the data as suitable to be treated as normally distributed, $D(80) = .10$, $p = .069$.

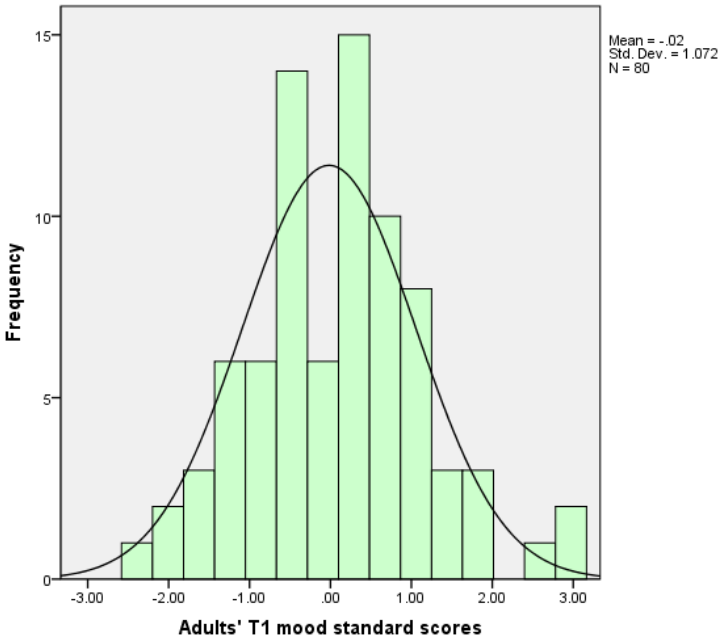


Figure 4.69. Distribution of z scores for adults' mood at T1.

4.5.3.1.7 Persistence

The mean for persistence at T1 was 0.23. The data was positively skewed, 0.48 and had a small negative kurtosis of -0.08. The skew value was just inside the twice the standard error cut-off limit for acceptability and demonstrates the shift of scores to populate the right of the curve (see *Figure 4.70*). Despite meeting standard error cut off limits, the KS test showed the data were not suitable to be treated as normally distributed, $D(80) = .10$, $p = .033$.

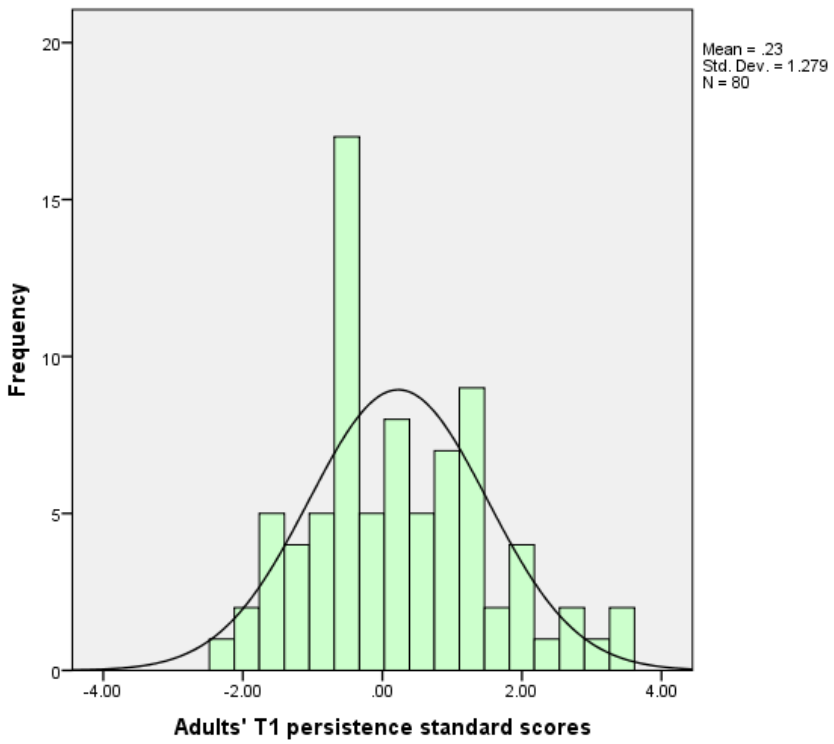


Figure 4.70. Distribution of z scores for adults' persistence at T1.

4.5.3.1.8 Rhythmicity

The mean for rhythmicity at T1 was 0.35. The data distribution showed both a negative skew, -0.12 and kurtosis, -0.68, which lay within cut-off limits for acceptability (see *Figure 4.71*). The KS test confirmed that the data were suitable to be treated as a normal distribution, $D(80) = .07$, $p = .200$.

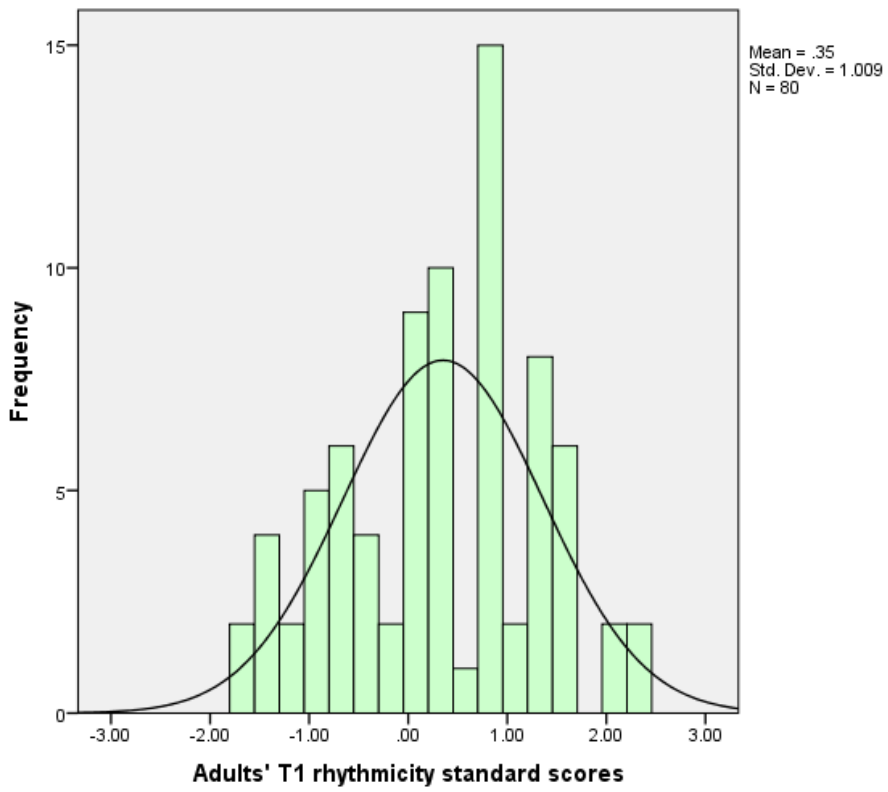


Figure 4.71. Distribution of z scores for adults' rhythmicity at T1.

4.5.3.1.9 Threshold

The mean for threshold at T1 was 0.09. The distribution of the data showed a slight negative skew, - 0.10 and a negative kurtosis, -0.56. Skew and kurtosis values were acceptable (see *Figure 4.72*). The KS test showed that the data were suitable to be treated as normally distributed, $D(80) = .07$, $p = .200$.

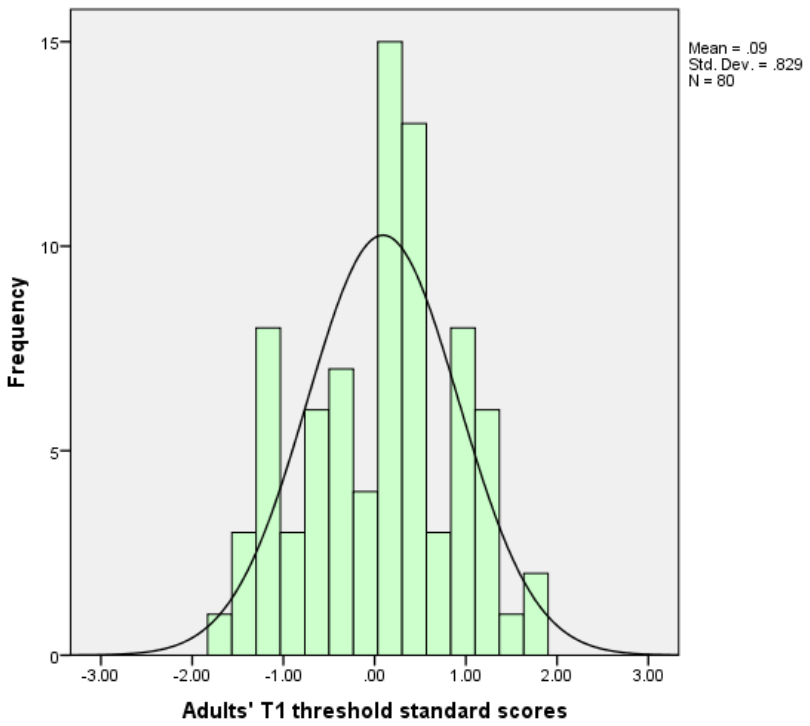


Figure 4.72. Distribution of *z* scores for adults' threshold at T1.

4.5.3.2 Did the parent cohort's temperament differ from the normative temperament data at the start of the study?

The T1 adult temperament data showed some differences from the standard scores of the standardisation sample.

The 95% CIs for intensity, mood, persistence and threshold standardised mean scores fell across the mean, suggesting that these scores were broadly representative of the normative sample.

However, the cohort was notably more distractible than the standardisation sample with the mean being further than 0.5*SD* from the standardised mean.

Looking at the 95% CI bands, those for the activity, adaptability, approach and rhythmicity dimensions all crossed above 0.5 *SD* away from the standardised mean and

did not cross the standardised mean (0). The results across dimensions are summarised in Table 4.23 below.

These differences in movement from the standardised dimension means are visually displayed in *Figure 4.73* and showed that the cohort have dissimilar scores to the standardisation sample with respect to distractibility.

Table 4.23 *Descriptive statistics for T1 dimensions of adult temperament*

Dimension *N* =80	Mean (z score)	95% BCa CI (10,000)	Standard Error	*SD*	Range	Data Distribution*
Activity	.42	.17, .67	.14	1.21	5.12 (-2.02, 3.10)	Normal
Adaptability	.43	.16, .72	.14	1.29	6.41 (-1.84, 4.58)	Not normal
Approach	.48	.23, .74	.14	1.21	5.34 (-2.08, 3.26)	Normal
Distractibility	.54	.30, .78	.12	1.10	6.32 (-2.93, 3.39)	Normal
Intensity	-.09	-.30, .12	.11	0.99	3.59 (-1.76, 1.83)	Normal
Mood	-.02	-.24, .21	.12	1.07	5.17 (-2.39, 2.78)	Normal
Persistence	.23	-.05, .52	.14	1.28	5.73 (-2.30, 3.43)	Not normal
Rhythmicity	.35	.13, .58	.11	1.01	4.14 (-1.68, 2.46)	Normal
Threshold	.09	-.09, .27	.09	0.83	3.60 (-1.70, 1.90)	Normal

*KS test significant at p <0.05

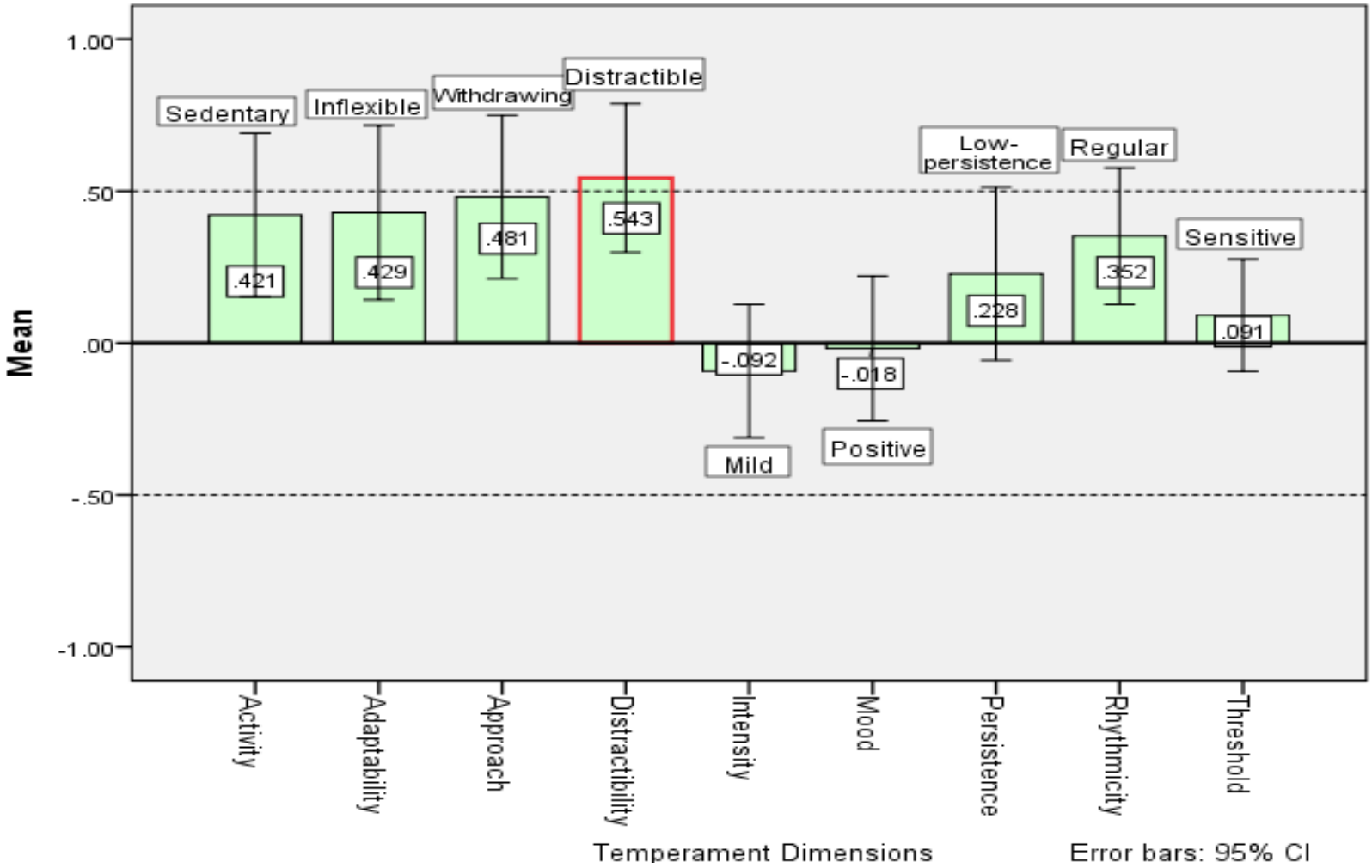


Figure 4.73. Adult cohort temperament profiles at entry to the study.

4.5.3.3 What were the parent cohort's temperament characteristics after 12 months?

Seventy-two of the parents remained in the study at the second point of data collection (T2). One of the parent-child dyads swopped a mother for a father at the second point of data collection and temperament data was not therefore collected. Mean scores for each scale were calculated for the cohort and then scores were transformed to *z* scores to allow comparison across the two data points, T1 and T2. These are now presented for each dimension.

4.5.3.3.1 Activity

The mean for activity at T2 was 0.45. Looking at the distribution of the cohort data, it showed a positive skew, 0.53 and negative kurtosis, -0.75, both of these were within the twice the standard error cut-off limit for acceptability (see *Figure 4.74*). The KS test showed the data were suitable to be treated as normally distributed, $D(72) = .07$, $p = .200$

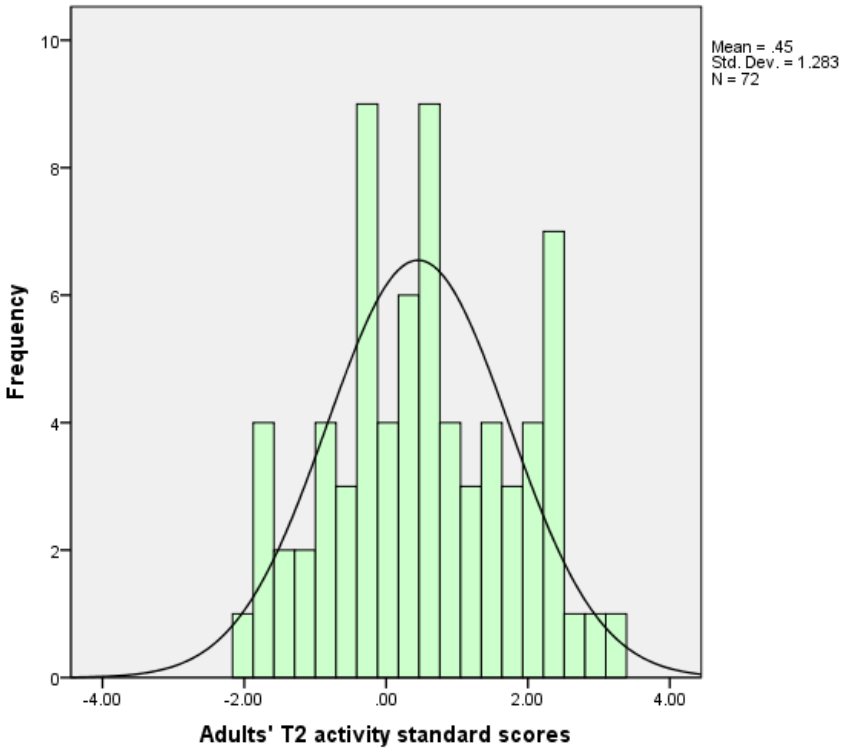


Figure 4.74. Distribution of z scores for adults' activity at T2.

4.5.3.3.2 Adaptability

The mean for T2 adaptability was 0.38. The distribution of the cohort data showed a positive skew, 0.40 and negative kurtosis, -0.53, both within the acceptable range (see *Figure 4.75*). The KS test showed the data were suitable to be treated as normally distributed, $D(72) = .09$, $p = .200$.

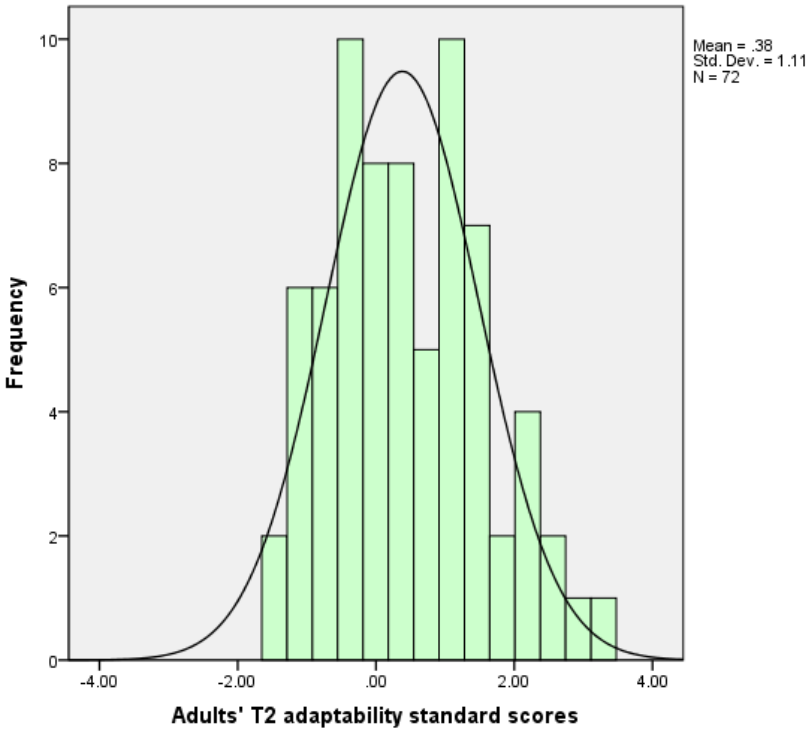


Figure 4.75. Distribution of z scores for adults' adaptability at T2.

4.5.3.3.3 Approach

The mean for T2 approach was 0.54. The distribution of the data showed a small acceptable positive skew, 0.22 and a negative kurtosis, -0.65 which lay outside the twice the standard error cut-off limit for acceptability (see *Figure 4.76*). However, the KS test showed the data were suitable to be treated as normally distributed, $D(72) = .07$, $p = .200$

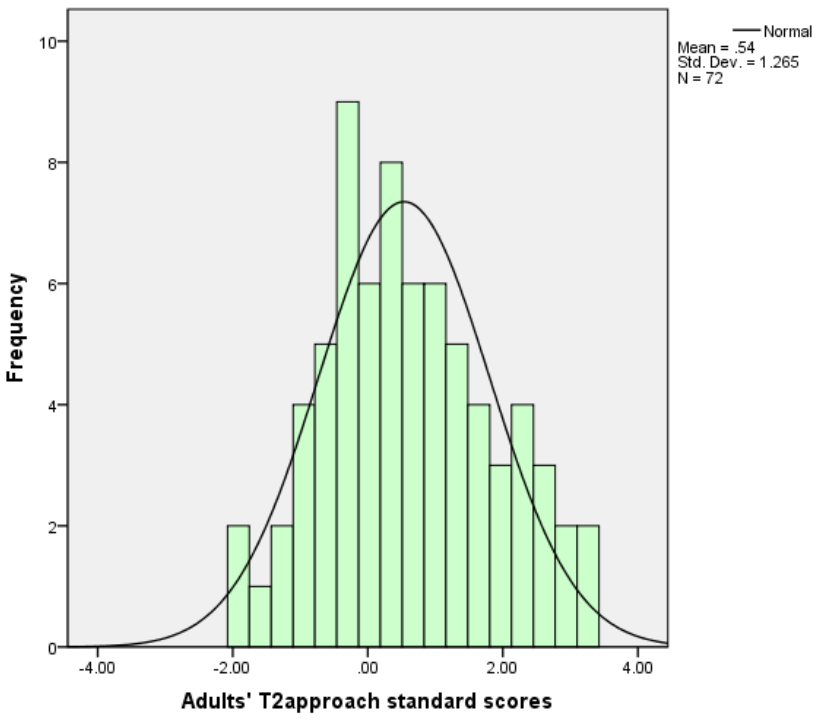


Figure 4.76. Distribution of z scores for adults' approach at T2.

4.5.3.3.4 Distractibility

The mean for T2 distractibility was 0.59. The distribution of the data showed a positive skew of 0.86, which lay outside acceptable limits and a positive kurtosis, 0.47, which was within the limit for acceptability. Further, the KS test showed the data were unsuitable to be treated as normally distributed, D(72) =.14, p <.001. Looking at *Figure 4.77*, it was seen that the data exhibited a positive skew that was overinflating the mean score. This was confirmed by inspecting the differences in the mean (0.59) and the median (0.41).

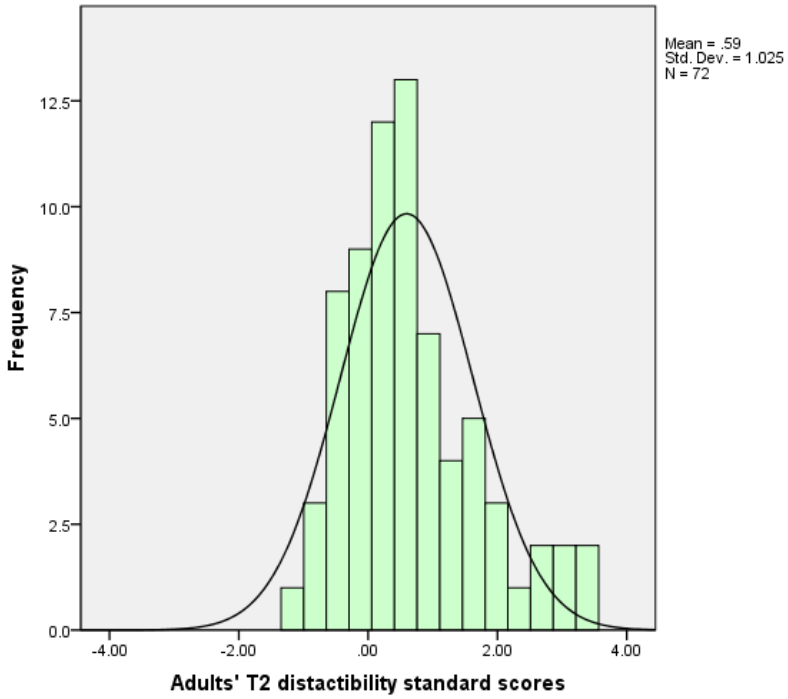


Figure 4.77. Distribution of z scores for adults' distractibility at T2.

4.5.3.3.5 Intensity

The mean for T2 intensity was -0.12. The distribution of the data showed a slight negative skew of -0.01 and kurtosis of -0.47, both of which fell within the cut-off limit for acceptability (see *Figure 4.78*). The KS test confirmed the data as suitable to be treated as normally distributed, $D(72) = .07$, $p = .200$.

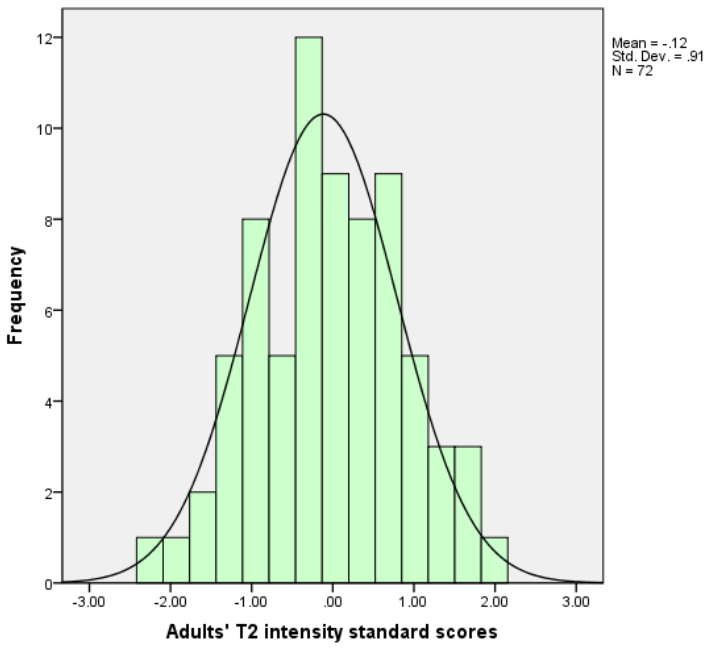


Figure 4.78. Distribution of z scores for adults' intensity at T2.

4.5.3.3.6 Mood

The mean for T2 mood was -0.02. The data distribution showed a positive skew of 0.25 and a slight negative kurtosis, -0.03. Skew and kurtosis values were inside acceptable limits (see *Figure 4.79*). The KS test showed the data were suitable to be treated as normally distributed, $D(72) = .09$, $p = .200$.

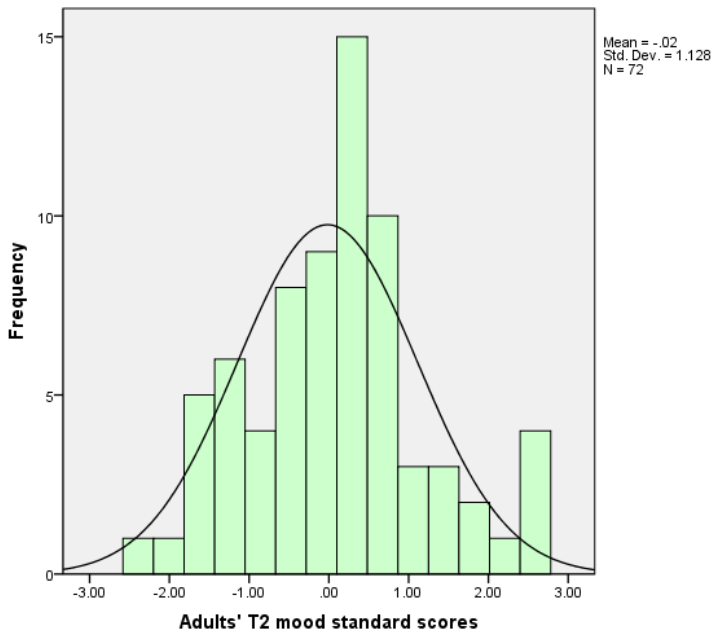


Figure 4.79. Distribution of z scores for adults' mood at T2.

4.5.3.3.7 Persistence

The mean for persistence at T2 was 0.35. Looking at the distribution of the cohort data, it shows a positive skew, 0.39 and negative kurtosis, -0.22. These both lay inside the twice the standard error cut-off limit for acceptability, however, the KS test showed the data were not suitable to be treated as normally distributed, D(72) =.11, *p* =.025. The histogram of standardised scores (*Figure 4.80*) shows that the scores are positively skewed, with the mean (.35) inflated in comparison to the median score (.21).

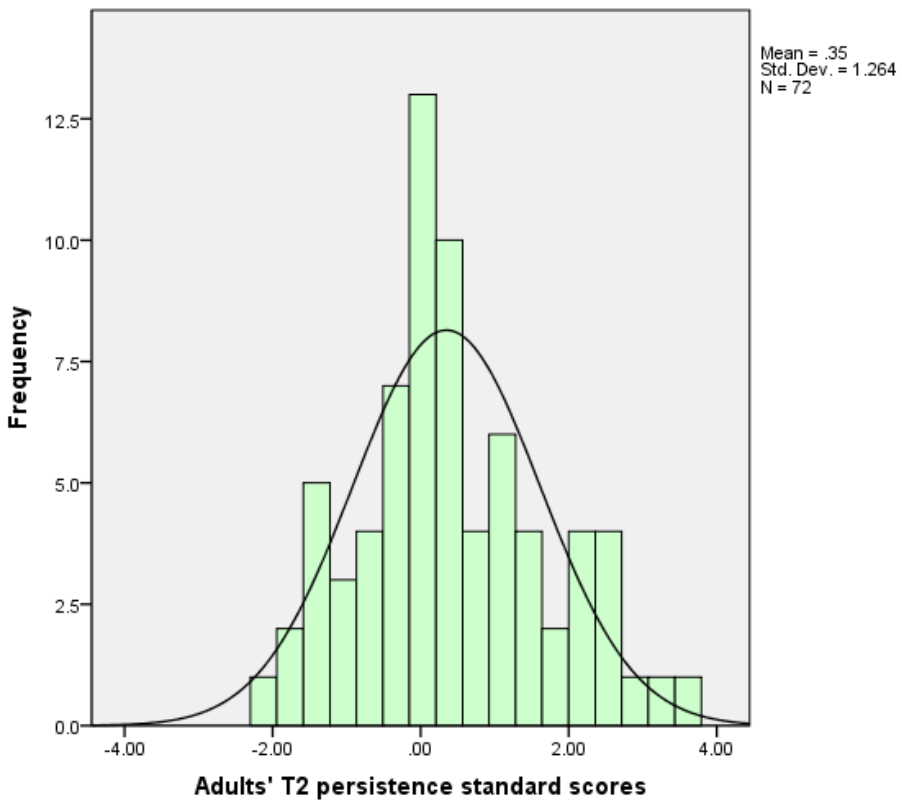


Figure 4.80. Distribution of z scores for adults' persistence at T2.

4.5.3.3.8 Rhythmicity

The mean for rhythmicity at T2 was 0.37. Looking at the distribution of the cohort data, there was a negative skew, - 0.10 and negative kurtosis of -0.91. The kurtosis value was outside the twice the standard error cut-off limit for acceptability. Looking at the histogram (*Figure 4.81*) the data display a bimodal distribution with peaks at -0.5 and 1.0. Further, the mean of 0.37 is depressed in comparison to the median of 0.52. However the KS test showed these data were suitable to be treated as normally distributed, $D(72) = .09$, $p = .169$.

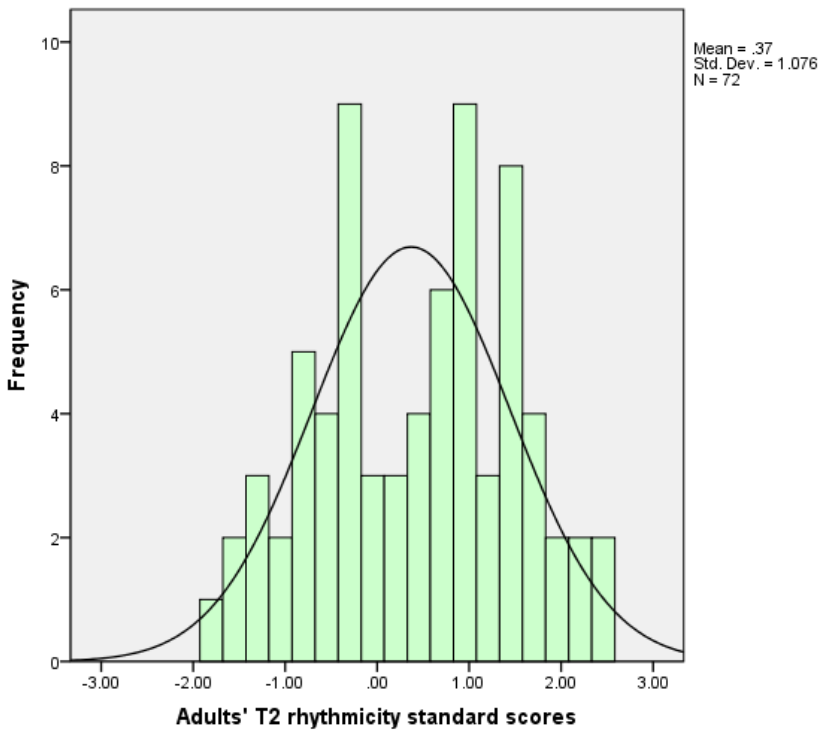


Figure 4.81. Distribution of z scores for adults' rhythmicity at T2.

4.5.3.3.9 Threshold

The mean for threshold at T2 was 0.06. Looking at the distribution of the cohort data, it showed a negative skew, - 0.06 and positive kurtosis of 0.21. These values fell within acceptable limits (see *Figure 4.82*). However, the KS test showed that these data were not suitable to be treated as normally distributed, $D(72) = .11$, $p = .026$

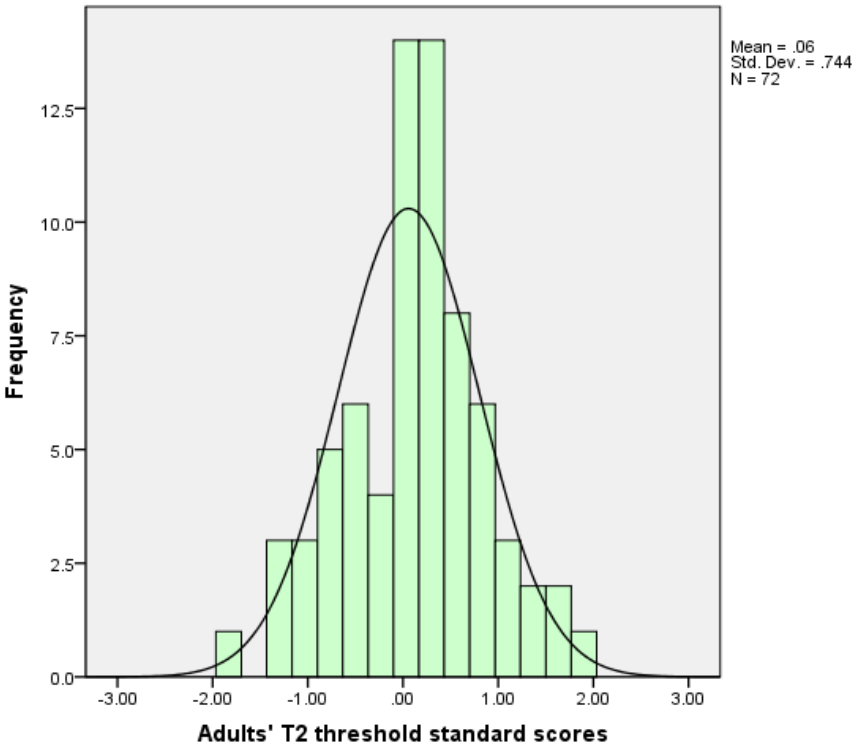


Figure 4.82. Distribution of *z* scores for adults' threshold at T2.

4.5.3.3.10 Summary

The results across the nine dimensions are summarised in Table 4.24 below:

Table 4.24 *Descriptive statistics for T2 dimensions of adult temperament*

Dimension *N* =72	Mean (z score)	95% BCa CI (10,000)	Standard error	*SD*	Range	Data distribution
Activity	.45	.16, .74	.15	1.28	5.12 (-2.02, 3.10)	Normal
Adaptability	.38	.13, .65	.13	1.11	4.58 (-1.47, 3.11)	Normal
Approach	.54	.26, .82	.15	1.26	5.18 (-1.92, 3.26)	Normal
Distractibility	.59	.37, .83	.12	1.02	4.56 (-1.17, 3.39)	Not normal
Intensity	-.12	-.33, .09	.11	0.91	4.08 (-2.25, 1.83)	Normal
Mood	-.02	-.28, .24	.13	1.13	4.98 (-2.39, 2.59)	Normal
Persistence	.35	.06, .63	.15	1.26	5.56 (-2.12, 3.43)	Not normal
Rhythmicity	.37	.13, .61	.13	1.08	4.26 (-1.80, 2.46)	Normal
Threshold	.06	-.11, .23	.09	0.74	3.73 (-1.83, 1.90)	Not normal

*KS test significant at p <0.05

4.5.3.4 Does the parent cohort's temperament differ from the normative data after 12 months?

The adults' T2 cohort temperament data showed some differences from the standard scores of the standardisation sample as can be seen in *Figure 4.83*.

The 95% CIs for intensity, mood and threshold standardised mean scores all fell across the mean, suggesting that these scores were broadly representative of the normative sample. However, the cohort was notably, less approaching and more distractible than the standardisation sample with each of these means being further than 0.5*SD* from the standardised mean, though the lower limit of the 95% CI bands fell within 0.5*SD* of the mean.

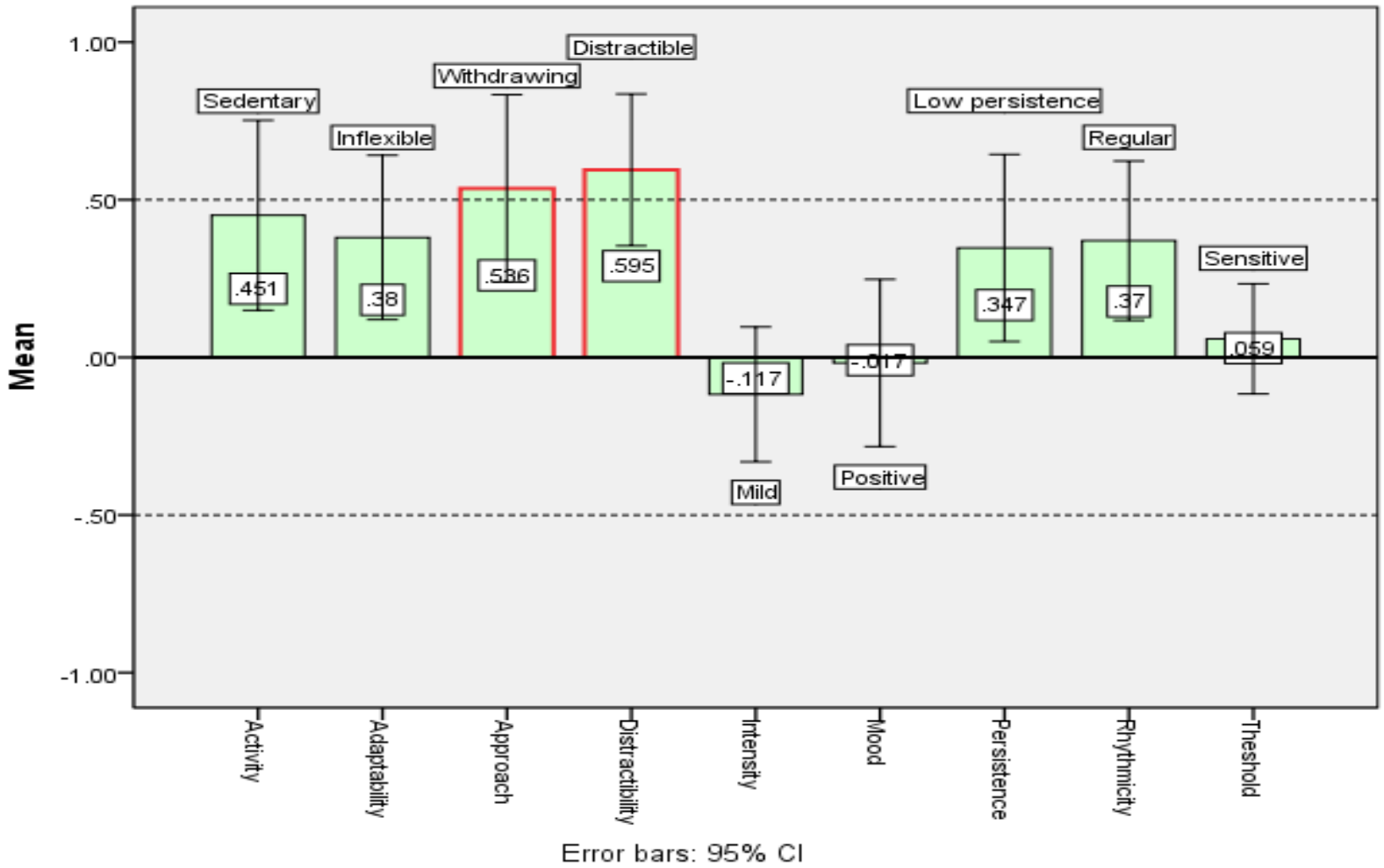


*Figure 4.83.*Temperament profiles after 12 months (T2).

4.5.3.5 How stable are temperament features after 1 year?

To look at the stability of the cohort's temperament features, a series of paired *t*-tests were used to compare the cohort mean scores for each dimension, whilst Pearson's correlation was conducted to examine the strength of any relationships. The data met the assumptions for these tests with the exception of T1 adaptability, T2 distractibility, T2 persistence and T2 threshold. Since only T2 adults who completed T2 would be involved in these tests, the T1 adaptability tests of normality were re-run for those adults who completed T2 data only.

Using data from these seventy-two adults who completed the study, T1 adaptability had a mean of 0.40. Looking at the distribution of the cohort data, it showed a positive skew, 0.98 and positive kurtosis, 1.09. The skew value fell outside the twice the standard error cut-off limit for acceptability (see *Figure 4.84*). The KS test showed that the data were not suitable to be treated as a normal distribution, $D(72) = .18$, $p < .001$.

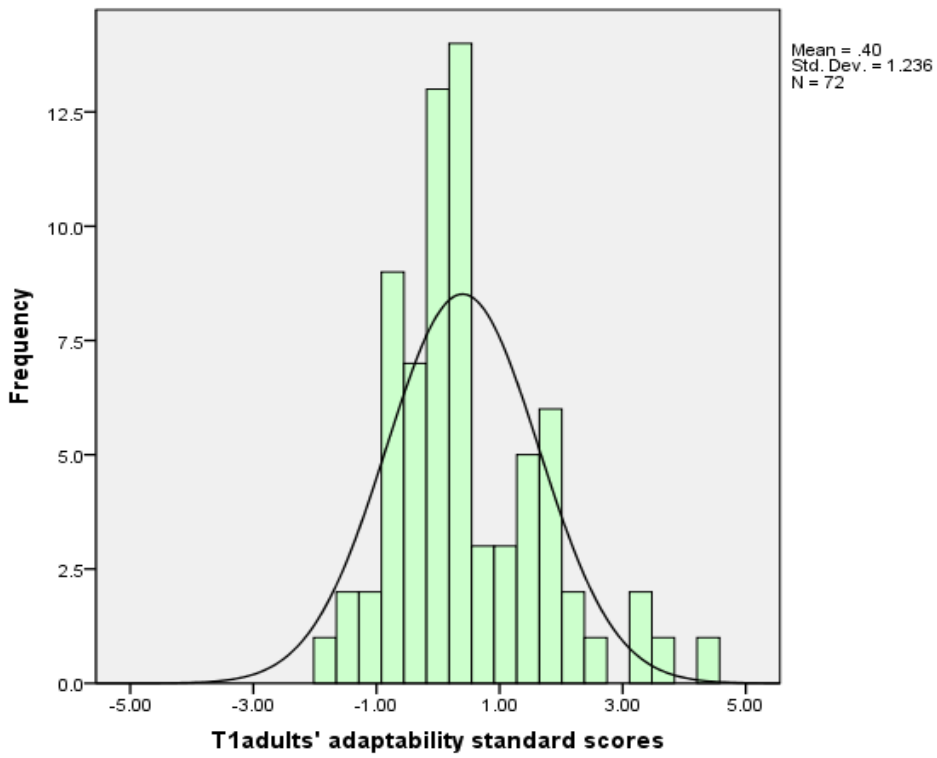


Figure 4.84. Distribution of z scores for adaptability at T1 for adults who completed the study (*N* =72).

To address these concerns about non-normality for the *t*-tests, bootstrapped bias corrected accelerated 95% CIs were calculated and further, for the non-normally distributed dimensions i.e. T1 adaptability, T2 distractibility, T2 persistence and T2 threshold the bias statistics reported.

4.5.3.5.1 Stability of the activity dimension

To establish the stability of the activity dimension over 12 months, a paired *t*-test was used: $t(71) = -0.53$, BCa 95% bootstrapped CI of the difference [-.20, .12], $p < .608$ (two

tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.85*).

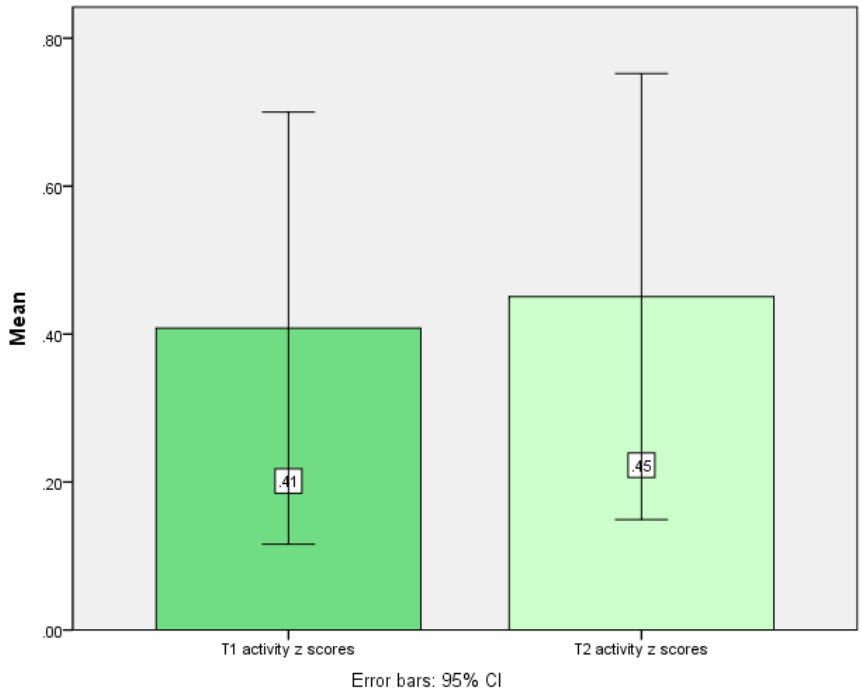


Figure 4.85. Difference in mean standard scores for adults' activity at T1 and T2.

The strength of the relationship between activity scores at T1 and T2 showed a very strong positive correlation (see *Figure 4.86*): $r(72) = .86$, BCa 95% bootstrapped, CI [.77, .92], $p < .001$.

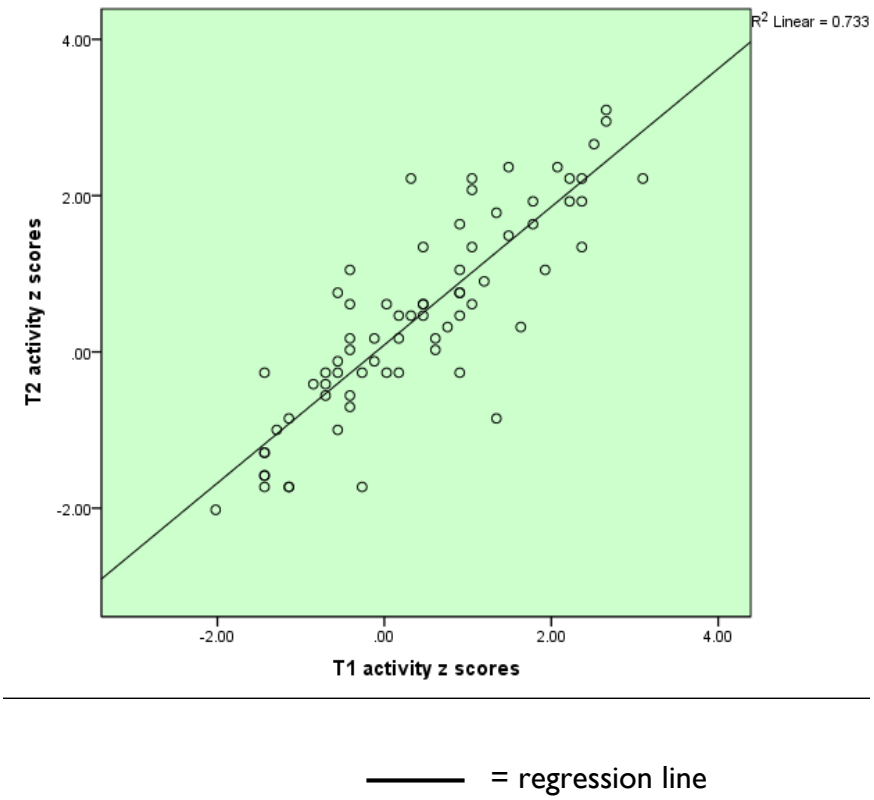


Figure 4.86. Scatterplot of adults' activity scores at T1 and T2.

4.5.3.5.2 Stability of the adaptability dimension

To establish the stability of the adaptability dimension over 12 months, a paired *t*-test was used: *t*(71) =0.17, BCa 95% bootstrapped CI of the difference [.18, .22], *p* =.861 (two tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.87*). It was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 adaptability the bias was .001, indicating that the non-normality of the distribution was not having an effect on the *t*-test.

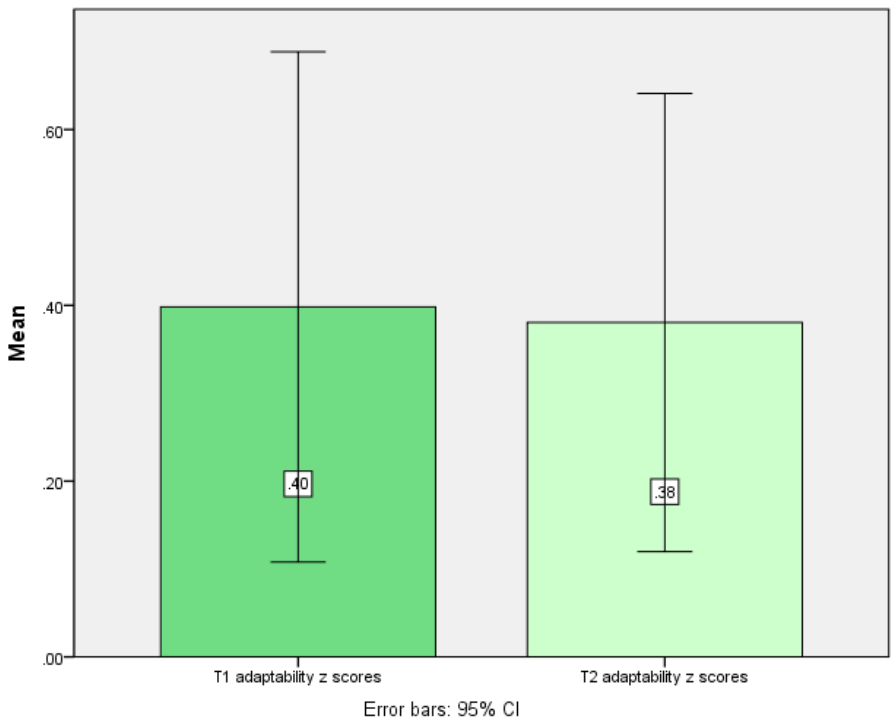
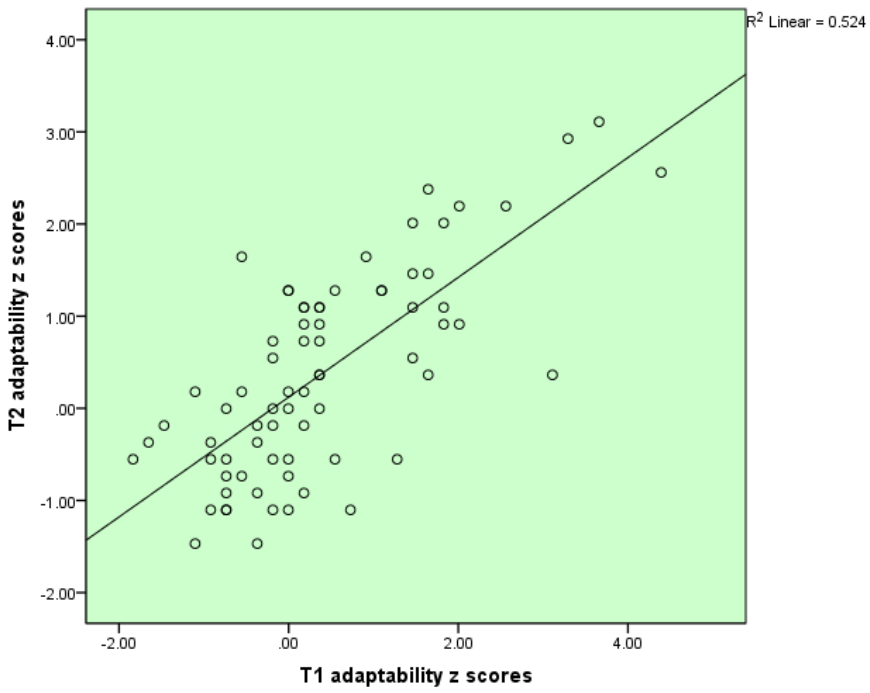


Figure 4.87. Difference in mean standard scores for adults' adaptability at T1 and T2.

The strength of the relationship between adaptability scores at T1 and T2 showed a very strong positive correlation: $r(71) = .72$, BCa 95% bootstrapped, CI [.58, .83], $p < .001$, bias =-.003 (see *Figure 4.88*).



_____ = regression line

Figure 4.88. Scatterplot of adults' adaptability at T1 & T2.

4.5.3.5.3 Stability of the approach dimension

To establish the stability of the approach dimension over 12 months, a paired *t*-test was used: $t(71) = -0.08$, BCa 95% bootstrapped CI [-.17, .16], $p = .936$ (two tailed). This confirmed that there was no significant difference between the means at T1 and T2 (see *Figure 4.89*).

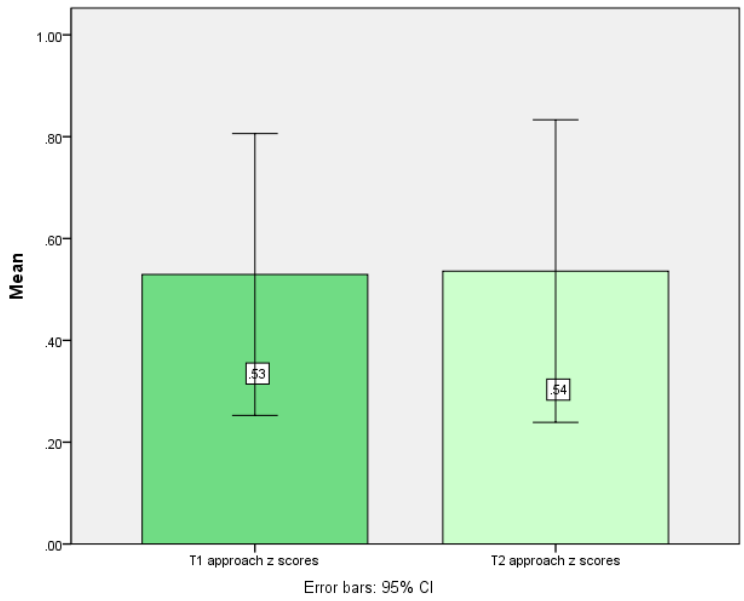
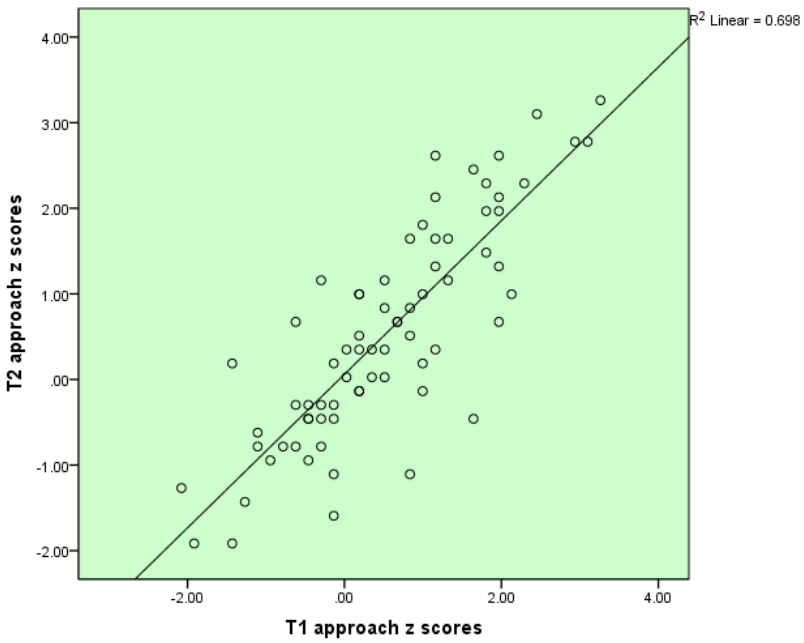


Figure 4.89. Difference in mean standard scores for adults' approach at T1 and T2.

The strength of the relationship between approach scores at T1 and T2 showed a very strong positive correlation: Pearson's *r* (71) =.84, BCa 95% bootstrapped, CI [.74, .90], *p* <.001 (see *Figure 4.90*).



_____ = regression line

Figure 4.90. Scatterplot of adults' approach scores at T1 & T2.

4.5.3.5.4 Stability of the distractibility dimension

To establish the stability of the distractibility dimension over 12 months, a paired *t*-test was used: $t(71) = -0.02$, BCa 95% bootstrapped CI [-.22, .21], $p = .983$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.91*). Further, it was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 distractibility the bias was -.001, indicating that the non-normality of the distribution was not having an effect on the *t*-test.

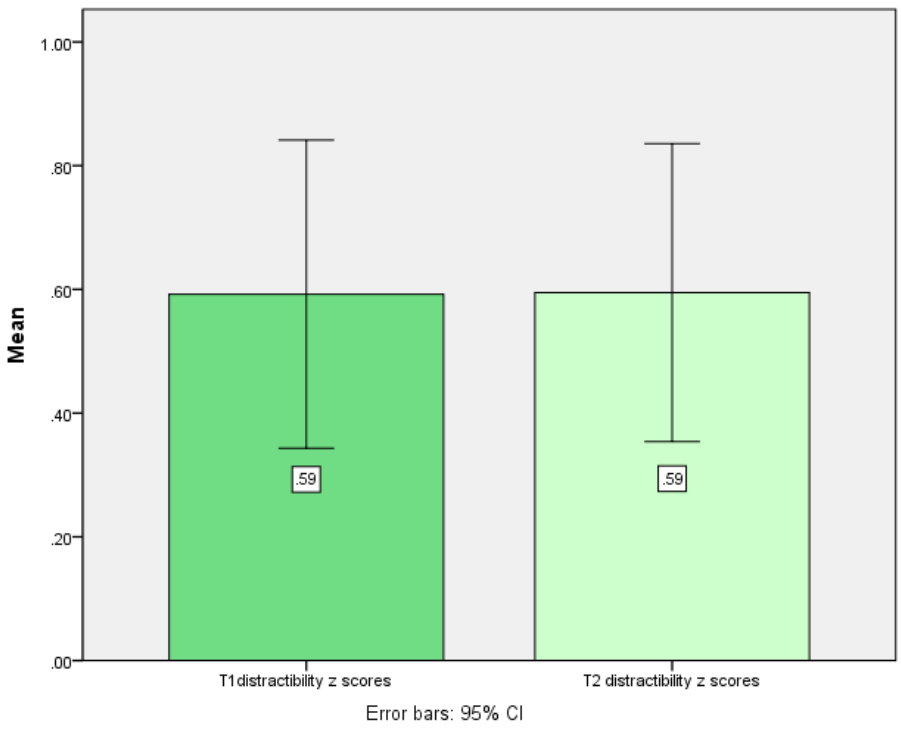
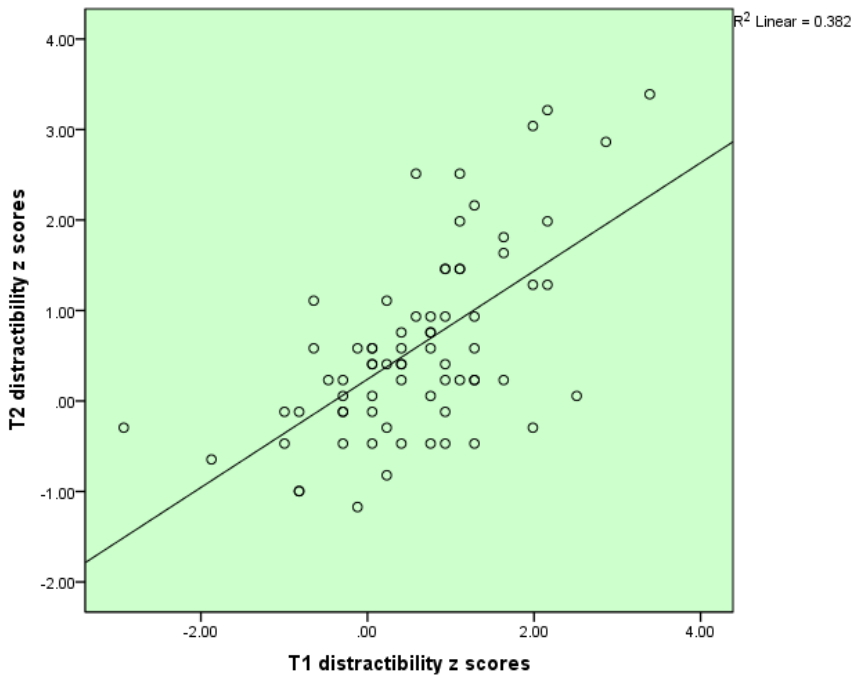


Figure 4.91. Difference in mean standard scores for adults' distractibility at T1 and T2.

The strength of the relationship between distractibility scores at T1 and T2 showed a very strong positive correlation: $r(71) = .62$, BCa 95% bootstrapped, CI [.45, .76], $p < .001$, bias =-.002 (see *Figure 4.92*).



_____ = regression line

Figure 4.92. Scatterplot showing adults' distractibility scores at T1 and T2.

4.5.3.5.5 Stability of the intensity dimension

To establish the stability of the intensity dimension over 12 months, a paired *t*-test was used: *t*(71) =.13, BCa 95% bootstrapped CI [-.16, .18], *p* =.890 (two tailed). This confirmed that the means at T1 and T2 were not significantly different (*Figure 4.93*).

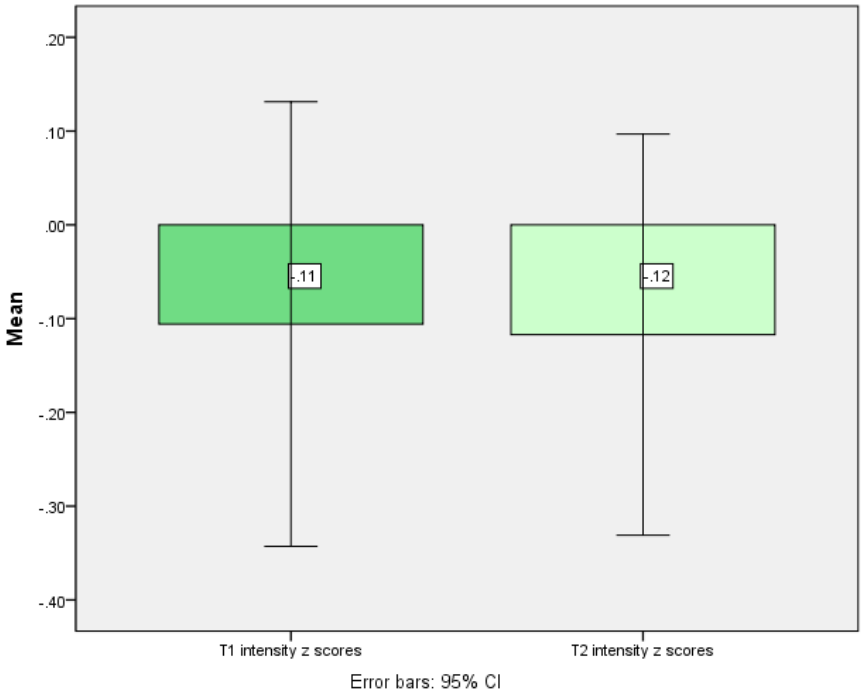
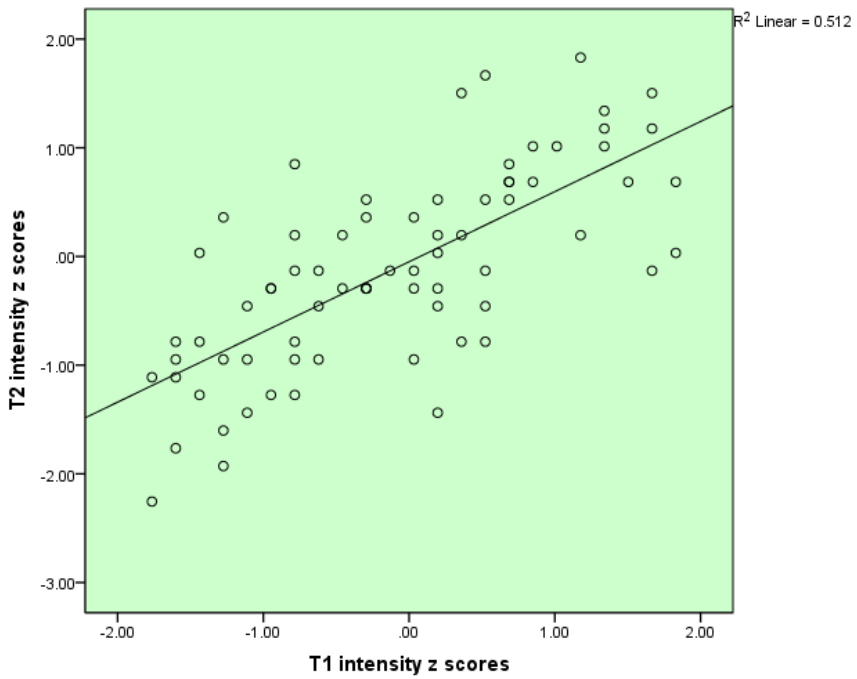


Figure 4.93. Difference in mean standard scores for adults' intensity at T1 and T2.

The strength of the relationship between intensity scores at T1 and T2 showed a very strong positive correlation: $r(71) = .72$, BCa 95% bootstrapped, CI [.59, .81], $p < .001$ (see *Figure 4.94*).



_____ = regression line

Figure 4.94 Scatterplot of adults' intensity scores at T1 and T2.

4.5.3.5.6 Stability of the mood dimension

To establish the stability of the mood dimension over 12 months, a paired *t*-test was used: *t*(71) =.17, BCa 95% bootstrapped CI [-.17, .20], *p* =.865 (two tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.95*).

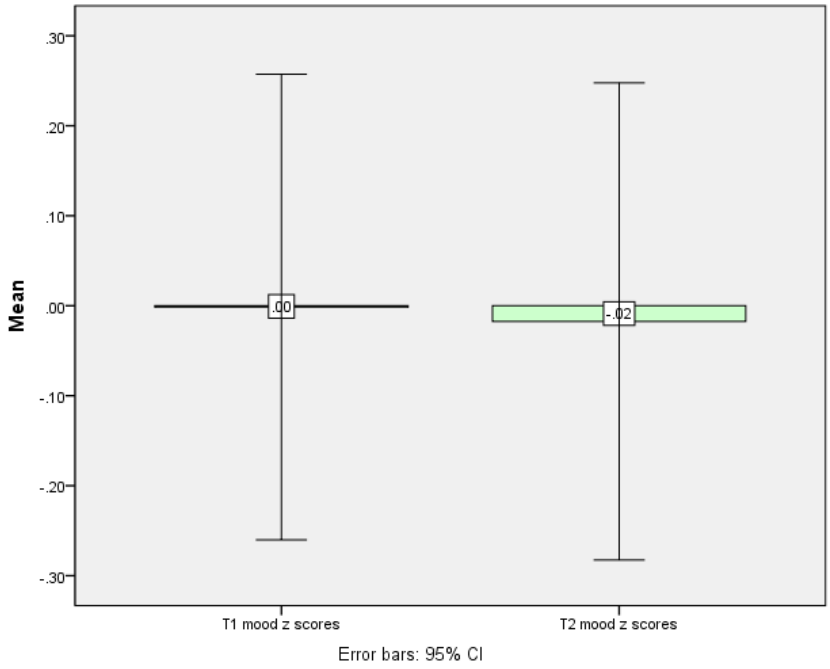
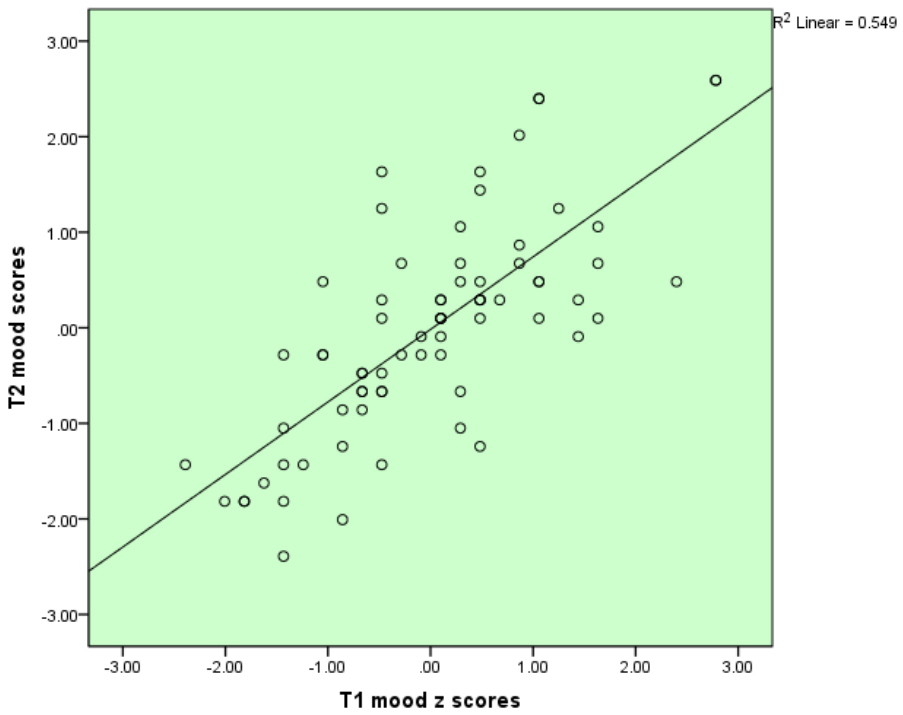


Figure 4.95. Difference in mean standard scores for adults' mood at T1 and T2.

The strength of the relationship between mood scores at T1 and T2 showed a very strong positive correlation (see *Figure 4.96*): $r(71) = .74$, BCa 95% bootstrapped, CI [.62, .84], $p < .001$.



_____ = regression line

Figure 4.96. Scatterplot of adults' mood scores at T1 and T2.

4.5.3.5.7 Stability of the persistence dimension

To establish the stability of the persistence dimension over 12 months, a paired *t*-test was used: $t(71) = -1.97$, BCa 95% bootstrapped CI [-.30, -.00], $p = .050$ (two tailed). This confirmed that the means at T1 and T2 were significantly different (see *Figure 4.97*). It was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 persistence the bias was -.000, indicating that the non-normality of the distribution was not having an effect on the *t*-test.

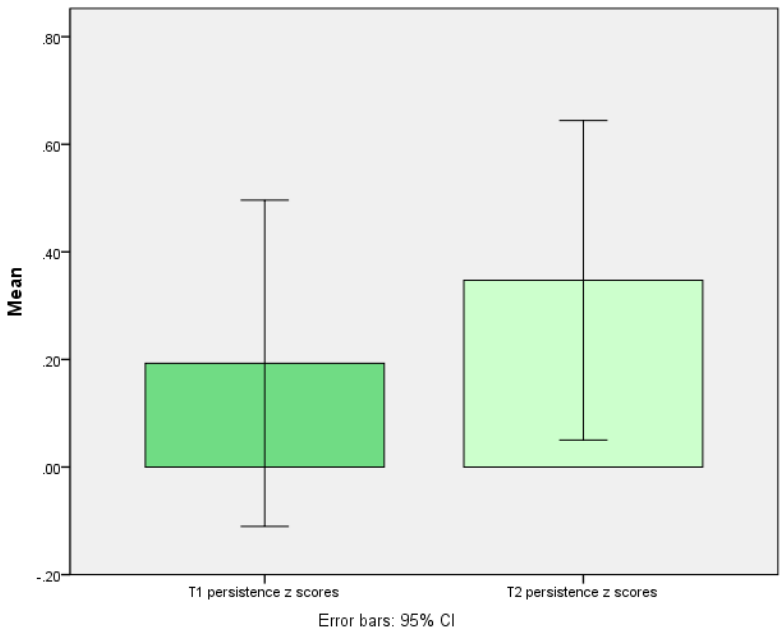
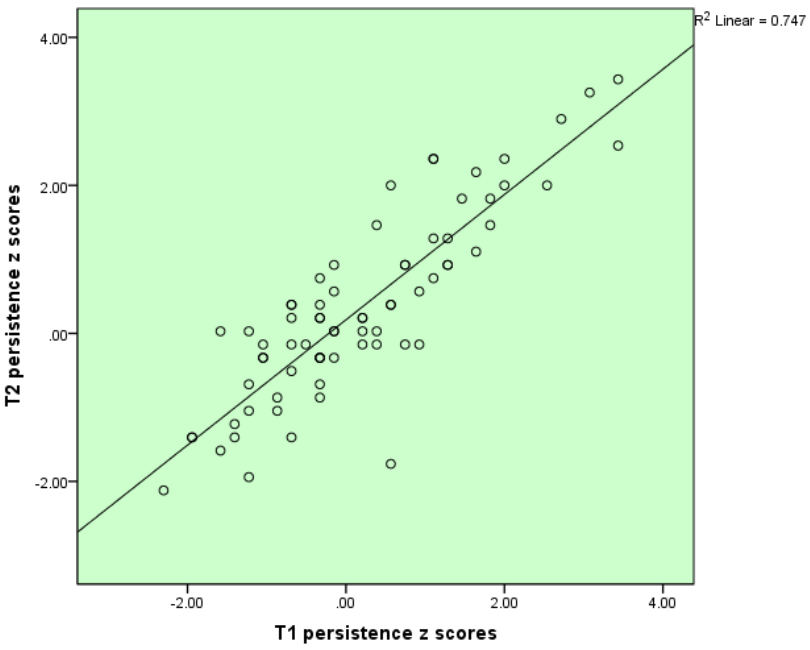


Figure 4.97. Difference in mean standard scores for adults' persistence at T1 and T2.

The strength of the relationship between persistence scores at T1 and T2 showed a very strong positive correlation (see *Figure 4.98*): $r(71) = .86$, BCa 95% bootstrapped, CI [.78 to .92], $p < .001$, bias =-.003.



_____ = regression line

Figure 4.98. Scatterplot of adults' persistence scores at T1 & T2.

4.5.3.5.8 Stability of the rhythmicity dimension

To establish the stability of the rhythmicity dimension over 12 months, a paired *t*-test was used: $t(71) = 0.55$, BCa 95% bootstrapped CI [-.13 to .22], $p = .584$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.99*).

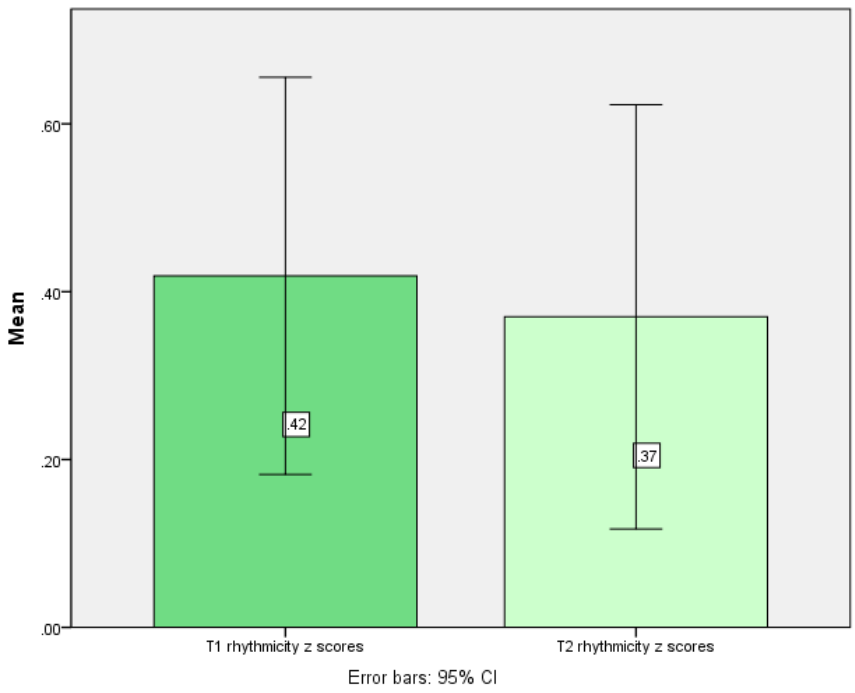
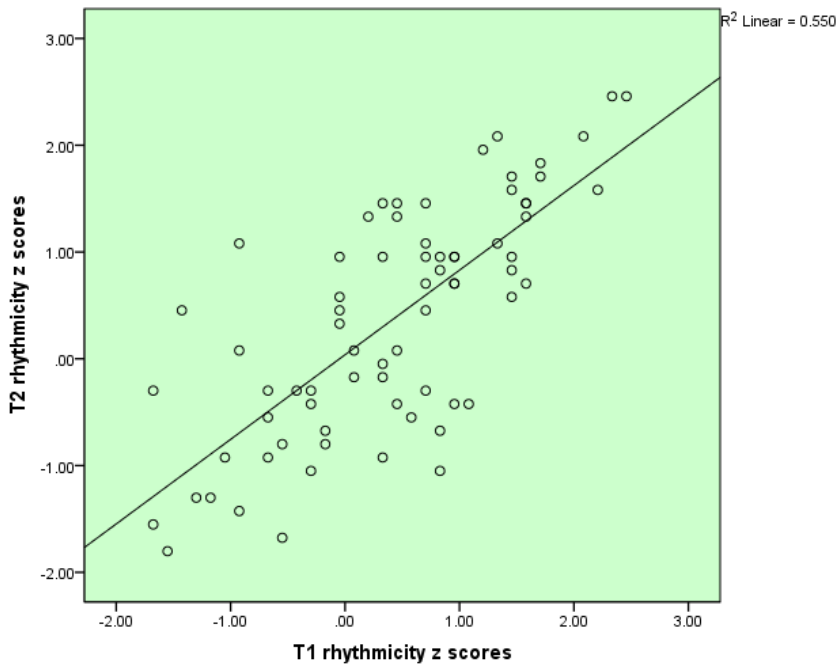


Figure 4.99. Difference in mean standard scores for adults' rhythmicity at T1 and T2.

The strength of the relationship between rhythmicity scores at T1 and T2 showed a very strong positive correlation: $r(71) = .74$, BCa 95% bootstrapped, CI [.61 to .84], $p < .001$ (see *Figure 4.100*).



_____ = regression line

Figure 4.100. Scatterplot of adults' rhythmicity scores at T1 and T2.

4.5.3.5.9 Stability of the threshold dimension

To establish the stability of the threshold dimension over 12 months, a paired *t*-test was used: $t(71)=-0.34$, BCa 95% bootstrapped CI [-.14 to .19], $p = .730$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different (see *Figure 4.101*).

It was important here to examine the bias statistic to consider the effect of the non-normal distributions for these data, for T1/T2 threshold, the bias was -.002, indicating that the non-normality of the distribution was not having an effect on the *t*-test.

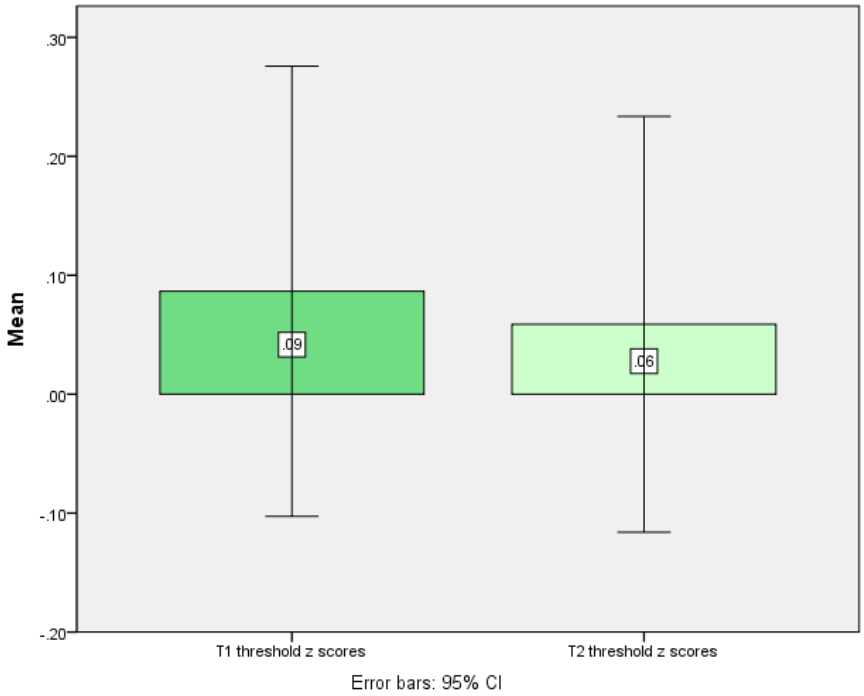
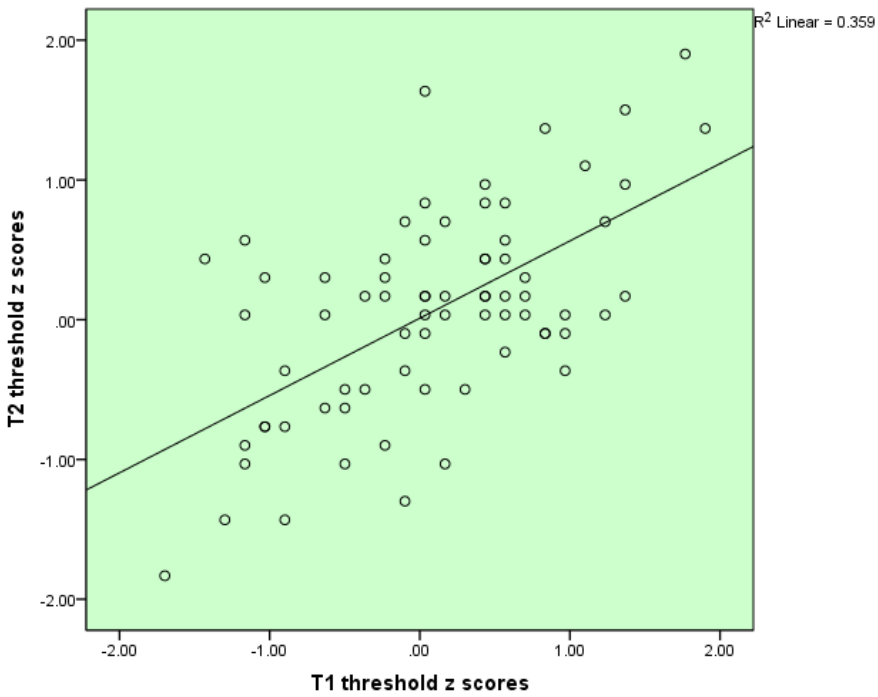


Figure 4.101. Difference in mean standard scores for adults' threshold at T1 and T2.

The strength of the relationship between threshold scores at T1 and T2 showed a strong positive correlation (see *Figure 4.102*): $r(71) = .60$, BCa 95% bootstrapped, CI [-.41, .75], $p < .001$, bias = -.004.



_____ = regression line

Figure 4.102. Scatterplot of adults' threshold scores at T1 and T2.

4.5.3.6 Aim 3 Summary

To describe the temperament characteristics of the parents of the study cohort.

I have considered whether the mean scores for the parents' temperament showed similarity to that of the standardisation sample. Specific differences in the cohort's temperament profile, compared to the standardisation sample, at entry to the study related to increased distractibility using a cut-off point of 0.5*SD* from the mean, with lower activity, lower adaptability, lower approach and increased regularity showing trends away from the standardised sample.

At 12 month retest, the adult cohort's temperament showed very good stability. Increased distractibility remained as a notable difference from the standardisation

sample, though low approach also reached above the 0.5*SD* cut-off point at this time. Lower activity continued to show a trend away from the standardisation sample. Pearson's correlations confirmed that T1 and T2 temperament were significantly and strongly related across all dimensions. These results are summarised in Table 4.25.

A series of dependent t-tests (two tailed) identified that there was a significant difference in the T1 vs T2 means for persistence. This change signalled a movement further away from the standardised mean. There was no significant difference (*p* =.05) for the other eight dimensions indicating stability across the twelve month period.

Table 4.25 *t-test and correlation for temperament dimensions (12 month test-retest)*

	Adults' temperament T1 vs T2					
	Dependent *t* test			**Paired Samples Correlations**		
N=72	*t* test	BCa 95% CI	Sig. (two tailed)	Pearson's r	BCa 95% CI	Sig. (two tailed)
Activity	-0.53	-.20, .12	.608	.86	.77, .92	<.001
Adaptability	0.17	.18, .22	.861	.72	.58, .83	<.001
Approach	-0.08	-.17, .16	.936	.84	.74, .90	<.001
Distractibility	-0.02	-.22, .21	.983	.62	.45, .76	<.001
Intensity	0.13	-.16, .18	.890	.72	.59, .81	<.001
Mood	0.17	-.17, .20	.865	.74	.62, .84	<.001
Persistence	-1.97	-.30, .00	.050	.86	.78, .92	<.001
Rhythmicity	0.55	-.13, .22	.584	.74	.61, .84	<.001
Threshold	-0.34	-.14, .19	.730	.60	-.41, .75	<.001

4.5.4 Research aim 4

To investigate relationships between temperament dimensions, which differ from normative expectations, auditory comprehension and expressive communication performance, and temperament variables associated with language differences from the literature.

The data to address this aim has emerged from the analysis of temperament and language profiles for the cohort that were established in aims 1-3. For this reason, the specific variables entered into the models were not specified in advance of conducting the earlier analyses. The rationale for inclusion of the combinations of specific variables in regression analyses is presented here to contextualise the analyses that were conducted.

Results from the cohort's language scores (see 4.5.1.8), identified that T1 auditory comprehension scores were predictive of T2 auditory comprehension scores. Further, the cohort temperament profiles for adaptability and persistence showed a significant difference from the normative standardisation sample and required additional investigation. Finally, the literature review presented in the introduction to this research report identified that some temperament dimensions have attracted research attention in relation to the roles they may play in language development and communication difficulties (section 2.10). Higher approach (Spere et al., 2004), low distractibility (Dixon, Salley and Clements, 2006) and positive mood (Salley and Dixon,

2007) have all been associated with protecting language development whilst low approach, high distractibility and negative mood have correlated with lower language performance (see Table 2.3). Despite this, the literature does not yet provide sufficient consensus about the direction or strength of these variables to support a theoretically driven hierarchical regression (Mayers, 2013).

However, as this study is framed to be exploratory in nature, there is also an argument to do just that and to also perform a more exploratory analysis to look at a wider range of predictors by using a stepwise entry with all potential temperament predictor variables which may contribute to the prediction of language scores after one year.

To explore these language- temperament associations, the following research questions were framed, following analysis in earlier sections:

4.5.4.1 Do adaptability and persistence at entry to the study (T1), along with T1 auditory comprehension scores, further develop the prediction of auditory comprehension scores after 12 months (T2)?

Prior to conducting the regression analysis, Pearson's correlation values were explored for the selected variables (Table 4.26). T1 and T2 auditory comprehension scores showed a very strong significant positive correlation. In relation to the temperament variables, adaptability showed a negligible correlation with T2 auditory comprehension scores and a weak negative relationship with T1 scores. Persistence had a weak negative relationship with T2 auditory comprehension and a moderate negative association with T1 auditory comprehension scores. T1 persistence and T1 adaptability showed a moderate positive correlation.

Table 4.26 *Correlation matrix for T1 auditory comprehension, T1 adaptability and T1 persistence and T2 auditory comprehension*

	T2AC	**T1AC**	**T1 adaptability**	**T1 persistence**
T2AC	1	. 87***	-.18	-.26*
T1AC		1	-.21*	-.32**
T1 adaptability			1	.33**
T1 persistence				1

AC= auditory comprehension standardised score *p < .05, **p < .01, ***p < .001

A multiple linear regression was conducted to examine if auditory comprehension, adaptability and persistence scores at T1 predicted variance in T2 auditory comprehension scores for the cohort (enter method). T1 expressive communication was excluded as a potential predictor since it had not significantly contributed to variance (β=. 04, t= .67, p = .504) in the regression model presented in 1h (see section 4.5.1.8).

Within the regression output, an analysis of standardised residuals identified one case (case 19) as a potential outlier (Std. Residual = - 3.44). The regression model was re-run, without this case, in the same way as detailed in section 4.5.1.8. The data (N =71) met the assumption of independent errors (Durbin-Watson value = 2.24). Within the regression model, the assumption of no multicollinearity was met for the T1 auditory comprehension standard score variable (Tolerance = .89, *VIF* = 1.13) the T1 adaptability *z* score variable (Tolerance =.88, *VIF* = 1.14) and the T1 persistence z score variable (Tolerance =.82, *VIF* = 1.21).

The standardised residuals histogram and P-P plot revealed a somewhat non-normal (positively skewed) distribution. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated acceptable linearity and homogeneity of variance.

The multiple correlation coefficient *R* was .88, mirroring the Pearson's correlation, and showing that the addition of adaptability and persistence at T1 did not develop the regression model. The multiple correlation coefficient, R^2 was .77, indicating approximately 77% of the variance of the T2 auditory comprehension score (Adjusted R^2 = .76) could be accounted for by the model. This significantly predicted T2 outcome scores, F (3, 67) = 72.80, p < .001.

Only T1 auditory comprehension scores contributed to the model (β = .88, t= 14.03, p <.001). Neither T1 adaptability scores (β = -.01, t=-.07, p = .943), nor T1 persistence scores (β = . 027, t= .41, p = .683), significantly contributed to variance in T2 auditory comprehension outcomes (see Table 4.27).

Table 4.27 *Summary of regression analysis for variables predicting T2 Auditory Comprehension Standardised Scores (N =71)*

Model	*R*	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
				B	Standard error	Beta			Zero-order	Partial	Part
	.88	.77	.76								
Constant				12.16	6.90		1.76	.083			
T1AC standard score				.99	.071	.88	14.03	*.001*	.87	.86	.83
T1 adaptability standard score				-.08	1.15	-.01	-.07	.943	-.18	-.01	-.00
T1 persistence standard score				.50	1.22	.03	.41	.68	-.26	.05	.02

4.5.4.2 Do any temperament dimensions, along with T1 auditory comprehension scores, further develop the prediction of auditory comprehension scores after 12 months (T2)?

Before conducting the regression analysis, Pearson's correlation values were inspected for the T1 auditory comprehension, T2 auditory comprehension and nine temperament variables (Table 4.28). T1 and T2 auditory comprehension scores showed a very strong significant positive correlation. In relation to the temperament variables, activity showed strong to moderate significant positive correlations with T1 auditory comprehension, adaptability and persistence. Further, adaptability had strong positive correlation with both mood and rhythmicity. Strong positive correlations between distractibility/threshold and rhythmicity/mood were also evident.

Table 4.28 *Correlation matrix for T1 auditory comprehension, T1 temperament dimensions and T2 auditory comprehension*

	T2AC	T1AC	T1 Activity	T1 Adaptability	T1 Approach	T1 Distractibility	T1 Intensity	T1 Mood	T1 Persistence	T1 Rhythmicity	T1 Threshold
T2 AC	1	. 87***	-.30**	-.18	.08	.11	-.21*	-.11	-.26*	-.06	.23*
T1AC		1	-.35***	-.21*	.15	-.02	-.27**	-.09	-.32**	-.05	.20*
T1 Activity			1	.48***	-.25*	.26*	.27**	.20*	.41***	.14	-.10
T1 Adaptability				1	.29**	.05	.33**	.45***	.33**	.45***	-.25*
T1 Approach					1	-.11	.09	.25*	-.17	.15	-.13
T1 Distractibility						1	.23*	-.03	.03	.11	.42***
T1 Intensity							1	.19	.07	-.05	.05
T1 Mood								1	.28**	.43***	-.11
T1 Persistence									1	.19*	-.20*
T1 Rhythmicity										1	.011
T1 Threshold											1

AC= auditory comprehension standardised score ******p* **<.05, *****p* **<.01, ******p* **<.001**

A multiple linear regression was then conducted to examine variance in T2 auditory comprehension scores for the seventy-one participants (case 19 excluded) using the stepwise method. (see Table 4.29) A significant model ($F(2, 68) = 224.16$, $p < .001$) predicted 78% of the variance in outcome (Adjusted $R^2 = .77$).

Ten predictors were entered into the model; the nine temperament dimensions and T1 auditory comprehension. T1 expressive communication was excluded as a potential predictor since it had not significantly contributed to variance (β=. 04, t= .67, p = .504) in the regression model presented in 1h (see section 4.5.1.8).

Of these, T1 auditory comprehension (β = .88, t=15.43, p < .001) and T1 distractibility (β = .13, t= 2.20, p = .031) were significantly predictive of T2 auditory comprehension scores. The eight other temperament dimensions were excluded from the model.

Table 4.29 *Summary of stepwise regression analysis for variables predicting T2 Auditory Comprehension Standardised Scores (N =71)*

	Model	*R*	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
					B	Standard error	Beta			Zero-order	Partial	Part
Step 1		.87	.77	.76								
	Constant				13.36	5.97		2.24	.029			
	T1AC Standard score				.98	.07	.87	14.97	.001	.87	.87	.87
Step 2		.88	.78	.77								
	Constant				13.90	5.82	.88	2.39	.020			
	T1AC Standard score				.99	.06	.13	15.43	.000	.87	.82	.88
	T1 distractibility standard score				2.24	1.02		2.20	.031	.11	.26	.13

4.5.4.3 Do adaptability and persistence at entry to the study (T1), along with T1 auditory comprehension scores and T1 expressive communication scores, further develop the prediction of expressive communication scores after 12 months (T2)?

Prior to conducting the regression analysis, Pearson's correlation values were explored for the selected variables (see Table 4.30). T2 expressive communication, T1 expressive communication and auditory comprehension scores showed strong significant positive correlations. In relation to the temperament variables, adaptability showed a negligible correlation with T2 auditory comprehension scores and a weak negative relationship with the T1 scores. Persistence had a moderate negative relationship with T1 auditory comprehension and a moderate positive association with T1 adaptability scores. T1 adaptability showed weak negative correlations with T2 expressive communication and T1 auditory comprehension.

Table 4.30 *Correlation matrix for T1 auditory comprehension, T1 expressive communication, T1 adaptability, T1 persistence and T2 expressive communication*

	T2EC	**T1AC**	**T1EC**	**T1 adaptability**	**T1 persistence**
T2 EC	1	.58***	.56***	-.29**	-.02
T1 AC		1	.37***	-.21*	-.32**
T1 EC			1	.08	.08
T1 adaptability				1	.33**
T1 persistence					1

AC = auditory comprehension standardised score *$p < .05$, **$p < .01$, ***$p < .001$

EC = expressive communication standardised score

A multiple linear regression was then conducted to examine if auditory comprehension, expressive communication, adaptability and persistence scores at T1 predicted variance in T2 expressive communication scores for the cohort (enter method).

The data (*N* =72) met the assumptions for normality and independent errors (Durbin-Watson value = 2.077).

Within the regression model, the assumption of no multicollinearity was met for the T1 auditory comprehension standard score variable (Tolerance = .73, *VIF* = 1.38), the T1 expressive communication standard score variable (Tolerance = .81, *VIF* =1.23), the adaptability *z* score variable (Tolerance =.87, *VIF* = 1.16) and the T1 persistence *z* score variable (Tolerance =.80, *VIF* = 1.25).

The standardised residuals histogram and P-P plot revealed a normal distribution. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated acceptable linearity and homogeneity of variance.

Table 4.31 *Summary of regression analysis for variables predicting T2 Expressive Communication Standardised Scores (N =72)*

	R	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
Model				*B*	Standard error	Beta			Zero-order	Partial	Part
	.75	.56	.54								
Constant				-9.91	12.15		-.82	.417			
T1AC standard score				.45	.10	.43	4.53	.001	.58	. 49	.37
T1EC standard score				.77	.17	.41	4.58	.001	.56	.49	.37
T1 adaptability standard score				-4.92	1.46	-.29	-3.38	.001	-.29	-.38	-.27
T1 persistence standard score				3.22	1.56	.19	2.06	.043	-.02	.24	.17

The multiple correlation coefficient R was .75, showing that the addition of adaptability and persistence at T1, alongside T1 auditory comprehension and expressive communication standard scores, did develop the regression model's predictive value further, from R = .69 in the model containing only AC1 and EC1 (Aim 1i, section 4.5.1.9). The multiple correlation coefficient, R^2 was .56, indicating approximately 56% of the variance of the T2 auditory comprehension score (Adjusted R^2 = .54) could be accounted for by T1 auditory comprehension, T1 expressive communication, T1 adaptability and T1 persistence scores. This significantly predicted T2 outcome scores, $F(4, 67) = 21.63$, $p < .001$. T1 auditory comprehension scores (β = .43, t= 4.53, $p < .001$), T1 expressive communication scores (β = .41, t= 4.58, $p < .001$, T1 adaptability scores (β = -.29, t=-3.38, $p < .001$), and T1 persistence scores (β = .19, t= 2.06, p = .043), significantly contributed to a model to predict variance in T2 expressive communication outcomes. These results are presented in Table 4.31

4.5.4.4 Do any temperament dimensions, along with T1 auditory comprehension, expressive communication, adaptability and persistence scores, further develop the prediction of expressive communication scores after 12 months (T2)?

Before conducting the regression analysis, Pearson's correlation values were inspected for the variables to be entered into the regression analysis: T2 expressive communication, T1 expressive communication, T1 auditory comprehension and all nine temperament variables (see Table 4.32). T2 expressive communication scores showed a strong significant positive correlation with both T1 expressive

communication and T1 auditory comprehension scores but not with any of the temperament variables.

Table 4.32 *Correlation matrix for T2 expressive communication, T1 auditory comprehension, T1 expressive communication and T1 temperament dimensions*

	T2EC	T1AC	T1EC	T1 Activity	T1 Adaptability	T1 Approach	T1 Distractibility	T1 Intensity	T1 Mood	T1 Persistence	T1 Rhythmicity	T1 Threshold
T2EC	1	. 58***	.56***	-.21	-.29*	.03	.08	-.31**	-.08	-.02	-.11	.18
T1AC		1	.38***	-.36***	-.22*	.18	-.01	-.26*	-.09	-.32**	-.03	.26*
T1EC			1	-.09	.06	.10	.07	-.24*	.03	.05	.15	.14
T1 Activity				1	.50***	-.30**	.29**	.28**	.22*	.43***	.24*	-.11
T1 Adaptability					1	.23*	.06	.34**	.45***	.35***	.45***	-.25*
T1 Approach						1	-.14	.01	.25*	-.16	.10	-.09
T1 Distractibility							1	.23*	-.04	.07	.18	.41***
T1 Intensity								1	.16	.06	-.02	.04
T1 Mood									1	.31**	.43***	-.10
T1 Persistence										1	.25*	-.20
T1 Rhythmicity											1	.04
T1 Threshold												1

AC= auditory comprehension standardised score

EC = expressive communication standardised score

* $p < .05$, ** $p < .01$, *** $p < .001$

A multiple linear regression was conducted to examine variance in T2 expressive communication scores for the seventy-two participants using the stepwise method. (see Table 4.34). Eleven predictors were entered into the model; the nine temperament dimensions, T1 auditory comprehension and T1 expressive communication standard scores.

A significant model ($F(4, 67) = 21.63$, $p < .001$) predicted 56% of the variance in outcome (Adjusted $R^2 = .54$) (see Table 4.31).

T1 auditory comprehension scores ($\beta = .43$, $t = 4.53$, $p < .001$), T1 expressive communication scores ($\beta = .41$, $t = 4.58$, $p < .001$), T1 adaptability scores ($\beta = -.29$, $t = -3.38$, $p < .001$), and T1 persistence scores ($\beta = .19$, $t = 2.06$, $p = .043$), continued to significantly contribute to a model to predict variance in T2 expressive communication outcomes. The seven additional temperament dimensions added to the stepwise regression were all excluded as not significantly benefitting the predictive value of the model.

4.5.4.5 Aim 4 Summary

To investigate relationships between cohort temperament dimensions, which differ from normative expectations (persistence, adaptability), cohort auditory comprehension and expressive communication performance, and candidate variables associated with language differences from extant literature.

Auditory comprehension and expressive communication 12 month outcome predictions were significantly enhanced, in multivariable linear regression models, by the addition of temperament variables.

For T2 auditory comprehension scores, 78% of the variance in scores was explained by a model which included T1 auditory comprehension and distractibility. Children with higher auditory comprehension scores, and who had a tendency to be more distractible achieved better auditory comprehension standard scores after one year. Distractibility added only a modest improvement to the model (R^2 change = .02, F change = 4.86, p = .031).

Variance in T2 expressive communication scores were explained by a model that included T1 auditory comprehension and expressive communication scores alongside T1 adaptability and persistence scores. The addition of the temperament variables increased the explained variance in T2 expressive communication scores from 48% to 56%. Within this model, T1 auditory comprehension explained the largest amount of variation (R^2 change = .34, F change = 36.28, $p < .001$) followed by T1 expressive communication scores (R^2 change = .14, F change = 18.31, $p < .001$), adaptability (R^2 change = .06, F change = 8.26, p = .005) and finally persistence scores (R^2 change = .03, F change = 4.26, p = .043).

In this cohort of preschool children with ELDs, children with higher T2 expressive language scores showed a tendency at T1 for higher auditory comprehension scores,

higher expressive communication scores and temperament scores which reflected greater adaptability and lower persistence.

4.5.5 Research aim 5

To investigate relationships between cohort auditory comprehension and expressive communication T2 outcomes and parent ratings of child manageability.

In these analyses, parents' impressions of their children's manageability are used as a proxy for the goodness of fit between parent-child dyads.

4.5.5.1 What are parents' ratings of their child's manageability at entry to the study?

At entry to the study, the parents' rated their perception of how manageable their child was, in comparison to other children the same age, as part of completing the child temperament questionnaire.

Data for seventy-nine of the parents who answered this question was available for analysis. One parent did not answer this question. Children were rated from very easy (score =1) to very difficult (score = 6) on a six point scale. Positive ratings accounted for 69% of the children, with 'easy' being the most frequent response (30%). More negative ratings were given by 31% of the parents, but only 3%, representing two children reported that their child was 'very difficult'. This information is summarised in *Figure 4.103*.

The mean score was 2.82. The distribution of the cohort data showed a positive skew of 0.39 and negative kurtosis, -0.31, both of which were within acceptable limits (see *Figure 4.104*.). However, the KS test showed that the data were not normally distributed, $D(79) = .19$, $p < .001$.

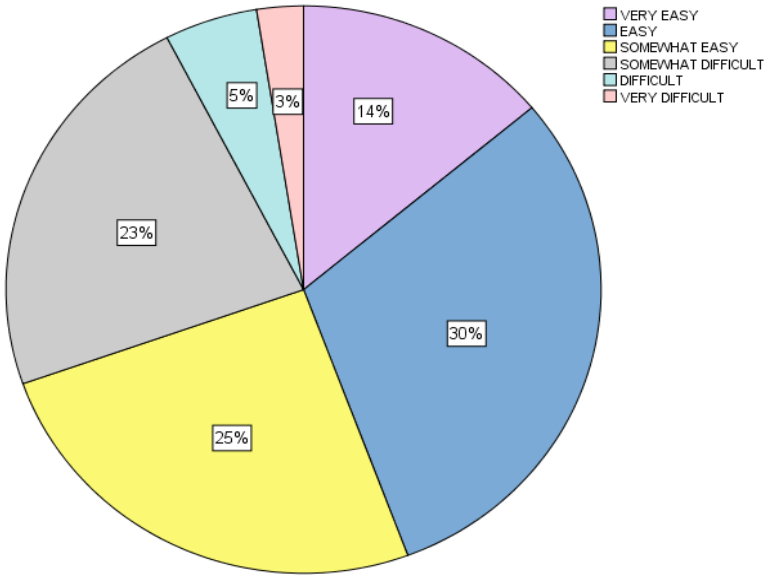


Figure 4.103. Parents' ratings of children's manageability at T1.

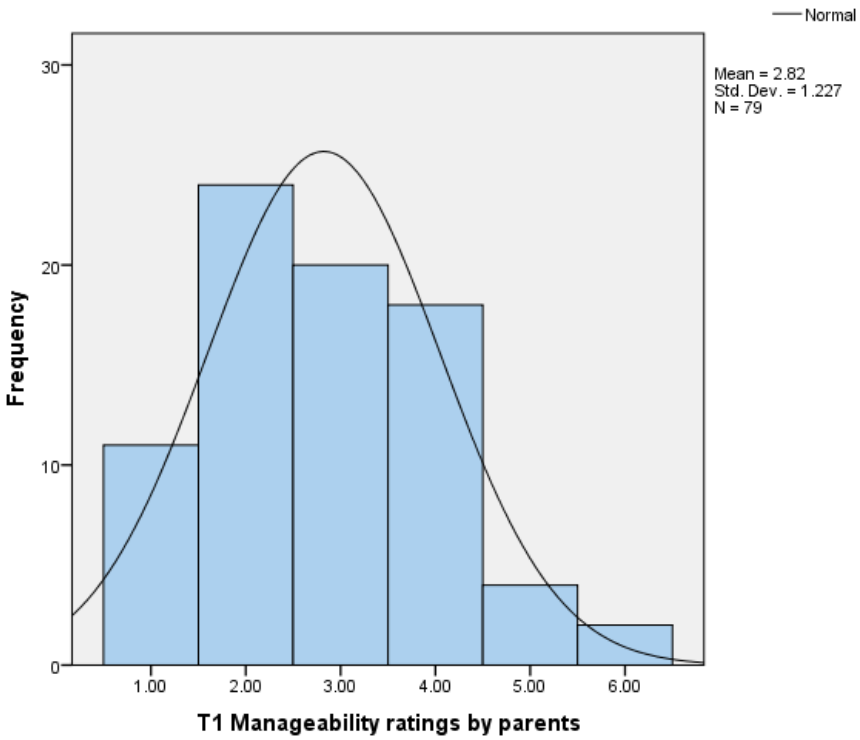


Figure 4.104. Distribution of scores for child manageability at T1.

4.5.5.2 What are parents' ratings of their child's manageability after 12 months (T2)?

After 12 months, seventy-three parents rated their perception of how manageable their child was, in comparison to other children the same age, as part of completing the child temperament questionnaire.

Children were rated from very easy (score of 1) to very difficult (score of 6) on a six point scale. Positive ratings accounted for 76% of the children at T2. This represented a percentage increase of 7%, with 'easy' remaining the most frequent response (30%). More negative ratings were given by 24% of the parents, but only 3%, representing two children reported that their child was 'very difficult'. This information is summarised in *Figure 4.105*.

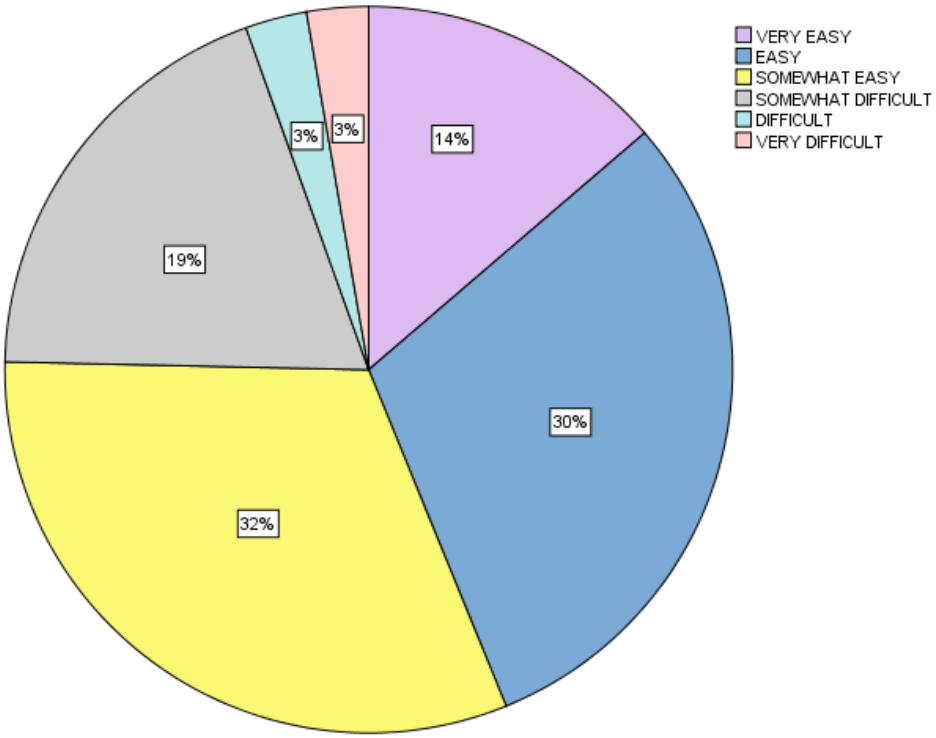


Figure 4.105. Parent's ratings of children's manageability at T2.

The mean score was 2.75. The data showed a positive skew of 0.50 and positive kurtosis, 0.23, both of which were within acceptable limits (see Figure 4.106). However, the KS test showed that the data were not normally distributed, $D(73) = .18$, $p < .000$.

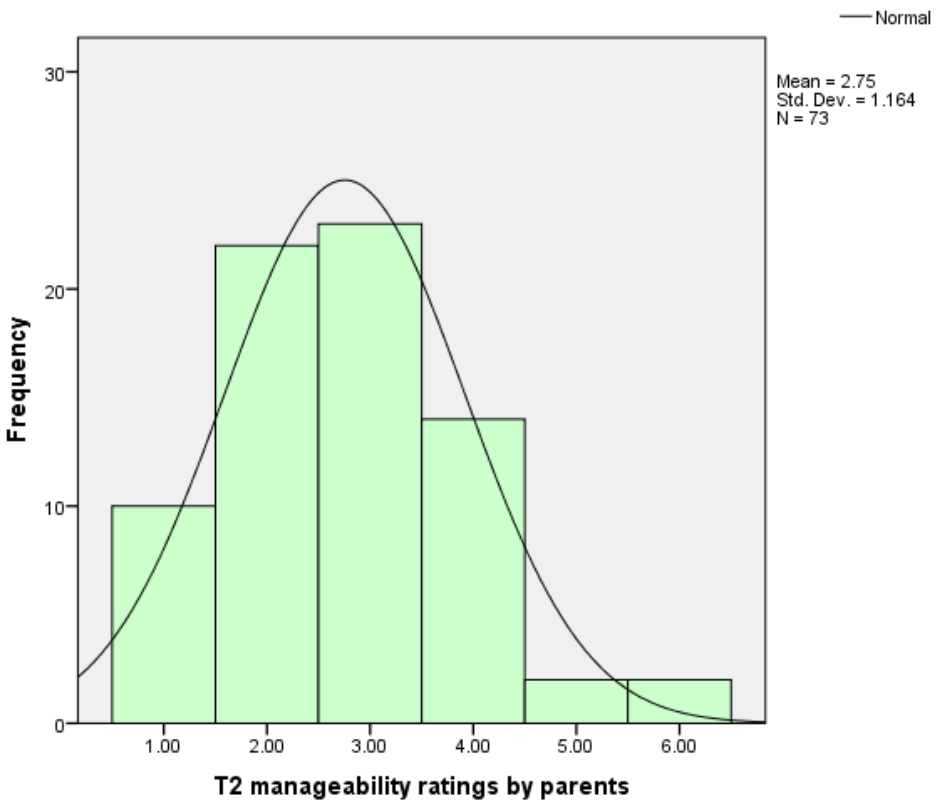


Figure 4.106. Distribution of scores for child manageability at T2

4.5.5.3 How stable are parents' ratings of their child's manageability over a 1 year period?

To establish the stability of the parents' manageability ratings over 12 months, a BCa bootstrapped paired *t*-test was performed: $t(71) = .53$, BCa 95% bootstrapped CI of the difference [-.19, .31], $p = .595$ (two tailed). This confirmed that the means at T1 and T2 were not significantly different. This is represented visually in *Figure 4.107*.

The strength of the relationship between manageability scores at T1 and T2 showed a strong positive correlation: Pearson's *r* (72) = .56, BCa 95% bootstrapped, CI [.35, .73], *p* <.001.

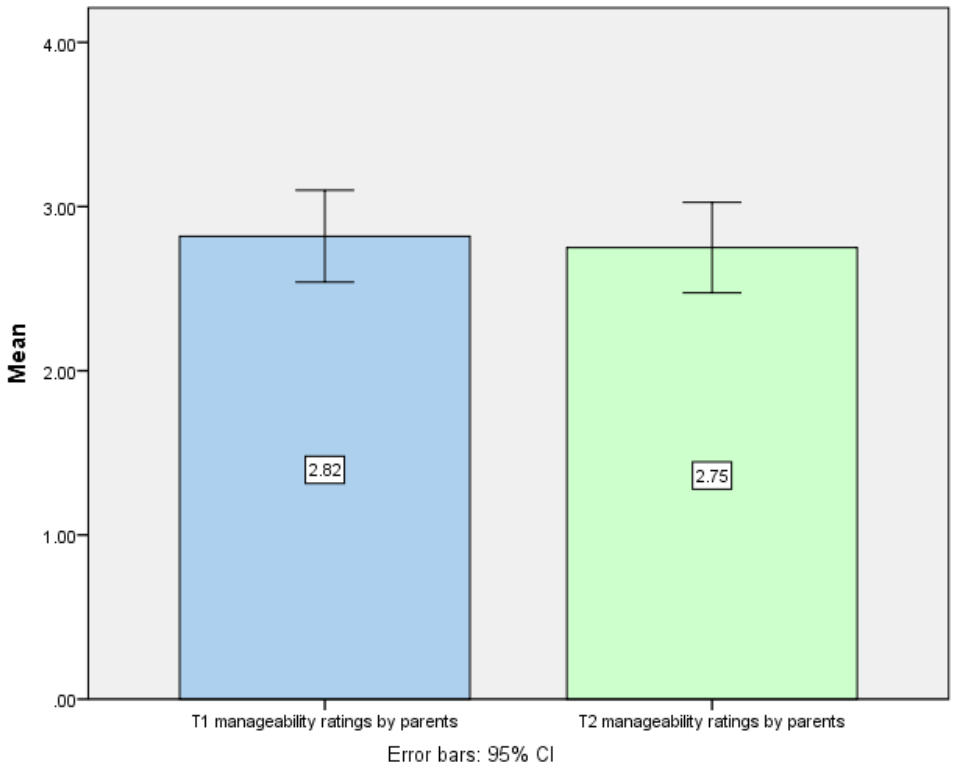


Figure 4.107. Difference in manageability rating mean scores at T1 and T2.

4.5.5.4 What is the change in manageability scores over 12 months?

To further investigate the change in parent manageability ratings, a value for the amount of change was produced as:

T2 manageability rating – T1 manageability rating = manageability change

The mean for the 'manageability change' variable was -0.07. The data distribution showed a positive skew of 0.15 and a positive kurtosis, 0.54. The skew value fell just outside the twice the standard error cut-off limit for acceptability (see *Figure 4.108*). The KS test showed the data were not suitable to be treated as normally distributed, $D(72) = .23$, $p < .001$.

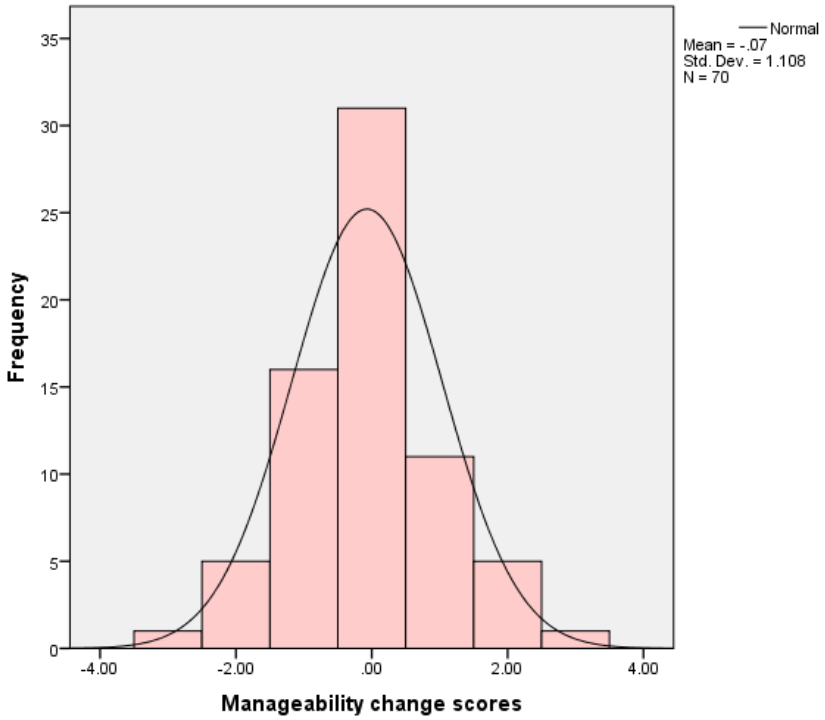
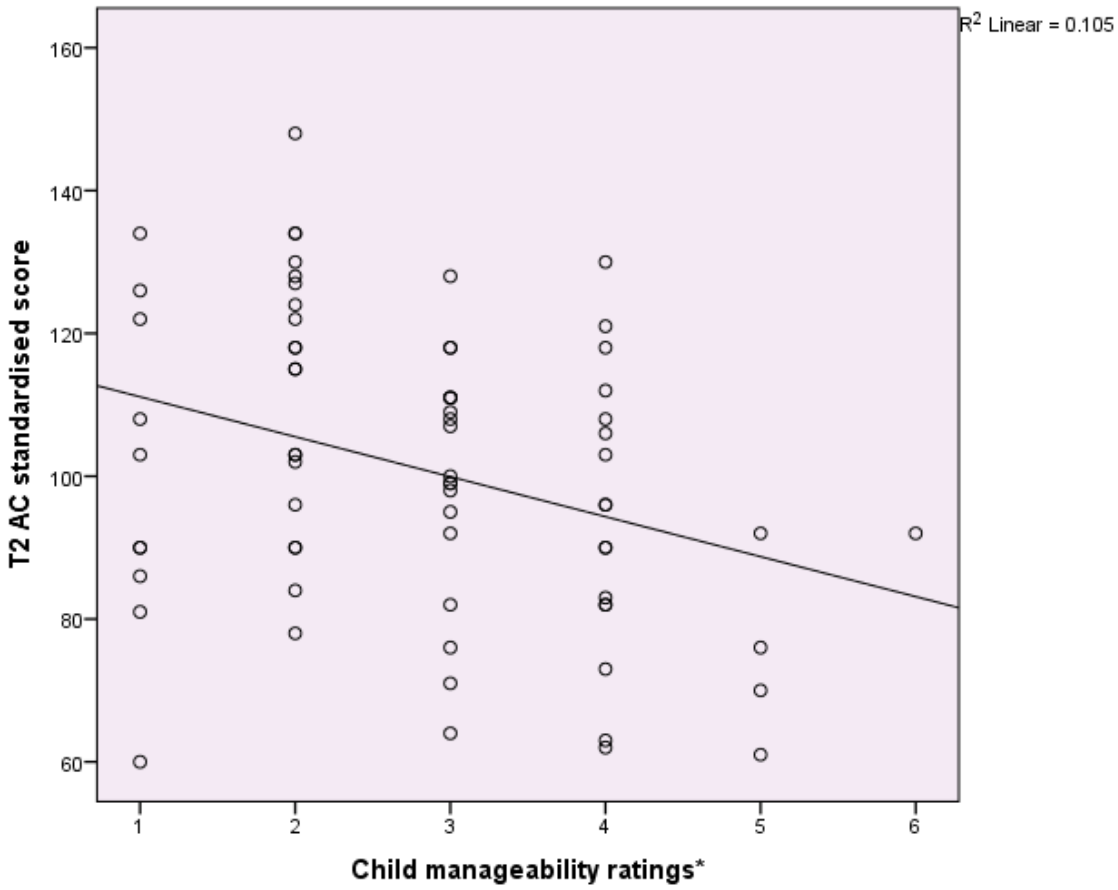


Figure 4.108. Distribution of change in Manageability scores.

4.5.5.5 What is the relationship between T2 auditory comprehension scores and parents' T1 ratings of manageability?

The strength of the relationship between manageability scores at T1 and auditory comprehension scores at T2 showed a moderate significant ($p = .006$) negative correlation: $r(71) = -.33$, BCa 95% bootstrapped, CI [-.53, -.09]. Lower auditory

comprehension scores associated with parents' ratings of children being more difficult to manage (see *Figure 4.109*). The bias statistic was .002, showing that the non-normal distribution for T1 manageability was having a negligible effect on the correlation.

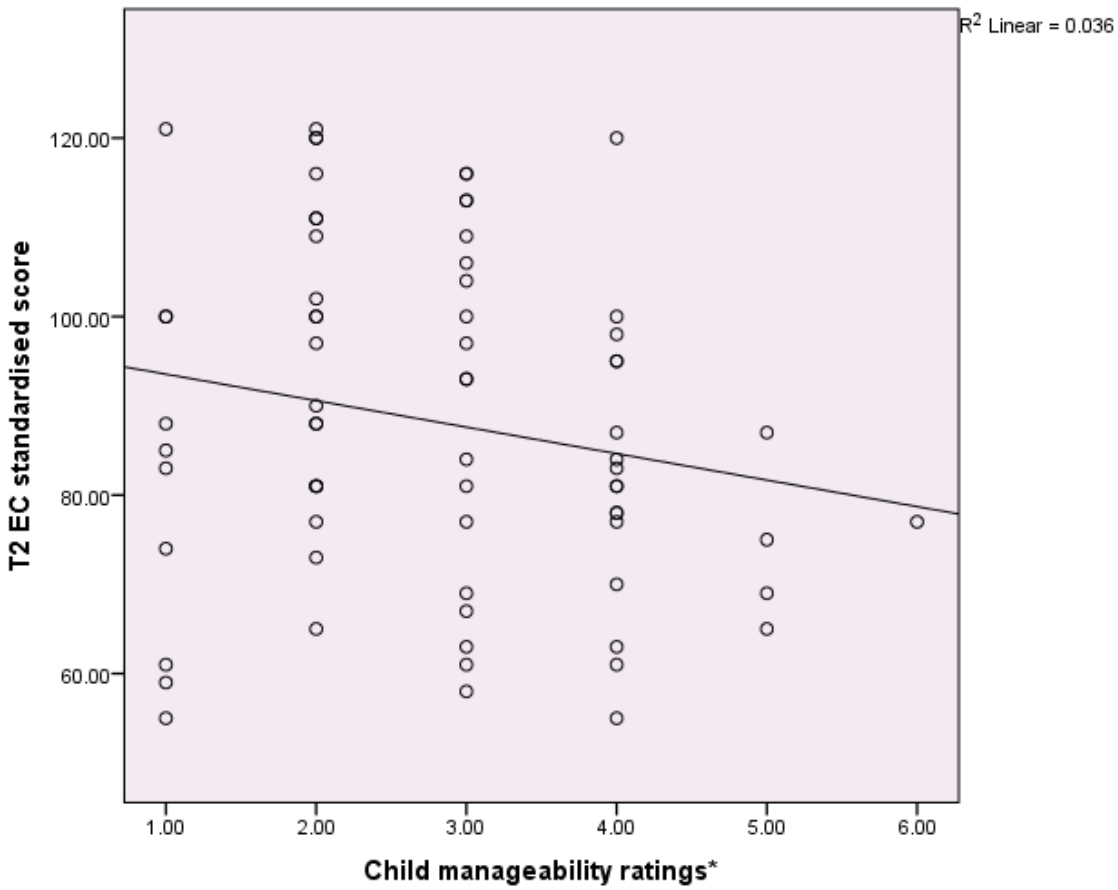


*1= very easy, 2=easy, 3=somewhat easy, 4=somewhat difficult, 5=difficult, 6=very difficult

Figure 4.109. T2 auditory comprehension scores and parents' T1 ratings of manageability

4.5.5.6 *What is the relationship between T2 expressive communication scores and parents' T1 ratings of manageability?*

The strength of the relationship between manageability scores at T1 and expressive communication scores at T2 was negligible; *r*(71) = -.19, BCa 95% bootstrapped, CI [-.40, .02], *p* =.113 (see *Figure 4.110*). The bias statistic was -.003, showing that the non-normal distribution for T1 manageability was having a negligible effect on the correlation statistic.



*1= very easy, 2=easy, 3=somewhat easy, 4=somewhat difficult, 5=difficult, 6=very difficult

Figure 4.110. T2 expressive communication scores and parents' T1 rating of manageability.

4.5.5.7 Is there a relationship between change in auditory comprehension scores from T1 to T2 and change in manageability ratings from T1 to T2?

The strength of the relationship between auditory comprehension change scores and manageability rating change scores was negligible (see *Figure 4.111*); *r*(71) = -.09, BCa 95% bootstrapped, CI [-.14, .30], *p* = .440. The bootstrapped bias statistic was -.002, showing that the non-normal distribution for manageability change was having a negligible effect on the correlation statistic.

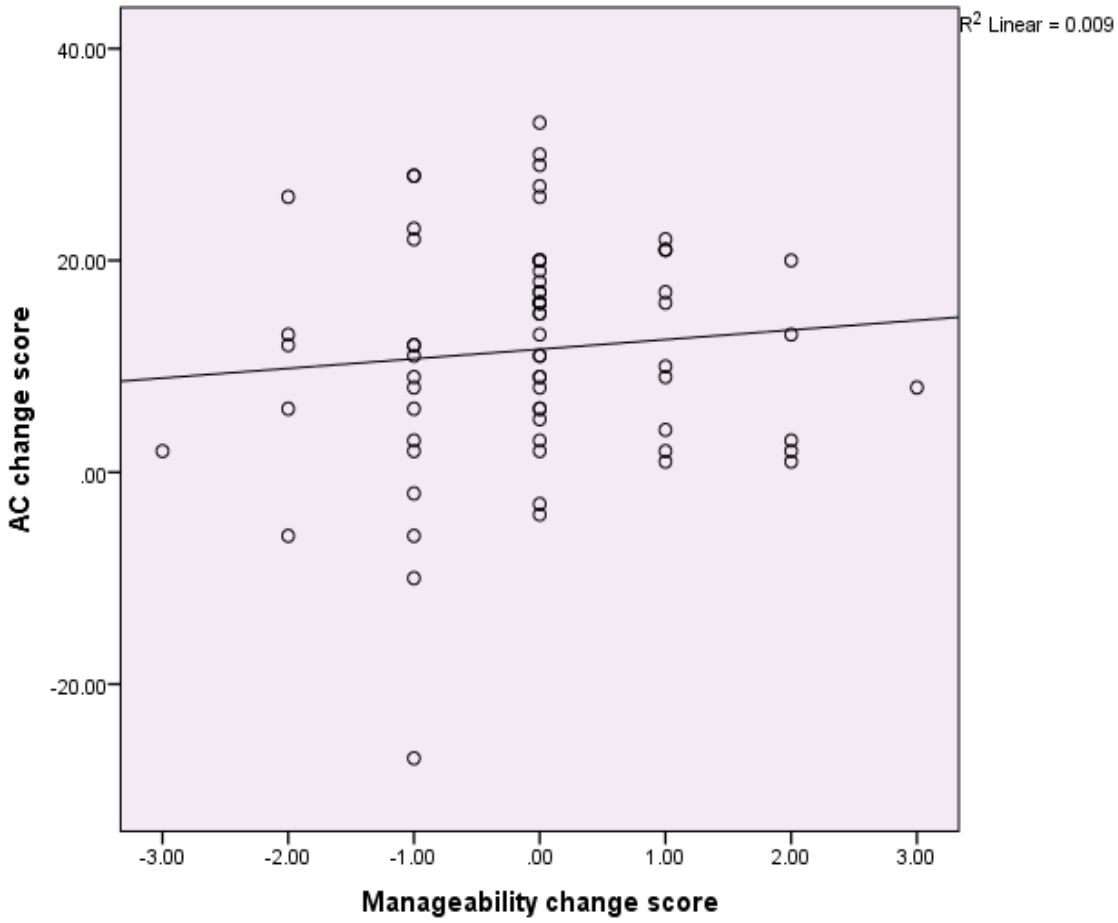


Figure 4.111. Relationship of auditory comprehension and manageability change.

4.5.5.8 Is there a relationship between change in expressive communication scores from T1 to T2 and change in manageability ratings from T1 to T2?

The strength of the relationship between expressive communication change scores and manageability rating change scores was negligible (see *Figure 4.112*): $r(71) = -.03$, BCa 95% bootstrapped, CI [-.18, .23], $p = .806$. The bootstrapped bias statistic was .000, showing that the non-normal distribution for manageability change was having no effect on the correlation statistic.

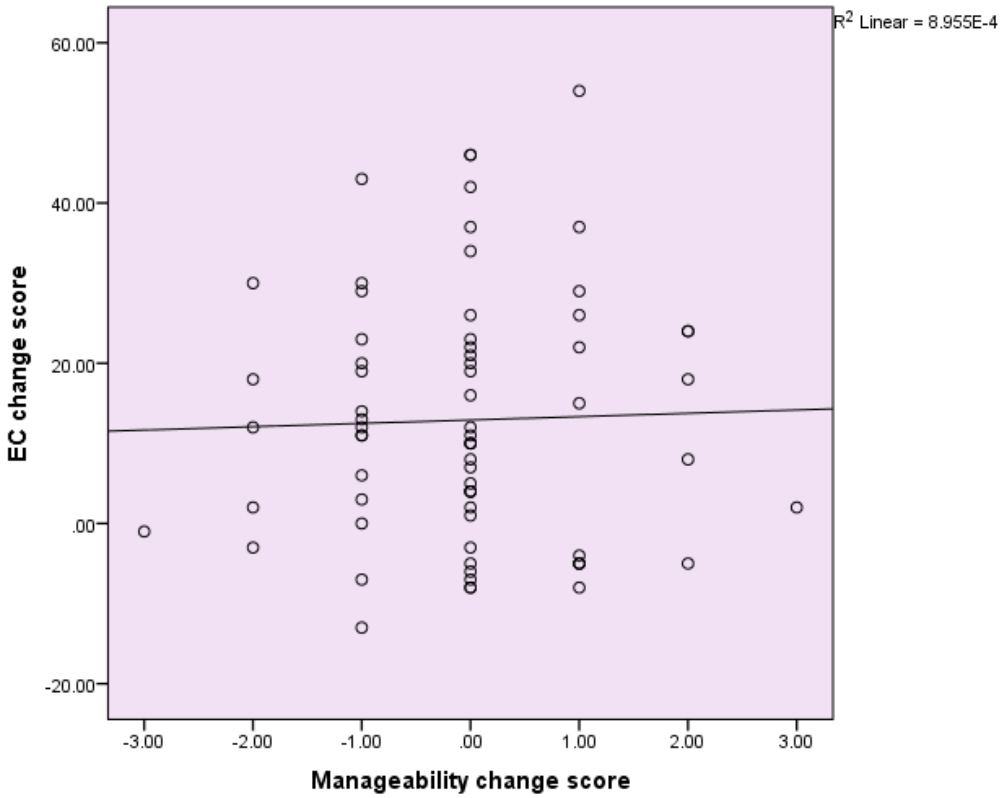


Figure 4.112. Relationship of auditory comprehension and manageability change.

4.5.5.9 Do parent ratings of manageability at T1, along with T1 auditory comprehension scores and T1 distractibility scores contribute to the prediction of auditory comprehension scores after 12 months (T2)?

Before examining the regression analysis, Pearson's correlation values were inspected for the variables to be entered into the regression analysis: T2 auditory comprehension, T1 auditory comprehension, T1 distractibility and T1 manageability (see Table 4.33). T2 auditory comprehension scores showed a strong significant positive correlation with T1 auditory comprehension and a moderate negative correlation with T1 manageability, such that as comprehension scores increase ratings of difficulty in manageability decrease. Despite distractibility adding to prediction (see section 4.5.4.4), there is a negligible correlation between it and T2AC.

Table 4.33 *Correlation matrix for T2 auditory comprehension, T1 auditory comprehension, T1 distractibility and T1 manageability*

	T2AC	**T1AC**	**T1 distractibility**	**T1 manageability**
T2AC	1	.87***	.11	-.31**
T1AC		1	-.01	-.34**
T1 distractibility			1	.04
T1 manageability				1

AC= auditory comprehension standardised score *$p < .05$, **$p < .01$, ***$p < .001$

A multiple linear regression was conducted to examine if auditory comprehension, distractibility and manageability scores at T1 predicted variance in T2 auditory comprehension scores for the cohort. The potential predictor variables were inputted into the regression model simultaneously using the enter method.

The data (*N* =71) met the assumptions for normality and of independent errors (Durbin-Watson value = 2.28).

The analysis of standardised residuals identified one case (case 19) as a potential outlier (Std. Residual = - 3.44). The regression model was re-run, without this case, in the same way as detailed in section 4.5.1.8.

The data (*N* =70) met the assumption of independent errors (Durbin-Watson value = 2.39). Within the regression model, the assumption of no multicollinearity was met for the T1 auditory comprehension standard score variable (Tolerance = .86, *VIF* = 1.16) the T1 distractibility *z* score variable (Tolerance =1.00, *VIF* = 1.00) and the T1 manageability score variable (Tolerance =.86, *VIF* = 1.16).

The standardised residuals histogram and P-P plot revealed a somewhat non-normal (negatively skewed) distribution. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated acceptable linearity and homogeneity of variance.

The multiple correlation coefficient *R* was .88. The multiple correlation coefficient, R^2 was .78, indicating approximately 78% of the variance of the T2 auditory comprehension score (Adjusted R^2 = .77) could be accounted for by the model. This significantly predicted T2 outcome scores, $F(3, 66) = 76.24$, $p < .001$.

Only T1 auditory comprehension (β = .88, *t*= -14.01, *p* < .001), and T1 distractibility scores contributed to the model (β = .13, *t*= 2.20, *p* = .031). T1 manageability scores (β

= .01, *t*= .41, *p* = .683), did not contribute to variance in T2 auditory comprehension outcomes (see Table 4.34).

Table 4.34 *Summary of stepwise regression analysis for variables predicting T2 Auditory Comprehension Standardised Scores (N =70)*

Model	R	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
				B	Standard error	Beta			Zero-order	Partial	Part
	.88	.78	.77								
Constant				13.48	7.99		1.69	.096			
T1AC standard scores				.99	.07	.88	14.01	.000	.87	.87	.82
T1 distractibility standard scores				2.26	1.03	.13	2.20	.031	.12	.26	.13
T1 manageability scores				.23	1.06	.13	2.20	.829	-.31	.03	.01

4.5.5.10 Do parental ratings of manageability at T1, along with T1 auditory comprehension scores, T1 expressive communication scores and T1 adaptability and persistence scores contribute to the prediction of expressive communication scores after 12 months (T2)?

Before examining the regression analysis, Pearson's correlation values were inspected for the variables to be entered into the regression analysis: T2 expressive communication, T1 auditory comprehension, T1 expressive communication, T1 adaptability, T1 persistence and T1 manageability (see Table 4.35). T2 EC scores showed a strong significant positive correlation with T1 auditory comprehension and T1 expressive communication and weak a negative correlation with T1 adaptability.

Table 4.35 *Correlation matrix for T2 expressive communication, T1 auditory comprehension, T1 expressive communication, T1 adaptability, T1 persistence and T1 manageability*

	T2EC	**T1AC**	**T1EC**	**T1 adaptability**	**T1 persistence**	**T1 manageability**
T2EC	1	.58***	.56***	-.26*	.00	-.18
T1AC		1	.38***	-.18	-.30*	-.37**
T1EC			1	.09	.08	.06
T1 adaptability				1	.31**	.49***
T1 persistence					1	.04
T1 manageability						1

AC= auditory comprehension standardised score *$p < .05$, **$p < .01$, ***$p < .001$

EC = expressive communication standardised score

A multiple linear regression was conducted to examine if auditory comprehension, expressive communication, adaptability, persistence and manageability scores at T1 predicted variance in T2 expressive communication scores for the cohort. The potential predictor variables were inputted into the regression model together using the enter method.

The data (*N* =71) met the assumptions for normality and of independent errors (Durbin-Watson value = 2.10). No outliers were identified. Within the regression model, the assumption of no multicollinearity was met for T1 auditory comprehension (Tolerance = .69, *VIF* = 1.45), T1 expressive communication (Tolerance =.80, VIF =1.25), T1 adaptability (Tolerance = .76, *VIF* = 1.32), T1 persistence (Tolerance = .68, *VIF* = 1.48) and T1 manageability (Tolerance =.55, *VIF* = 1.83). The standardised residuals histogram and P-P plot had a somewhat non-normal (positively skewed) distribution. However, the scatterplot of standardised predicted values and partial plots for both predictors had acceptable linearity and homogeneity of variance.

The multiple correlation coefficient *R* was .75. The multiple correlation coefficient, R^2 was .56, indicating approximately 56% of the variance of the T2 expressive communication score (adjusted R^2 = .52) could be accounted for by the model. This significantly predicted T2 outcome scores, F (5, 65) = 16.27, $p < .001$.

T1 manageability scores did not contribute to the model (β = -.04, *t*= -.33, *p* = .743), whilst all the other variables did: T1 auditory comprehension (β = .42, *t*= 4 .22, *p* < .001), T1 expressive communication (β = .42, *t*= 4 .53, *p* < .001), T1 adaptability (β = -

.27, t= -2.79, p < .001) and T1 persistence (β = .20, t= 1.99, p < .001) as is presented in Table 4.36.

Table 4.36 *Summary of stepwise regression analysis for variables predicting T2 Expressive communication Standardised Scores (N =70)*

Model	*R*	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
				B	Standard error	Beta			Zero-order	Partial	Part
	.75	.56	.52								
Constant				-8.21	13.31		-.62	.540			
T1AC standard scores				.44	.10	.42	4.22	.000	.58	.46	.35
T1EC standard scores				.77	.17	.42	4.53	.000	.57	.49	.37
T1 adaptability standard scores				-4.67	1.67	-.27	-2.79	.007	-.26	-.33	-.23
T1 persistence standard scores				3.46	1.74	.20	1.99	.051	.01	.24	.16
T1 manageability scores				-.58	1.75	-.04	-.33	.743	-.19	-.04	-.03

4.5.5.11 Aim 5 Summary

To investigate relationships between cohort auditory comprehension and expressive communication T2 outcomes and parent ratings of child manageability.

Parents' ratings of their child's manageability were distributed across the full six point range. Positive ratings (very easy, easy, somewhat easy) accounted for 69% of the children, with 'easy' being the most frequent response (30%). More negative ratings (somewhat difficult, difficult, very difficult) were given by 31% of the parents, but only 3% reported that their child was 'very difficult', suggesting that the parents did not feel their children with language delay were more difficult than children of a similar age. Ratings after one year remained broadly similar with a trend towards more positive ratings but no statistically significant change in the mean.

There was an association between parents' reports of easy manageability at entry to the study and higher auditory comprehension scores at the end of the study, and with lower auditory comprehension scores being related to ratings of more difficult manageability. This trend did not hold for expressive communication scores where there was a negligible relationship between manageability and expressive communication.

There was no evidence that as children made progress in either comprehension or expressive language skills parents found them easier to manage. Finally, ratings of manageability did not improve prediction for either auditory comprehension scores or expressive communication scores after 12 months.

4.5.6 Research aim 6:

To investigate relationships between biographical and demographic variables alongside any previously identified predictors of cohort auditory comprehension and expressive communication T2 outcomes.

Information was collected from the participants about their biographical and demographic characteristics (see section 2.7). Here, the analyses seek to confirm or negate associations between biographical and demographic factors and outcomes of ELD after one year (T2).

4.5.6.1 Do associations exist between biographical and demographic variables and T2 auditory comprehension and T2 expressive communication scores?

Pearson's correlation values were calculated for variables which may be associated with ELD based on contemporary literature (see sections 2.8 and 2.10.6), alongside variables previously identified within these analyses as contributing to language outcomes. These correlations are presented in Table 4.37 below.

The correlations were as expected for the variables previously included in the analyses (see Table 4.28 and Table 4.32). Of the new variables included, age showed a weak negative correlation with both T1 and T2 auditory comprehension standard scores. A positive family history of language delay showed a similarly weak but positive correlation with T1 expressive communication standard scores but this association was not upheld at T2.

Parents' education level was positively correlated with both T1 and T2 auditory comprehension scores, with the T1 association being strong and then weakening at T2. Similar associations did not exist for expressive communication scores.

Table 4.37 *Correlation matrix for communication, temperament, biographical and demographic variables*

	T2AC	T2EC	T1AC	T1EC	T1 Adapt	T1 Persist	T1 Distract	Age	Family History	Perinatal	URTIs	Birth order	No. siblings	Deprivation index	Parents' education
T2AC	1	.66***	.85***	.37***	-.19	-.24*	.15	-.27*	-.06	-.17	-.13	-.05	-.10	-.19	.29**
T2EC		1	.58***	.56***	-.29**	-.02	.08	-.18	-.08	-.05	-.00	-.18	-.22	-.14	.19
T1AC			1	.38***	-.22*	-.32**	-.01	-.28**	-.04	-.14	-.06	-.09	-.17	-.27*	.41***
T1EC				1	.06	.05	.07	.02	.22*	-.04	.03	-.03	-.06	-.00	.09
T1 Adapt					1	.35***	.06	.14	.11	.02	.09	.12	.14	-.01	-.32**
T1 Persist						1	.07	-.03	.17	-.13	.03	.09	.10	.03	-.18
T1 Distract							1	.14	-.00	.00	.08	-.02	-.02	-.08	-.06
Age								1	-.05	.20	-.01	.10	.24*	.28**	-.19

Family History	1	.03	.04	.08	.12	.15	.23*
Perinatal		1	.105	-.057	-.029	.023	.004
URTIs			1	.146	.108	-.061	-.160
Birth order				1	.89***	-.06	-.17
No. siblings					1	.07	-.15
Deprivation index						1	-.04
Parents' education							1

***p* < .05, ****p* < .01, *****p* < .001**

4.5.6.2 Does the addition of biographical and demographic variables improve the prediction of T2 auditory comprehension scores?

A multiple linear regression was conducted to examine variance in T2 auditory comprehension scores for the seventy two participants using the SPSS 21 stepwise method with a probability of *F* for entry into the model set at .05 and for removal of variables set at .10 (see Table 4.38).

Eleven predictors were entered into the model; the contributor variables from earlier analyses (T1AC, T1EC and T1 distractibility) and eight biographical/demographic variables (age, family history of language difficulties, perinatal problems, URTIs, birth order, number of siblings , deprivation index score and parent's education).

Even though not all of these variables displayed significant correlations with T2 auditory comprehension scores (see Table 4.37), all were entered in order to pick up any suppressor variable contributions in this primarily exploratory analysis.

An analysis of standardised residuals identified one case (case 19) as a potential outlier (Std. Residual = - 3.44). The regression model was re-run, without this case, in the same way as detailed in section 4.5.1.8. The data (*N* =71) met the assumption of independent errors (Durbin-Watson value = 2.39) and no multicollinearity (T1AC, Tolerance = 1.00, *VIF* = 1.00; T1 distractibility, Tolerance =1.00, *VIF* = 1.00).
The standardised residuals histogram and P-P plot exhibited a slightly negatively skewed distribution. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated acceptable linearity and homogeneity of variance.

The stepwise regression model for the prediction of T2 auditory comprehension standardised scores replicated the model described in section 4.5.4.2 and presented in Table 4.29.

The model produced identified that only T1 auditory comprehension and T1 distractibility contributed to the model with all other variables excluded. This two variable model was significant, F (2, 68) = 120.77, $p < .001$ with both predictor variables at step two significantly contributing to the prediction of T2 auditory comprehension variance (R^2= 78%) R^2 change from step one (T1AC as predictor) to step two (both T1AC and T1 distractibility) indicated that T1 distractibility uniquely added 1.6% to the prediction of T2 auditory comprehension standard score variance over that which was predictable from the T1 auditory comprehension standard scores alone (76.5%).

None of the added biographic or demographic variables improved the model for prediction of variance in T2 auditory comprehension outcomes.

4.5.6.3 Do the addition of demographic and biographical variables improve the prediction of T2 expressive communication scores?

A multiple linear regression was conducted to examine variance in T2 expressive communication scores for the seventy-two participants using the SPSS 21 stepwise

method with a probability of *F* for entry into the model set at .05 and for removal of variables set at .10 (see Table 4.38)

Twelve predictors were entered into the model; the contributor variables from earlier analyses (T1AC, T1EC, T1 adaptability and T1 persistence) and eight biographical/demographic variables (age, family history of language difficulties, perinatal problems, upper respiratory tract infections (URTIs), birth order, number of siblings , deprivation index score and parent's education).

Even though not all of these variables had showed significant correlations with T2 auditory comprehension scores (see Table 4.37), they were all entered so that any suppressor variables operating would be identified.

The data (*N* =72) met the assumptions for normality and of independent errors (Durbin-Watson value = 1.98). The assumption of no multicollinearity was met for all variables (T1AC, Tolerance = .72, *VIF* = 1.39; T1EC, Tolerance = .76, *VIF* = 1.32; T1 adaptability, Tolerance = .86, *VIF* = 1.16; T1 persistence, Tolerance = .80, *VIF* = 1.26 and family history of language difficulties, Tolerance = .92, *VIF* = 1.09). The standardised residuals histogram and P-P plot revealed a slightly negatively skew. The scatterplot of standardised predicted values, along with partial plots for both predictors, indicated acceptable linearity and homogeneity of variance.

The stepwise regression model for the prediction of T2 expressive communication standardised scores is presented in Table 4.38. The model identified that T1 auditory comprehension scores, T1 expressive communication scores, T1 adaptability scores, T1

persistence scores and family history of language difficulties contributed to the model with the other seven variables excluded.

The model (see Table 4.38) was significant, F (5, 66) = 19.57, $p < .001$ with the predictor variables at step five significantly contributing to the prediction of T2 expressive communication variance (R^2= 59.7%). R^2 change statistics showed that T1 expressive communication scores predicted 13.8%, T1 adaptability predicted 5.6%, negative family history of language difficulties added 3% and T1 persistence added 3.1% to the prediction of T2 expressive communication score variance over that predictable from the T1 auditory comprehension scores alone (34%).

Table 4.38 *Summary of stepwise regression analysis for variables predicting T2* Aim 6 Summary

	Model	R	R^2	Adj R^2	Unstandardised coefficients		Standardised coefficients	*t*	Sig	Correlations		
					B	Standard error	Beta			Zero-order	Partial	Part
Step 1		.58	.34	.33								
	Constant				33.54	9.19		3.65	.001			
	T1AC Standard score				.61	.10	.58	6.02	.000	.58	.58	.58
Step 2		.69	.48	.46								
	Constant				-8.92	12.89		-.69	.490			
	T1AC Standard score				.45	.10	.44	4.67	.000	.58	.49	.41
	T1EC standard score				.75	.17	.40	4.28	.000	.56	.46	.37
Step 3		.73	.54	.52								
	Constant				-6.21	12.30		-.51	.615			
	T1AC Standard score				.38	.10	.37	4.00	.000	.58	.44	.33
	T1EC standard score				.83	.17	.44	4.92	.000	.56	.51	.41
	T1 Adaptability				-4.15	1.44	-.25	-2.87	.01	-.29	-.33	-.24

Step 4		.75	.57	.54								
	Constant				-11.60	12.24		-.95	.347			
	T1AC Standard score				.36	.09	.35	3.86	.000	.58	.43	.31
	T1EC standard score				.93	.17	.50	5.44	.000	.56	.55	.44
	T1 Adaptability				-3.98	1.41	-.24	-2.83	.006	-.29	-.33	-.23
	Family history of language difficulties				-3.36	1.56	-.18	-2.15	.035	-.08	-.25	-.17
Step 5		.77	.60	.57								
	Constant				-15.89	12.03		-1.32	.191			
	T1AC Standard score				.43	.10	.41	4.49	.000	.58	.49	.35
	T1EC standard score				.87	.17	.46	5.17	.000	.56	.54	.40
	T1 Adaptability				-4.80	1.41	-.29	-3.40	.001	-.29	-.39	-.27
	Family history of language difficulties				-3.57	1.52	-.19	-2.35	.022	-.08	-.28	-.18
	T1 Persistence				3.43	1.51	.20	-2.27	.027	-.017	.269	.18

4.5.6.4 Aim 6 Summary

To investigate relationships between biographical and demographic variables alongside any previously identified predictors of cohort auditory comprehension and expressive communication T2 outcomes.

Parents' education level was significantly correlated with children's auditory comprehension standard scores both at entry to the study and after 12 months however, in regression analysis it did not contribute to the prediction of outcomes. None of the other demographic or biographical traits added to the prediction of auditory comprehension outcomes.

For expressive communication scores, having a family history of language difficulties in a first degree relative was significantly correlated with poorer scores at entry to the study and, in regression analysis, made a small contribution (3%) to the explanation of variation in outcomes after one year.

4.5.7 Summary of findings

This study was designed to describe the language characteristics and temperament profiles of a group of children identified as having ELD by their local SLT service, and the temperament profiles of their parents. Further, the study sought to identify associations between language progress, temperament characteristics and goodness of fit between parent and child dyads.

Aim 1 presented the communication characteristics of a group of pre-school children accepted on to the caseload of community SLT services at two time points, 12 months apart. Language impairment was identified, through the use of the PLS3-UK, in 88.75% of the cohort (*N* =71/80) at entry to the study and this reduced to 51.39% (*N* =37/72) 1 year later.

Aim 2 identified the temperament characteristics of the cohort. Their temperament profile showed that they were significantly less adaptable and less persistent than the instruments' standardisation samples at both time points. There was a good degree of stability in their temperament across the 12 month period.

Aim 3 described the temperament characteristics of the cohort's parents. Their group temperament profile showed higher distractibility and lower approach than the standardised sample and had a higher degree of stability than the children's temperament over the 12 month period.

In aim 4, the relationships between child temperament dimensions, auditory comprehension and expressive communication outcomes were investigated. The twelve month language outcomes were significantly predicted by initial language scores and showed a small improvement after the addition of temperament variables. For auditory comprehension, 76.6% of the variance in outcome was explained by initial auditory comprehension score and this was further improved to 78% by the addition of distractibility. Children with higher auditory comprehension scores, and who had a tendency to be more distractible achieved better auditory comprehension standard scores after one year. For expressive communication, initial auditory comprehension and expressive communication scores explained 48% of the variance in expressive

communication outcome. The addition of the temperament variables of adaptability (being more adaptable) and persistence (being less persistent) increased this to 56%.

The fifth aim investigated relationships between auditory comprehension and expressive communication outcomes and parent ratings of child manageability.

Parents' ratings of manageability were used as a proxy for goodness of fit between child and parent. Positive ratings accounted for 69% of the children, suggesting that the parents did not feel their children with ELD were more difficult to manage than children of a similar age. Ratings after one year remained broadly similar.

There was an association between lower auditory comprehension scores and ratings of more difficult manageability. This trend did not hold for expressive communication scores.

No evidence was provided that as children made progress in their language skills, parents found them easier to manage.

Finally, ratings of manageability did not improve prediction for either auditory comprehension scores or expressive communication scores after 12 months.

The sixth aim of the study was to investigate relationships between biographical and demographic variables alongside previously identified predictors of the cohorts' auditory comprehension and expressive communication T2 outcomes. Parents' education level was significantly associated with children's auditory comprehension standard scores both at entry to the study and after 12 months however, in regression analysis no demographic or biographical traits added to the prediction of auditory comprehension outcomes.

For expressive communication scores, having a family history of language difficulties in a first degree relative was associated with poorer scores at entry to the study and, in regression analysis, contributed to explanation of variation in outcomes after one year.

These main findings will now be debated in the discussion chapter.

Chapter 5 Discussion

5.1 Introduction

As described in Chapter 1, the impetus for this study arose through my experiences in clinical practice, working with children and their families in community clinics and nurseries. When assessing young children with slow-to-develop language (ELD), it can be difficult to ascertain the cause of the delay or its likely trajectory (see section 2.8). Some late talkers do "catch up" with their peers by around four to five years (Rescorla, 2011) but a proportion of these children continue to have persistent language problems (Law et al., 2000). Further, some families are successful in attending for SLT sessions and implementing advice, whilst others find this difficult for a range of reasons including, access, long waiting times and inconvenient appointments (Layne, Lowton and Goldsmith, 2003; Phillips, 2004; Richardson, 1998; Stathopulu, Ajetunmobi, and Selling, 2003). Developing robust, effective, efficient and 'family appropriate' services to promote optimal language development is a key concern for paediatric SLTs (Kamhi, 2014). SLTs and parents of children with ELD have proposed a range of explanations to account for ELD, including genetic and environmental theories (Bishop et al., 2012; Law et al., 2011). Temperament bridges both of these domains (Gallagher, 2012; Shiner at al., 2012) and my primary purpose in this study (see section 2.10.7) was to consider if temperament could add to an understanding of children with ELD and their needs.

The overarching aim of the current study, therefore, was to explore and examine associations between temperament characteristics of children with ELD and their language change over a twelve month period and to consider if goodness of fit between parent and child contributed to language progress. In this chapter, I will exploring the findings and contextualise them in the light of existing frameworks and knowledge about ELD and temperament. The limitations and strengths of the study will then be discussed before the clinical implications are appraised, with reference to the assessment and treatment of language delay in young children. Finally, suggestions for further investigations into associations between temperament and language delay are considered.

Prior to considering and debating the main research aims of the study in turn, I will first address the specific context of the study. Here I will consider the characteristics of the participants and their demographic and biographic profiles, since ELD has been associated in the literature with overrepresentation of specific features (Henrichs et al., 2012; Law et al., 2011; Nelson et al. 2006; Reilly et al., 2010; Zubrick et al. , 2007).

5.2 The study cohort

The data presented in this study were obtained from eighty children, aged between 2;00 and 3;09 years (mean = 2;09 years). Seventy-eight of the children came from one NHS Primary Care Trust and two children from a neighbouring NHS Primary Care Trust. Although, therefore, the sample size was moderate for a multivariate clinical study the

cohort were drawn from one small geographical area in the North West of England. The children and parents who participated were invited by their SLT following a first appointment but this process was not implemented stringently, with the SLTs telling me that they often forgot to mention the study or that they did not feel it was appropriate to ask particular families. Thus, the cohort considered here may be biased in a range of ways, which are unknowable but could be affecting the data. It is therefore important to consider the cohort's characteristics in relation to what is already known about children with ELDs. The literature has reported myriad factors associated with slower language development (Harrison and McLeod, 2010) and of these gender, perinatal difficulties, family history of language or literacy problems, socioeconomic position and maternal education are commonly reported across studies of ELD. Information was collected for this study about these risk factors but also about hearing difficulties or concerns, upper respiratory tract infections, birth order and number of siblings, languages spoken to the child, ethnicity and child care arrangements.

The key cohort characteristics, associated with risks for ELD, are presented for consideration here.

5.2.1 Gender

In my study cohort, the ratio of boys to girls was 75:25, echoing published research findings and mirroring Broomfield and Dodd's (2004) community clinic cohort.

Gender imbalance has been identified across a range of studies with a consensus that boys are more likely to have delayed language development in clinical groups, such as Broomfield and Dodd's (2004) who reported a 75:25 ratio of males to females for

receptive and a 78:22 ratio for expressive language difficulties. It could be that boys trigger more clinical referrals because their vulnerability to language delays is well known amongst early years professionals, however further robust support is available from large prospective national and community cohort studies which confirm such clinical findings. Prathanee et al. (2009) reported that being male gave an odds ratio of 2.12 for ELD, in a large national cohort of Thai children and similar findings have been reported from Australia (Reilly et al. 2010; Zubrick et al., 2007) and in the Netherlands (Henrichs et al., 2012). Adamson-Macedo et al. (2009) used receptive and expressive language measures involving both parent report and direct testing in a group of 244 two year old children living in a Sure Start area. They found that boys' scores were significantly lower than girls' scores. This suggests that gender imbalance in language delay is found across communities, languages and socioeconomic strata. Whilst this does not mean that the study cohort was representative of referrals to SLT in the geographical area the study took place, it can be concluded that in respect of gender balance, the cohort is comparable to other contemporary studies of ELD.

5.2.2 Perinatal difficulties

Perinatal difficulties were operationalised as the need for additional medical support in the first two months following birth. In the current study, just over a quarter of the children (26%) had needed such support. Perinatal difficulties have been associated with ELDs (Cusson, 2003; Eapen et al., 2004; Mossabeb et al., 2012) but studies have not been conclusive and evidence of age appropriate language skills in pre-term and unwell infants has also been found (Harrison and McLeod, 2010; Smith et al., 2014).

Henrichs et al.'s (2012) large prospective cohort study sought to identify risk and predictive factors for language delay and concluded,

> 'Although multiple perinatal, demographic, and maternal psychosocial factors significantly predicted vocabulary skills at 30 months, positive predictive value and sensitivity were low.' p. 854

It is not possible to interpret the rates of perinatal difficulty found in this study, since I have not been able to access local or national data to ascertain how the study rates compare to children in the whole population. Further, I did not have a control group of children without ELD to act as a comparison to these rates of perinatal difficulty. This would have enabled a contextualisation of this risk factor. However, current statistics from BLISS (www.bliss.org.uk), a national UK charity supporting neonatal care, report an incidence of 11% of babies born premature or sick. The rates in this study are considerably higher and may point to an increase in vulnerability to language delays for children with perinatal difficulties or alternatively to a heightened concern from both their parents or from health professionals involved in early surveillance for these children. Research into the referral decision making practices of these groups of professionals may reveal useful qualitative information about this. Direct comparison of rates identified in the literature is complicated by the varying operational criteria for perinatal difficulty. Reilly et al. (2007) used criteria of twin birth, prematurity and low birth weight. They reported separate rates for each of these perinatal factors, but did not report on early ill-health requiring medical support, whilst Broomfield and Dodd (2004) provided details on health concerns for their participants (rather than 'perinatal

difficulties'; 21% expressive language disability; 13.5% receptive language disability). In their study, being born below or above four weeks from the due date of birth, having frequent hospitalisations or convulsions were the category criteria for identifying early health problems. Rather confusingly, their report changes terminology with 'birth history' (p310) later identified as 'health' (p314) in the results section. Broomfield and Dodd's (2004) incidence rates though slightly lower are broadly similar to those in this study and this may reflect the different criteria used (see section 3.6.2.1) or the smaller sample size in my study. Landry, Smith and Swank (2002) followed two groups of very low birth weight children through to eight years of age (high medical risk, *n* =94; low medical risk, *n* =132) and a group of full term low risk (*n* =134) children who acted as a control group. They identified that risk status was a significant predictor for language level ($p < .001$) across time points. Full term children showed higher language ages than both high risk children (by 8.5 months) and low risk children (by 5.2 months)

5.2.3 Family history of language or literacy problems

In this study a high percentage (64%) of children were identified as having a family member with a history of language or literacy problems. This was expected from the literature which has identified associations between children and relatives with language or literacy impairments, both through direct testing of relatives (Bishop et al., 2012) and via parent report (Zubrick et al., 2007; Reilly et al., 2010). Here, the number of parents reporting a history is higher than many other studies. This may be in part because I included first and second degree relatives, i.e. aunts, uncles and grandparents, rather than parents and siblings only. Second degree relatives accounted for 9% of this total, leaving 55% of the children with a first degree relative history of

language needs. However, differences also existed in the way I gathered the information, which was through direct interview rather than questionnaire, which is usually used in large prospective cohort studies. Parents may have reported more carefully, taking time to think about the histories of their relatives, alternatively the face to face interview may have influenced parents to produce a positive reply as a form of respondent bias.

Zambrana et al. (2013), in Norway, found the risk for persistent language difficulties was 'almost tripled' for children with a positive family history of language difficulties in their large cohort study (*N* = 10,587). In contrast, no predictive value was conferred by family history of language difficulties by Everitt et al. (2013) who identified equal rates in their 3-4 year old children with delayed (*n* =47) and typically developing (*n* =47) language. This is an interesting finding that could point to issues with small sample sizes. Again, the lack of a reference group and small sample size require consideration in interpretation of the family history rates in my study, though it is clear that the rates are above those that would be expected in the general population. As such, this study lends support to research identifying that family history of language difficulties increases the vulnerability for ELD in children from these families.

5.2.4 Socioeconomic position

This study used Neighbourhood Statistics produced by the Office for National Statistics to ascertain the socioeconomic position for the study participants via the MDI, to give a holistic view of income, employment, educational attainment and access to resources at the micro level of participant postcode.

The mean MDI rank for the study children was 15,377 with a mode of 7,886. This was slightly higher than the mean rank for the local authority area (14,235 in 2010) and a little lower than that for England (16,241). Within the study cohort, a wide range of MDI ranks was represented, from 253 - 32,164 (range = 31,911) accounting for 98% of the available ranks.

The literature attests both to associations between deprivation and language delays (Law et al., 2011) and conversely higher SEP and better language skills (UK, Becker, 2011; USA, Farkas and Beron, 2004; USA, Rowe et al., 2012). However, Harrison and McLeod (2010) in their large Australian population study found no association between SES and increased risk for any speech or language impairment from data collected by parental report.

This wide variation suggests that although the literature identifies trends in increasing prevalence of language delay for children who live in areas of higher deprivation, language delay is also found in children living in higher SEP areas. The profile of SEP in the study cohort is broad and does not give support to the premise of increased vulnerability to ELD in lower SEP groups. It may be that despite the range of SEP in my cohort this does not reflect the natural profile of SEP in referrals to the service since recruitment was purposive.

5.2.5 Maternal education

In this cohort, seventy-one of the parents had qualifications that met the national expectation of five grade C minimum GCSEs (89%) and nine parents had qualifications below the five grade C subjects in the GCSE examinations (or equivalent). This data was difficult to gather as parents did not always remember the qualifications they had attained clearly. In addition, there may have been an unhelpful dynamic involved in being asked about this by someone from a university. It is difficult to establish true equivalence across different educational measures such as GCSE, O'level and CSE which were reported (see section 4.2.2.1). Maternal education has been used as a proxy, in some studies, for a deprivation index. Law et al. (2012) adopted this metric and found an increased odds ratio for children with persistent and decreasing language levels whose mothers had low educational levels (OR = 0.49). Letts et al. (2013), using the New Reynell Developmental Language Scales (NRDLS), found children of mothers who had more years of education performed better than those whose mothers had less years of education on this language test. The effect was noted to be stronger for younger children, potentially reflecting the larger amount of time that younger children spend with their mothers in comparison to older children, who have a wider range of influences and social partners. Similarly, Sylvestre et al. (2012) reported that lower maternal education was predicative of lower receptive language performance in multivariate regression analysis.

Meeting, or not meeting, these educational attainments could link to future employment prospects and financial security but it is a rather undifferentiated measure without the fine grained variability that MDIs offer. However, it is noteworthy

that the majority of the cohort had educational attainments that will have facilitated their understanding of the data collection tools used in the study.

5.2.6 Parent characteristics

There was a clear overrepresentation of mothers in comparison to fathers in the sample and this reflects that mothers were most usually the main carer for the children in the family (see section 4.2.2). Further, the parents ages ranged from 18 to 45 years (range = 27 years) with an average age of 32 years and 7 months, giving an average age of 29 years and 11 months when the children were born, mirroring Sylvestre et al.'s (2012) parent sample. This fits closely with national data, with the average age of women giving birth for the first time rising from 28.4 years in 1999 to 29.4 years in 2009 and reaching 30.0 years in 2013 (Office for National Statistics, 2014).

5.2.7 Summary of cohort characteristics

In summary, the cohort recruited to the study represented an invited but self-selecting group of parents and preschool children who had recently been admitted on to the caseload of their local SLT service. They exhibited some characteristics associated with vulnerability to ELD, specifically a high proportion of boys and children with a family history of language or literacy difficulties. Although perinatal difficulties, hearing difficulties, frequent URTIs, later birth order, SEP and maternal education have been proposed as risk factors for ELD in the literature, these characteristics were not evident as overrepresented in the cohort recruited to this study. These cohort characteristics are summarised in Table 5.1 below.

Table 5.1 *Cohort characteristics*

Biographic/demographic factor	**Study Cohort**
Maleness	75% were boys
Family history	55% of the children had a first degree relative with a history of language or literacy difficulty
Perinatal difficulties	26% had needed additional medical support in their first two months of life.
Birth order	76% of the children had siblings 45% of them were first born, 39% were second born.
URTIs	26% experienced three or more colds within the previous year. One parent had concerns about their child's hearing.
Maternal education	89% of the parents had qualifications that met the national minimum.
Socioeconomic position	24% of children live in the most deprived quarter of areas, 26% live in the least deprived quarter of areas of England

5.3 Research aim 1

The first aim of the thesis was to describe the communication characteristics of the study cohort, at two time points, 12 months apart.

The cohort all met the service criteria for group or individual treatment (see appendix 19) following informal assessment by an experienced SLT. In respect of their language performance on the PLS3-UK formal assessment, most, but not all, of the children had

scores which met criteria for diagnosing a language delay (Table 4.19 *PLS3-UK language scores at T1 and T2 in relation to test manual descriptions*). Roulstone et al., (2003) report analogous practice from their twelve month study following the progress of preschool children (mean age = 34.2 months) from referral to the SLT service. They used baseline assessments of children but also included clinician judgement as part of their cohort inclusion criteria. It may be that clinicians' judgements add usefully to a qualitative cluster of variables which are signals about language development but are not amenable to criterion referenced testing, for example attention control and engagement with others. It would be interesting to follow up children who do not meet assessment score criteria but are accepted on to caseloads, both to ascertain their group characteristics but also to monitor their language outcomes to see if they remain above service criteria or whether SLTs are exercising an expert clinical judgement which can be objectively tracked in caseload outcome profiles.

5.3.1 Auditory comprehension skills

The cohort as a whole had a depressed mean and mode score for auditory comprehension of 88 (range = 56-131). A clinical delay of below 1*SD* in auditory comprehension was identified for just under half (47%) of the cohort. Roos and Weismer (2008) argue for the need to consider receptive language difficulties in studies of the natural history of language delay, discussing their role in expressive language development and in prediction of language outcomes, with poor auditory comprehension associated with poorer outcomes.

The literature is scarce in respect of studies that have used direct testing to ascertain auditory comprehension status in pre-school children and in larger studies,

reservations exist as to the accuracy of parent report for *receptive* language skills (Bishop et al., 2012). Where a direct testing approach has been used, studies are typically constrained by smaller sample sizes (Bishop and McDonald 2009, Everitt et al., 2013).

Roulstone et al. (2008) reported PLS3-UK scores for their clinical sample (mean age =32.9 months) defined by SLTs (*N* =157). The mean auditory comprehension standard score was 83 (range = 53-127), suggesting similarities in the children's profiles across the current study and Roulstone et al.'s (2008), despite their cohort being much larger. Everitt et al. (2013) reported on a group of forty-seven late talkers who were rather older (mean age = 43 months). This cohort were recruited because of concern about their expressive language development, but Everitt et al. (2013) also assessed their auditory comprehension using the PLS3-UK and reported a mean standardised score of 82.98 (range = 64-115). It is interesting that Everitt et al.'s (2013) sample, recruited with expressive language concerns had a similar mean to Rouslstone et al.'s (2008) sample. In respect of the range of scores Everitt et al.'s (2013) group show the smallest range with the highest score being just 1*SD* above the standardised mean. It may be that as children get older, some auditory comprehension problems become masked by more obvious expressive language problems. In my study cohort, at entry to services there was a trend for older children to have lower auditory comprehension standard scores, despite higher raw scores (see Table 4.10). This is an important characteristic since poor auditory comprehension has been identified as a warning signal for persistent language delays (Chiat and Roy, 2008; Paul and Roth, 2011; Watt et al., 2006) and yet in my sample was likely to relate to later referral age.

5.3.2 Auditory comprehension outcomes after one year

When the cohort's auditory comprehension was reassessed after one year (*N* =72) there was a significant (*p* <.001) increase in the mean standardised score (mean = 100.5) such that it lay on the expected test mean. Inspection of the *range* of the scores however showed that this had widened (see Table 4.14). This suggests that whilst the cohort's scores had progressed, some individual children had made little progress, for example, case 19 had a raw score of 18 at T1 and 15 at T2 with a resulting standardised score of 65 falling to 62 at T2. Other children made very significant progress, for example, case 56 had a score of 10 (standardised score 59), which rose by over 2*SD* at follow up. These differences are reflected in the auditory comprehension change scores for the cohort (see *Auditory comprehension standard score change Figure 4.15*).

Change scores are not typically reported in papers which look at the natural history of ELD and in reporting them this study adds an insight into the heterogeneous detail of change patterns in addition to describing group change. This reveals cases that may be fruitful to inspect at a qualitative level to identify characteristics which may act to stimulate thought about which individuals are likely to not meet the expected cohort profiles, since language impairments are characterised by heterogeneity (Conti-Ramsden, 2008). Developing a qualitative analysis around this information was outside the scope of this thesis but would be interesting to investigate outside of this format.

Overall, good progress was made by the cohort and improved scores equated to a reduction to 25% (18) of the children continuing to have auditory comprehension problems (see Table 4.19). This finding reflects reports by Dale et al. (2003) and Rescorla et al. (2000) that a majority of early-referred young children, described as late talkers, catch up with their peers within 1-2 years. An interesting feature of the current study is that a pattern from T1, of the youngest children obtaining the highest comprehension scores, has been maintained across the year, with mean scores becoming lower for each age band. However, small numbers of children populate these older groups and so it has not been possible to interrogate this further or draw conclusions in a meaningful way. Future research looking at outcomes of early compared to later referrals would be valuable to illuminate the characteristics for referral that may be operating at different ages within the preschool years. It may be that 'not talking' triggers referral to SLT services more easily than concerns about auditory comprehension which are more context dependent and may be masked by sensitive parenting. A further consideration is the optimal age for early intervention. Receptive language skills are more resistant to change through interventions (Boyle et al., 2010), if these language difficulties are also later identified this may be impacting on the effectiveness of interventions in unknown ways. For example, early identification may facilitate earlier structured teaching and practice of attention to verbal cues whilst later identification and intervention may occur at a point where the child has established primacy of visual and emotional cues over more cognitively demanding verbal input. Equally, later identification may follow a point at which intervention is ideally suited and represent a 'tipping point' at which time natural

facilitation has begun to become ineffective and alternative strategies are needed for the child to maintain progress.

In respect of the pattern of change over the twelve month period, T1 scores showed a strong (*r* = .85) correlation with follow up scores at T2. This pattern supports previous research which has identified baseline auditory comprehension scores as predictive of outcome at follow up (Roulstone et al., 2003; Henrichs et al., 2012) and predictive of persistent language difficulties (Bishop et al., 2012; Zambrana et al., 2013). Chiat and Roy, (2008) used a battery of assessments in their study of 163 pre-school children who had attracted clinical concern, using the PLS3-UK at baseline and 18 month follow up. Their results reflect the findings of this study with respect to auditory comprehension:

> 'Intercorrelations at and between T1 and T2 were high, and dissociations were rare.' p. 635

In conclusion, the receptive language skills and progress of this study cohort closely resembles those of other contemporary studies which have reported on the natural history of ELD.

5.3.3 Expressive Communication

At T1, all the children had expressive standard scores that fell below the mean with the exception of one child. The cohort as a whole had a depressed mean score for expressive communication of 74.8 (range = 60-109) and mode of 69. A clinical delay of

below 1*SD* in expressive communication was, therefore, identified in 85% of the cohort. These scores are similar to those found in both Roulstone at al.'s (2008) and Everitt et al.'s (2013) cohort studies which reported PLS3-UK expressive communication means of 77.4 and 76.94 respectively. These findings across areas of the UK (North West, South West, North Scotland) suggest that SLTs make equitable decisions at the point of referral and follow a professional consensus such as that outlined in the RCSLT Communicating Quality (Williamson, 2006).

The outlier case had a standard score of 109 at T1 (age 29 months) rising to 116 at T2 (42 months). This little boy had been born prematurely to a mother who was 16 years old. She reported that there had been increased surveillance since he was born and she felt this was both because of his prematurity and her age. She reported that he had developed 'better than anyone thought'. He had no expressive words at 26 months and this had triggered referral to SLT. His mother reported that he had made significant language gains since the initial assessment. At the second point of data collection, he had been discharged from the service. The literature reports on 'late bloomers' (Rescorla, 2009) whose language trajectory is characterised by a delayed start to expressive language, often in the context of appropriate auditory comprehension skills. Paul and Roth, (2011) in their review of language outcomes , concluded that 75% of children identified as late talkers at 18 months of age will move into the normal range on standardized language measures by 3 years of age. However, this child's language trajectory is in contrast to those reported by Thal et al. (2004) and Rescorla et al. (2000), where late talkers showed improvement but remained with weaker language skills than controls as this child ended the study with expressive skills

of 1*SD* above the mean score for his age. This child's scores resonate with findings from Ellis Weismer's (2007) sample of late talkers (*N*=40), 25% of whom demonstrated age appropriate language skills by 5;06.

Early expressive language delay is reported widely in contemporary literature both in large prospective cohort studies (Henrichs et al., 2012; Reilly et al., 2010; Zubrick et al., 2007) and in smaller studies (Everitt et al. 2013; Chiat and Roy, 2008; Broomfield and Dodd, 2004; Roulstone et al., 2008). As detailed in section 2.8 of the literature review, the majority of children with ELD catch up with their peers within two years (Henrichs et al., 2012; Dale et al., 2003). However, a difficulty with this conclusion, as debated in section 2.4, is that criteria for defining expressive language delay vary by measures used and cut-off criteria established. Additionally, in most large scale longitudinal cohort studies receptive language skills have not been assessed, meaning that variability in outcomes may be confounded by children with mixed expressive and receptive language delays (Zambrana et al., 2013; Prathanee, 2009). Despite these elements of variability, for those children with expressive language delay only, the outcomes are reported to be more positive than for children with mixed receptive and expressive language delays (Paul and Roth 2011; Rescorla 2002, 2009).

Inspecting the expressive communication scores by age band, it is evident that the range of scores for the youngest children (2-2;05) shows the most variability with a range of 48 (61-109) in comparison to older children where the range has halved to 24 (71-95) (see Table 4.12). This finding supports the literature on early language development, which details wide variability between children in the early stages of language development (Clark, 2003). In addition, it may be that the youngest children

are less predictable in their response to testing, though the fact that this group included the highest scores does not support this explanation. Alternatively, these differences in score ranges may reflect that the variation in expressive language skills is more difficult to assign scores to at the youngest ages i.e. the test is less sensitive.

5.3.4 Expressive communication outcomes after one year

When the cohort's expressive communication was reassessed after one year (*N* =72) there was a significant ($p < .001$) increase in the mean standardised score (mean = 87.81). The mean score now lay just within -1*SD* from the test mean, evidencing that despite improved scores the children had not yet caught up with their peers. These scores are higher than those reported by Everitt et al. (2013) whose cohort scores reduced from a mean of 77 at baseline to 71 after one year. The difference in outcomes, despite similar baseline scores, across my study and Everitt et al.'s (2013) may be explained by her cohort being older (mean age 4:08) and having a narrower age range, meaning that children who quickly resolve their ELD were not part of Everitt et al.'s (2013) cohort.

In this study, half of the cohort retained scores below 1*SD* of the test mean and continued to meet criteria for clinical concern. Inspection of the range of the scores however showed that this was characteristically different from the auditory comprehension scores, which exhibited a clear age trend (with younger children showing higher mean scores). For expressive communication, no such age variation was evident (see Table 4.15). This suggests that whilst the cohort's scores had

progressed, there remained considerable differences in the developmental change of individual children. These differences are reflected in the expressive communication change scores for the cohort. The mean change in scores was 12.89, and there was a wide range of sixty-seven points between children who changed the most and the least (range = -27–33) (see *Figure 4.20*). A decrease from the T1 standard score was shown by 25% of the T2 cohort (*N* =72), whilst 37.5% of the cohort increased their T1 standard score by 1*SD* or more.

Overall, good progress was made by the cohort and improved scores equated to a reduction to 49% (35) of the children continuing to have expressive communication problems (see Table 4.19). This finding lends some support to papers evidencing catch up in ELD (Dale et al., 2003; Ellis Weismer 2007; Rescorla et al., 2000) that a majority of early referred young children, described as late talkers, catch up with their peers within 1-2 years. It may be that a 12 month follow up has not provided sufficient time for the children to make more substantial progress, however it is also likely that some of these children, who are losing ground in comparison to their peers, are at risk of persisting language impairment. It would have been valuable to follow the cohort for at least a further 12 months but this was not possible within the study constraints.
In respect of the pattern of change over the twelve month period, T1 scores showed a moderate (*r* = .56) correlation with follow up scores at T2. This pattern reflects the variation found in change scores across the 12 month period with greater variability than in auditory comprehension progress.

5.3.5 The relationship between receptive and expressive language skills at entry to the study and after one year

At entry to the study the profile of the cohort's language difficulties revealed almost equal numbers of children with expressive only (45%) and mixed receptive-expressive language delays (43%). The least common profile was receptive language difficulties alone (2%). This profile of equal numbers of mixed receptive-expressive and expressive only delays was maintained at one year follow up, though reduced numbers of children were in each group, now 24% and 25% respectively. This finding is somewhat surprising in the context of literature supporting a hierarchy of language outcomes, in which involvement of receptive language difficulties has less positive outcomes than those for expressive language delay (Paul and Roth, 2011; Roulstone et al., 2003). This literature would lead to an expectation that the group with expressive delay would reduce in size more than the mixed receptive–expressive group. Again, it may be that the follow up interval of just 12 months was insufficient to reveal the full pattern of language change these young children were moving through. Follow up, involving shorter time gaps over a longer period, would have produced a more nuanced picture of language progress. This would also have allowed a more considered inspection of the rates of resolution of these early occurring language delays.

Nelson et al. (2006) report resolved ELDs of 40-60% in toddlers and there is some evidence that early intervention is supportive of better outcomes (van Agt et al., 2011; Wake et al., 2012). In this study, rates of language delay reduced from 90% to 50% of the participating cohort after 12 months, fitting Nelson et al.'s (2006) reported rates.

Encouragingly, 25% of the cohort scored above the mean for both receptive and expressive language at follow up, suggesting that these children fitted Ellis Weismer's (2007) findings of resolved language delay. In contrast, 24% of the cohort, whose skills moved out of the clinical range but stayed below the test means, give support to Thal et al. (2004) and Rescorla et al. (2000) who argue for acceptable but weaker language skills in children recovered from ELD. (see section 4.5.1.7)

There was a significant relationship between scores at T1 and T2 for both for auditory comprehension and expressive communication (see *Figure 4.21*). These correlations are presented fully in section 4.5.1.7 (

Table 4.16), alongside the regression analyses results (see sections 4.5.1.8 and 4.5.1.9).

The correlations between auditory comprehension and expressive communication scores were moderate at entry to the study (r = .378**) and became more pronounced at follow up (r = .657**), underlining the interrelationship of these two aspects of

language development. It is interesting that the association between the two areas becomes stronger across this time period, supporting theories of language development which emphasise the symbiotic roles across domains of language development (Clark, 2003).

5.3.6 The predictive ability of auditory comprehension and expressive communication scores at entry to the study (T1) for auditory comprehension and expressive communication outcome scores after 12 months (T2)

At one year follow up, regression analyses revealed that a proportion of the variance in the children's outcomes was predictable from their language scores at entry to the study for both auditory comprehension and expressive communication.

5.3.6.1 Auditory comprehension outcomes

For auditory comprehension outcomes, only initial auditory comprehension scores contributed to the prediction of outcome but did so very strongly, explaining 76.6% of the variance. The predictive value of initial auditory comprehension abilities is consistent with reports by Everitt et al. (2013), Roulstone et al. (2003), Chiat and Roy (2008), Flax et al. (2009) and Watt et al. (2006), who identified in their studies that early receptive language performance was a strong predictor of later receptive, and expressive, language skills. Further, Zambrana et al. (2013) found that odds for persistent language delay were doubled by poor initial auditory comprehension scores, supporting similar findings from Henrich et al.'s (2012) population study whose

analysis recorded a nine times greater risk of expressive vocabulary delay for children with delayed receptive vocabulary and Bishop et al.'s (2012) smaller matched groups study.

Although my study echoes with the consensus in the literature about the predictive utility of auditory comprehension skills for outcomes, the amount of variance explained by this study is far higher than that found in other studies. Our understanding of language impairment as having a multifactorial aetiology (Moyle et al., 2011) supports the view that a range of factors impact on outcomes and so it is surprising that for these children PLS3-UK auditory comprehension scores are so predictive of one year outcome scores. There are a number of factors which may provide partial explanations. Firstly, the sample of children included in the study merits consideration. The children, similarly to Roulstone et al. (2003) and Everitt et al.'s (2013) study samples, had attracted a degree of concern in relation to their language, rather than participants being drawn from across a representative community. For my study this meant that the auditory comprehension scores yielded by the PLS3-UK, although following a pattern of normal distribution, showed a depressed mean of 87 which may have affected the outcome scores as the children were starting with lower scores at outset in comparison to community generated cohorts (Reilly et al., 2010; Dale et al., 2003).

A further issue to consider is the instruments used to collect information. Relatively few studies have collected data about their cohorts' receptive language skills via direct assessment, relying rather on parent reports through checklist assessments (Dale et al., 2003; Henrichs et al., 2012; Reilly et al., 2007). Bishop et al. (2012) argue that

parent completed checklists are not as reliable as direct information gathering. This study, which employed the same assessor and used a formal language assessment conducted in the child's own home, may have produced more accurate and reliable results than studies using checklists or where assessment took place in clinical (unfamiliar) settings or across a range of assessors (Roulstone et al., 2003).

Finally, it is of note that this study had a liberal participant inclusion policy, as it sought to generate a valid SLT community clinic sample. It may be that some of the children included had additional cognitive difficulties that were masked by their auditory comprehension difficulties and had not been identified explicitly at the time they took part in the study. Bishop et al. (2012) used non-verbal cognitive assessment as one of the measures in their study protocols and this allowed discrimination between primary language and more complex language with cognitive difficulties. However only small numbers of children were identified in this small scale study and this limited analytic possibilities and gave no clear conclusion. Such a measure would have been a useful addition to my study, as it could have allowed a clearer insight into the interrelationship of receptive language and cognitive skills. but was not available within the planned design. Moyle et al. (2011) argue that language difficulties are 'domain general' deficits, rather than categorical (see section 2.3) and that cognitive facets such as slow processing speed, poor temporal auditory processing, reduced verbal working memory and weaker procedural memory are implicated in children who have persisting language difficulties. Boyle et al. (2010) support this position, arguing that limited processing capacity underpins receptive language difficulties.

Information processing skills are integral to the test of auditory comprehension used in my study and any such deficits in cohort members may have somewhat enhanced the predictive value of the auditory comprehension scale. Roos and Weismer (2008) comment,

> 'It is possible that variability in language comprehension within late talkers may ultimately point to processing deficits shown in older children with specific language impairment.' p123

However, the PLS3-UK was standardised on a broadly representative UK population and though such an effect may plausibly be operating, it is unlikely to be contributing a strong effect.

5.3.6.2 Expressive communication outcomes

The variance in outcomes for expressive communication scores were predicted by a regression model that included both initial expressive communication scores and auditory comprehension scores. These two variables explained 48% of the variance in 12 month outcome scores with auditory comprehension (β=.44) contributing marginally more than expressive communication (β=.40) (see Table 4.18). The predictive value of initial auditory comprehension and expressive communication abilities is consistent with reports by Everitt et al. (2013); Chiat and Roy (2008); Roulstone et al. (2003); and Watt et al. (2006), who identified in their studies that early receptive language performance was a strong predictor of later receptive and expressive language skills. Further support in contemporary literature is provided by

Law et al. (2012) who found that 16% of variance in naming vocabulary on the British Ability Scales ll at 5yrs was explained by naming at 3yrs, in addition low maternal education was associated with lower language improvements in this large (*N* =13016) population cohort drawn from the Millenium cohort study. In contrast, Roulstone's (2003) 12 month follow up of clinically referred children found that expressive language at entry did not predict outcome at follow up, although the disability scale the Therapy Outcome Measures (Enderby and John, 1997) identified that ceasing to be eligible for SLT services was predicted by lower disability scores at entry to the study.

Henrichs et al. (2012) obtained language data at 18 months of age via parent completed questionnaires and follow up data when the cohort were 30 months old. In hierarchical linear regression, expressive vocabulary at 18 months was the largest predictor of 30 month expressive vocabulary delay, accounting for 11% of variance. The model was further enhanced by the addition of receptive vocabulary at 18 months (0.5%). The authors concluded that the strongest predictors of language outcomes were previous and concurrent language skills. For the rather older children involved in this investigation, auditory comprehension skills were as predictive as expressive communication skills contributing 17% of unique variance (as indicated by the semi-partial correlation, see Table 4.18) in comparison to 14% derived from expressive communication scores. One interpretation of this could be that over time the role of auditory comprehension skills becomes more important for predicting future language trajectory. Alternatively, these differences in strength and balance of prediction may be rooted in the broader measures used in this study compared to predictive value of vocabulary measures alone.

The literature does appear to be reaching a consensus that the status of a child's language skills by 18 months of age is the major influence on their future growth, however the amount of variance explained shows little consistency across studies and this is likely to be in part due to the methodological differences across studies and analytical strategies employed. This makes it difficult to use such information clinically, for example, parent report of receptive language skills may vary according to the instrument used and may lack the detail of direct assessment, if collected at all, and thus not have been represented as accurately as the contribution made by expressive language skills that are reported on. Bishop et al. (2012) argue for the utility of maintaining separate scores for expressive and receptive language skills rather than using general language composite scores on premise that they may have different predictive power that has not yet been adequately identified. Further, they argue that if these *were* established a smaller subset of child language testing may be needed to identify children at risk. The variance explained for this study was higher than typically reported in the literature, with auditory comprehension and expressive communication at baseline making a large contribution to one year outcomes. It would be useful to have comparator studies which had similar age and sized cohorts to act as closer comparators than the current literature allows.

5.4 Research aim 2

To describe the temperament characteristics of the study cohort children, at two time points, 12 months apart.

The children's temperament profile at baseline was characterised by low adaptability i.e. the children were less flexible in coping with changes in known routines and in managing imposed transitions from one activity to another, low persistence, i.e. the children found it more difficult to continue with an activity if they encountered problems during it or were interrupted from it. The final difference from the expected profiles of children of a similar age was in rhythmicity. The cohort presented with less regular predictable patterns in eating and sleeping. At the second point of data collection, low adaptability and low persistence remained above 0.5 *SD* of the standardised mean but rhythmicity had moved closer to the mean (0.44 *SD*). No additional dimensions fell above or below the 0.5 *SD* level at this second point of data collection.

5.4.1 Adaptability

The cohort demonstrated low adaptability in their temperament profiles at both time points. There was a significant change in the means across the two points of data collection such that the mean increased from 0.63 at T1 to 0.95 at T2, representing a small effect size (Cohen's *d*= 0.32) but illustrating that this trait was gaining strength as the children aged. Further, the correlation between scores at the baseline and outcome points was strong (*r* = .591, BCa 95% bootstrapped, CI [.41, .72] identifying a clear relationship between T1 and T2 scores for this variable.

Adaptability has been explored in the literature as a temperament characteristic associated with early communication difficulties (Anderson et al., 2003; Kubicek and Emde, 2012). Anderson et al. (2012) identified that children who stammered, in their

study of children and matched peers of a similar age to the children in this study, were less adaptable than their non-stammering peers, based on joint parent ratings using the BSQ (McDevitt and Carey, 1978). Anderson et al. (2012) hypothesised that being slow to adapt may contribute to both causation and maintenance of stammering behaviour by adding to the child's stress levels when faced with new communicative situations and partners, in turn leading to reduced communicative opportunities. (see section 2.10.1) Although the children in this study did not have fluency difficulties, Anderson et al.'s (2012) hypothesis could provide a rationale for the impact of low adaptability on the communication experiences of young children. Anderson et al. (2012) identified that the low adaptability trait preceded the onset of fluency difficulties and this gives their hypothesis a direction of low adaptability possibly implicated in the development of fluency difficulties. In relation to the children in the current study, temperament (Thomas and Chess, 1977) and language (Law et al., 2013; Reilly et al., 2010) share both biological and social influences and no temperament data was available from before their language difficulties were identified. However, the relative stability of temperament (Shiner et al., 2012) coupled with Anderson et al.'s (2012) findings provide some justification for future research investigating whether low adaptability confers slower language development in comparison to higher adaptability. Further research with larger samples of children who have low, mid and high adaptability could provide some added perspective on the role of adaptability in facilitating language development.

Low flexibility has been identified in children with autism (Hepburn and Stone 2006) and was noted by Ozonoff et al. (2011) as a trait which increased over the two and a half year study period in the *siblings* of children with confirmed ASC. This is an interesting finding, which reflects the trajectory of adaptability in this study for children with ELD. Low adaptability has also been found in children with VCFS (Antshel et al., 2007). These children were also described as less rhythmical, and also more distractible, less positive in mood and less persistent than either their siblings or controls. Explanations for why their profiles were different was not offered, but in using a sibling group as one of the comparators, shared environments mean differences in temperament are more likely to express genetic variation.

Temperament, however, is centered around the concept of individual differences and at a family level it could be argued that each child creates unique relationships and interactions with people around them such that siblings do not experience the same environment as each other once the interplay of these relationships are taken into account.

Whilst the literature confirms associations between low adaptability and communication difficulties, other studies have not identified it as influential (Harrison and McLeod, 2010) and further investigation of the role of adaptability in communication development remains warranted to corroborate the findings of this study. There is a common sense fit to the idea that being slow to adapt may limit communication opportunities both in number and type and this may differentially affect children according to their specific wider temperamental developmental and

environmental contexts e.g. being at home with a parent compared to being in day care.

5.4.2 Persistence

The cohort demonstrated low persistence in their temperament profiles at both time points. This temperament dimension showed the largest difference from the standardised mean score. There was no significant change in the means across the two points of data collection such that the trait showed a good level of stability (p = .44). In addition, correlation between scores at the baseline and outcome points was strong (r = .568) identifying a robust relationship between T1 and T2 scores for this variable.

Persistence has been explored as a temperament characteristic associated with language outcomes, supporting the findings in this study. Harrison and McLeod (2010) identified that increased persistence conferred reduced odds for expressive/receptive language concern, low vocabulary score and attendance at SLT. Prior et al. (2011) reported on a subset of the same large cohort of 4 year old children, finding that children with language impairment were lower in persistence than their peers without language impairment, using the Australian Temperament Questionnaire. Christiansen et al. (2014) again using data from the same cohort found that being low in persistence increased the likelihood of being in the lowest 15% for receptive vocabulary at eight years of age (OR: 2.75). All these studies are drawn from the LSAC project and used similar measures across time. Low persistence has also been implicated in Williams syndrome (Hahn et al., 2014; Perez-Garcia et al., 2011; Mervis and Klein-Tasman, 2000) VCFS (Antshel et al., 2007). This study's cohort of young children with ELD were

notably non- persistent and this provides additional support for the association between poor persistence and poorer language outcomes.

The trait of persistence is one element instrumental in overcoming challenges, rather than avoiding them or switching to a different course of action. It may be that for children who are developing language skills, the ability to persist in their communicative attempts is supportive of future progress and conversely where persistence is low and communicative attempts are not noticed by partners 'first time' the child quickly 'gives up' and switches activity to something with more easily guaranteed success. Furthermore, in the context of being identified with a language delay low persistence is likely to contribute to children finding it difficult to engage with language stimulation activities if they do not feel they are achieving well or in the context of other environmental distractions. This study makes a useful contribution to increasing the impetus to conduct further research in this area since understanding the associations more clearly has the potential to positively contribute to the development of effective interventions for children with ELD.

5.4.3 Rhythmicity

The cohort just met the cutoff point of 0.5 *SD* for irregular rhythms in their temperament profiles at T1, but this difference was not maintained at T2. The mean decreased from 0.51 at T1 to 0.44 at T2, representing a negligible effect size (Cohen's *d* =0.60), illustrating that this trait *may* be moving closer to the mean as the children matured, but that confidence in such a claim is limited. In respect of inferring direction of change, the confidence limits overlapped across the time points and it is therefore

equally likely that no real change has been made in approaching the mean. A *t*-test confirmed that this did not represent a significant change in the means across the two points of data collection. Further, there was a strong correlation between scores at the baseline and outcome (r = .51) suggesting that the trait was stable. There is therefore no evidence that the rhythmicity trait in the cohort was meaningfully different to that of the standardisation sample.

Rhythmicity has not been identified in the literature as a temperament characteristic associated with early communication difficulties or specific phenotypes. This study it gives this null finding further confirmation.

In exploratory studies, null findings have an important role, useful in developing hypotheses and discerning further fruitful avenues for more focussed investigation. Candidate temperament variables from the current literature (see section 2.10.6) most clearly identify adaptability, persistence, approach, distractibility, and mood. Having considered this study's results in relation to adaptability, persistence and rhythmicity, it is additionally useful to look at how the results differ from the literature in relation to approach, distractibility, and mood.

5.4.4 Approach

The approach dimension had a mean of 0.22 at entry, evidencing low approach in the cohort, which had changed to 0.40 by T2 data collection but a *t*-test established that this difference was not significant and further, Pearson's correlation was strong (r =.602) suggesting the children's scores had a good degree of stability. This was confirmed by visual inspection of the scatterplot (see *Figure 4.51*). Approach has been linked to language difficulties in some studies (see 2.10.2) and to both ADHD

(Karalunas et al., 2014) and Williams syndrome (Hahn et al., 2014; Perez-Garcia et al., 2011; Mervis and Klein-Tasman, 2000), whilst in autism low approach has also been identified as a trait (Bailey et al., 2000; Hepburn and Stone, 2006; Garon et al., 2009; Bolton, et al., 2012; Brock et al., 2012).

Although the results from this cohort do not reach significance, and do not therefore lend to support to other studies cited here, there was a trend emerging of movement away from the mean, towards lower approach, and it would have been interesting to follow up the children for an additional year to see if this continued and became significant, particularly as many of the studies took place with older cohorts.

5.4.5 Distractibility

The cohort's distractibility ratings at entry to the study showed a small negative difference from the mean (within 0.5 *SD*), indicating they were less distractible than expected for their age. At T2, the mean score was 0.04 and the CI fell across the mean. The means were confirmed as significantly different, though the effect size was small (Cohen's d = .33). Further, this dimension showed only moderate stability across the 12 month period (r = .332). Distractibility was one of only three of the temperament dimensions that showed a significant mean change across the 12 month period, moving from a profile of the cohort being over focussed in comparison to expected standardised scores, to a typical profile at second point of data collection. Contemporary studies which have reported on distractibility have not reached a consensus about its relationship to language development or language difficulties.

Dixon et al.'s (2006) study gave support to a hypothesis that high attentional focus may serve as a protective factor against environmental distractions, which in

themselves may interfere with new word learning. Spaulding (2010) echoed these results, identifying that the young children in her study found it more difficult to complete a task in the presence of irrelevant stimuli and that this effect was particularly marked where children had identified language difficulties. The results from this study superficially suggested otherwise, with children who showed relatively less focus having better language outcomes. There was a trend for increased distractibility in the cohort at the second point of data collection, alongside improving language skills. However, it is important to note that 'more distractible' in the context of this cohort represented *typical* levels of distractibility rather than having a distractible profile.

In studies which have looked at phenotypic profiles, findings about distractibility have also shown variation with Antshel et al. (2007) identifying children with VCFS to be higher in distractibility than siblings or an age and gender matched control group. These children were older than those in my study and so it was not possible to make any direct comparisons. It would have been useful to know how this trait varied or remained stable over time within the cohort with VCFS, but this was not reported. A similar profile of high distractibility has been identified in Williams syndrome (Hahn et al., 2014; Mervis and Klein-Tasman, 2000; Perez-Garcia, 2011) has been identified. However, Brock et al. (2012) considered groups of children diagnosed with ASC who had either sensory hypo-responsiveness or hyper-responsiveness, and groups of children with developmental delay and typical development. They reported that only the hypo-responsive group was associated with low distractibility (i.e. increased focus), and that this, together with low approach, differentiated them as a group from both

hyper-responsive, typically developing and developmentally delayed children. Some additional support for low distractibility being associated with ASC is provided by Ozonoff et al. (2011) who found that it distinguished toddlers who were later diagnosed with ASC from those high risk toddlers who did not meet diagnostic criteria, in conjunction with a profile which also included low approach and high activity when they were 24 months of age. Each of these developmental conditions have associated language and communication difficulties and cognitive strengths and weaknesses yet there is no consistent finding in relation to distractibility with both too much focus and too much distractibility found across the groups.

In this study of children with ELD, distractibility did not significantly differ from that of the standardised sample. Theoretical accounts of language development include the role of positive attentional control in supporting language acquisition (Bloom, 1993; Tomasello and Farrar, 1986). It may be that over focused attention is a risk factor for language learning since it may reduce the child's ability to maximise incidental learning opportunities where their conversational partner seeks to recruit their attention to a novel event e.g. the transient appearance of a cat, dog or aeroplane. Children who are very high in focus are likely to miss subtle social signals because their attention is narrowly focussed and they may be described informally as often 'being in their own world'. In contrast, where children are high in distractibility they may struggle to maintain their focus of attention on an event for long enough to benefit from the language learning available from it and this may have a negative impact on language learning. In order to test out these hypotheses further targeted research is needed

both to describe the developmental nature of distractibility and to design research to investigate the way it supports different types of language learning opportunities.

5.4.6 Mood

The cohort's mood ratings at entry to the study showed a small negative difference from the standardised mean and the 95% CI did not fall across the mean indicating they were less positive in mood than expected for their age (see *Figure 4.34*). At T2 the mean cohort score had moved closer to the standardised mean, with the CI falling across the mean (see *Figure 4.44*). Further, this dimension showed only moderate stability across the 12 month period (r = .332) suggesting that children's mood was subject to wider variation than many of the other temperament dimensions. Within this study, the cohort's mood scores could therefore be described as slightly negative moving to typical at the second point of data collection.

Negative mood has been associated in some studies with less well developed language skills (see section 2.10.4) and Rieser-Danner (2003) proposed two routes by which negative mood may impact on the development of language, either through poorer quality interpersonal contacts or through the disruption caused by high negative emotional load.

Positive mood has correlated with better language ability in a range of studies involving children with typical development (Dixon and Smith, 2000; Kubicek and Emde, 2012; Leve et al., 2013; Salley and Dixon, 2007; Zubrick et al., 2007). Zubrick et al.'s (2007) large prospective epidemiological study ascertained that, despite negative mood correlating with poorer language skills, it did not predict late talking, though it occurred more frequently within the late talker group.

In a similar way to the current study, Kubicek and Emde (2012) reported that although not reaching significance, parent report identified late talkers as more negative in their mood. These correlational studies do give a rationale for further research to investigate causal mechanisms that may be in operation such as those proposed by Rieser-Danner (2003). Mood has been identified as part of a behavioural phenotype in Down syndrome (Gunn and Berry 1985), VCFS (Antshel et al., 2007), FXS (Kau et al., 2000) and hyper-responsive ASC (Brock et al., 2012), although not all in the same direction. Whilst children with ASC and VCFS were identified as negative in mood, children with Down Syndrome and FXS were identified as more positive in mood than typically developing peers. This may suggest that mood does not uniquely link to communication and language skills since all these groups typically experience weaker communication skills and varying degrees of cognitive difficulty. It may be that temperament is independent of cognition as proposed by Hatton et al. (1999) and that current studies of children with ELD are picking up an underlying phenotype associated with primary communication and language difficulties.

5.4.7 The stability of temperament

In order for temperament to be a useful concept to consider in relation to its potential role in supporting or challenging positive language outcomes, it needs to have a degree of stability such that change can meaningfully be measured. For data from this study, stability was inspected by comparing group means for temperament dimensions at baseline and end of the 12 month study period and through inspecting paired sample correlation coefficients.

Six of the nine dimensions demonstrated good stability, operationalised as no significant change in the mean score for the dimension. Three dimensions did show a significant change (activity, adaptability and distractibility) as summarised in table 4.23. These results broadly support Shiner et al.'s (2012) assertion that temperament does show relative longitudinal stability and particularly after the infant period, from 2 years onwards (Kochanska, 2001; Matheny and Philips, 2001; Rothbart et al., 2000), to greater stability after 24 months of age. Interestingly, whilst distractibility moved closer to the standardised mean score, perhaps reflecting developmental maturity, both activity and adaptability moved further away from the mean indicating increasing difference in the expression of these traits such that the children with language delay became more active and more rigid in their behaviour. It would be interesting to replicate these findings in a larger group of children alongside a control group matched for age and gender and physical environment. A range of mechanisms may be operating here that underpin such a pattern of findings. It could be that in the context of slower developing language skills children become relatively more physically active whilst their peers start to spend more time in more sedentary communicative activities or that parents encourage physical pursuits in preference to more passive ones. Similarly, in relation to adaptability, children may become increasingly resistant to new activities and experiences as a consequence of their language difficulties or it may be that parents offer their children less new experiences because their children have 'taught' them that these will not be positively received. Both of these tentative hypotheses would need to be carefully investigated, ideally using multiple methods of data collection including video of parent child interaction and information about daily routines in conjunction with temperament and language data. These findings also

chime with Goldsmith et al. (1987) and Rothbart and Bates' (2006) research which emphasised that maturational changes are integral to temperament through a dynamic mix of social, environmental and biological interactions.

The paired sample correlations for temperament were all significant at the 0.05 level (see Table 4.25), although there was variation in their strength, which ranged from .72 to .23, such variation fits with findings from other longitudinal studies in America (Guerin and Gottfried, 1994) and New Zealand (Caspi et al., 1995). It is accepted that temperament changes and matures (Goldsmith et al., 1987; Rothbart and Bates, 2006) and these differences in correlation strengths along with mean changes may point to an order in which variables become stable though this would need to be explored and verified by further studies.

In the UK, Bould et al. (2013), reported on stability of temperament from the ALSPAC study when children were three, five and six years old finding paired correlations across dimensions which ranged between .78- .46. These are broadly similar but a little higher than for this study and that may reflect the older age of the children in the ALSPAC data, Bould et al. (2013) note that confirming the stability of temperament is a necessary precursor to being able to use temperament as a variable in the prediction of child outcomes. I was satisfied that these study data met this suitability criterion. Further, studies that have followed up children's behavioural outcomes, as discussed in section 2.9.5, have provided evidence that early occurring temperament profiles are associated with outcomes in adolescence and early adulthood (Caspi et al., 1995). Asendorpf et al. (2008), whilst noting these continuities, also caution that in the

complexity of human development and social functioning much variance will be left unexplained if taking a univariate perspective of temperament alone. These studies lend support to the exploration of temperament and language together.

5.5 Research aim 3

The third aim of the thesis was to describe the temperament characteristics of the parents of the study cohort children, at two time points, 12 months apart.

The cohort temperament profile at baseline was characterised by high distractibility (0.54 *SD* above the mean) i.e. the adults were less focussed in their attention control. At the second point of data collection, high distractibility remained above 0.5 *SD* of the standardised mean and low approach also lay above 0.5 *SD* of the mean, though the 95% CIs crossed this 0.5 *SD* cut off point. No other dimensions fell above or below the 0.5 *SD* level at this second point of data collection.

5.5.1 Distractibility

Whilst the children's temperament profile showed typical levels of distractibility, the parent group rated themselves as more highly distractible than the normative sample. It is difficult to draw firm conclusions from this finding, though I think it raises some interesting issues, especially in the light of the generally typical temperament profile of these adults. The adults all had primary caregiving responsibility for their young children and so distractibility may represent an adaptation to current circumstances in needing vigilance to watch over young children at this stage of developmental

exploration. Thus, being distractible to noise, sound and movement could be an asset to this role. An alternative explanation could be that the parents were stable within this dimension and represent a skewed distribution either through use of a small and gender biased sample or because there is an association between distractibility in parents and language outcomes, which this study has failed to pick up. There is a need for longitudinal research which identifies temperament characteristics of both parents pre-nataly and follows changes in temperament across the child's life course. This would deliver unique insights, adding to our understanding of stability and change in temperament in response to significant environmental change, in this instance the birth of a baby.

5.5.2 Approach

The approach dimension relates to the individual's initial response to new situations and events. People who are low in approach are typically reserved in their behaviours and prefer the known to new challenges. At entry to the study, this cohort demonstrated low approach which lay just within the 0.5 *SD* cutoff point at 0.48. At the second point of measurement, approach, had increased to 0.58 away from the mean indicating that there was a trend for the parents to be less approaching than the normative population. A *t*-test established that this change did not represent a significant difference in the means (see Table 4.22). It was necessary to consider this finding cautiously, since I did not find any other directly comparable published information about the temperament of parents of children with ELD. This study presented a novel insight into factors acting on the parent child relationship, which

sets the context in which language development occurs. Correlation between scores at the two time points was very strong (*r* =.84) and so it is reasonable to conclude that the description of the sample is a stable finding and that the main carer parents of these children with ELD were shyer than would be expected. Interpretation or hypothesis about why these parents are more withdrawing (shyer) is however difficult and can only be speculative at this point. In conversation with some of the participants, as I gave them feedback about their temperament profile (see appendix 15), I enquired into why they had decided to take part in the study if they were naturally quite shy. Unanimously the response lay in wanting to help their child and that one to one situations in their home were not challenging, some added that attending group sessions of SLT was quite difficult and these small pieces of anecdotal evidence make a case for exploring this in future research.

I found this particularly interesting in the context of some research support for a view that *children* low in approach have weaker language skills (Reynolds and Evans, 2009; Spere et al., 2004), as discussed in section 2.10.2 and section 5.4.4 earlier in this chapter, though this was not borne out for the cohort of children in this study.

5.5.3 Persistence

The persistence dimension was the only one that demonstrated a change in means at 12 month follow up (*p* = .05 level). This dimension remained within 0.5 *SD* of the normative mean but there was a trend for the parents to report that they were less persistent at the second point of data collection. This trend is difficult to unpick and again there is an absence of direction from the literature. This trend may reflect the business of family life with the children one year on where many parents were

combining child care, part time nursery school placements and sometimes older and younger siblings to care for or part time working. This constellation of demands may have led to a reduction in the ability to persevere and complete tasks but this conjecture is not able to be interrogated given the limited current data.

5.5.4 Stability

As expected from the literature (Rothbart et al., 2012) (see section 2.9.5), the temperament dimensions for the parents showed a high level of stability across the 12 month period with only the persistence dimension just meeting significance criteria for difference (p = .050). In addition to stability of mean scores, paired correlations were higher and strong to very strong for the adult dimensions ranging between .60 - .86. This provides strong support for the plateauing of change in temperament past late childhood (Rothbart, 2012).

5.5.5 Summary

The temperament of this cohort of parents who have children with ELD maintained a high level of stability across the year, as would be expected from the literature (Rothbart, 2012). Two aspects of cohort temperament differed significantly from the standardised sample; the cohort were less outgoing and more distractible. Further research is necessary to contextualise these findings, both in relation to a UK population, and a population of parents whose children have a language delay to allow for clarity in interpreting the nature and value of these findings.

5.6 Research aim 4

The fourth aim of the study was to investigate possible relationships between the temperament dimensions and language scores at entry to the study that were predictive of language outcomes. In particular, investigation of temperament dimensions identified as different from normative expectations and those associated with language differences in the literature were important to explore in relation to the outcome measures of auditory comprehension and expressive communication standard scores.

5.6.1 Temperament and auditory comprehension outcomes

Having established that auditory comprehension scores at T1 were significantly predictive of T2 auditory comprehension outcomes (see section 5.3.6), analysis also sought to establish if temperament variables could further improve the prediction of the auditory comprehension outcomes.

At T2, the proportion of the variance explained in the children's outcomes was not enhanced by the addition of either T1 adaptability or T1 persistence variables, despite a weak but significant correlation between T2 auditory comprehension scores and T1 persistence (see Table 4.28), such that lower T2 auditory comprehension scores were associated with a less flexible temperament. Distractibility did contribute to a marginally improved model for prediction of outcome, increasing explained variance to 78% from 76.5% (see Table 4.29).

5.6.1.1 Adaptability

The cohort profile was low in adaptability at both time points echoing results from the later talkers in Kubicek and Emde's (2012) cohort of typically developing young children (see section 2.10.2) and for this study cohort the finding was more prominent at T2 and this was confirmed by a significant difference in the mean scores (see section 4.5.2.5.2). However, adaptability did not correlate significantly with T2 auditory comprehension scores (see Table 4.26)**.** It is worth considering that, since there was a trend for inflexibility to increase for the cohort over time, measuring language outcomes and adaptability over a longer time period may have revealed different results, though such data was not available. Few studies have identified adaptability as either a risk or protective factor in relation to language development (Henrichs et al., 2012; Reilly et al., 2007). Despite higher than expected levels of inflexibility in these children with ELD, there is currently no evidence that low adaptability can predict variance in outcomes for auditory comprehension.

5.6.1.2 Persistence

The cohort profile was low in persistence at both time points. Although at T2 the score was moving closer towards the mean, a *t*-test identified that the means were not significantly different and this was supported by a strong correlation between T1 and T2 scores. Low persistence has been associated with language difficulties (Prior et al., 2011). Harrison and McLeod (2010) gathered data on children's auditory comprehension and expressive language at four years of age and noted that protection from the likelihood of concern about communication difficulties was modestly conferred by increased persistence. Using follow up data, at 8 years of age,

Christiansen et al. (2014) reported that low persistence continued to increase the risk of having low receptive vocabulary, although other factors, including vocabulary score at 4years, low family income and not being read to at home, carried more weight (see section 2.10.5). In this study there was a weak correlation between T2 auditory comprehension scores and T1 persistence (see Table 4.26), though in regression analysis persistence was not useful in predicting outcome scores. There is some evidence that low persistence has a modest association with receptive language difficulties. Research studies have not yet addressed why this may be, possibly because reported effects are small to modest and not consistent across studies. This current study offers support to the finding that low persistence is associated with receptive language difficulties, although not as a predictor for 12 month outcomes.

At a clinical level however, developing intervention practices which consider and account for children who may be low in persistence may have the potential to positively influence outcomes or satisfaction with the therapy process. Such adaptations are likely to already be part of the personalisation of many individual therapy sessions but may be less easy to incorporate into group or indirect case management approaches. Further research into the role of persistence in supporting or constraining receptive language development is necessary to gather sufficient evidence to influence practice.

5.6.1.3 Distractibility

The addition of T1 distractibility improved the predictive model from 76.6% to 78.4%. (see Table 4.17 and Table 4.29). This finding was surprising, since there was a negligible

correlation between distractibility and T2 auditory comprehension (see Table 4.28). It appeared that distractibility was operating within the regression model as a suppressor variable. As such, it did not share direct variance with T2 auditory comprehension but served to remove irrelevant variance from other independent variables (Nathans et al., 2012).

Children who scored more highly on being distractible at T1 had higher T2 auditory comprehension scores, contradicting Dixon et al.'s (2006) findings and hypothesis that being focussed provided a protective influence for language development. However, as discussed in section 5.4.5., the children as a group had low scores on this dimension at entry to the study and were more focussed than typical of their age, based on the standardised norms. It may be that where children are very focussed on their own activity they miss opportunities for developing their auditory comprehension because they do not respond to or notice language or activity around them. In this context, being less focussed represents a more typical level of distractibility found in children that may promote language development opportunities through children noticing and engaging in new events around them. At the second point of data collection, cohort distractibility scores were typical, rather than distractible (see 5.4.5) and auditory comprehension scores had improved (see 4.5.1.4.1). Following the cohort over a longer period would have been valuable in mapping the direction of this trend to see whether T2 scores remained stable over a further 12 months or continued to increase. I would predict that both would tend towards stability as the children matured. This distractibility dimension underlines one of the complexities of temperament research, since although temperament dimensions can be measured, higher or lower scores on

any dimension do not translate to developmental progress, neither do any cut off points in themselves translate to agreed difficulties. In the pre-school years, temperament is characterised by both stability and change, as the child learns about the world and matures, it is therefore difficult to clearly navigate, given current knowledge, what may constitute a robust and clinically valuable result. Temperament could however support clinicians and parents to develop strategies that could be maximally supportive to the child's temperamental style whilst developing in areas they are finding challenging (language development).

5.6.1.4 Additional temperament variables

Only the distractibility dimension added to explanation of variance in T2 outcomes, yet there is some evidence from previous research that approach (Spere et al., 2004) has been associated with less favourable receptive language development. It is difficult to make clear comparisons across this study and Spere et al.'s (2004) work, since there are differences in the cohorts, with Spere et al.'s (2004) children being older by one year. The receptive language measurement used was also more narrow than that used in the present study and most importantly Spere et al.'s (2004) design used a small size, typically developing cohort with an extreme groups design based on shyness ratings in contrast to the single clinical sample in this study.

This study cohort yielded a more withdrawing profile at both time points and supports Smith Watts et al.'s (2014) longitudinal same sex twin study in concluding that low approach does not impact on receptive language development. This has implications for clinical practice, in that sharing information to raise awareness that shyness does

not affect the development of language with parents and key referrers to SLT, may support more timely referrals for shy children who do have language difficulties.

5.6.2 Temperament and expressive communication outcomes

Having established that both auditory comprehension and expressive communication scores at T1 were significantly predictive of T2 expressive communication outcomes (see 5.3.6.2), analysis sought to establish if temperament variables would improve the prediction of expressive communication outcomes.

Linear regression analyses revealed that the proportion of the variance in the children's outcomes explained at T2 was enhanced by addition of the T1 adaptability and T1 persistence temperament variables, though none of the other seven temperament variables added to the prediction.

5.6.2.1 Adaptability

As discussed in 5.6.1.1, the children were low in adaptability at both time points. Adaptability uniquely explained 7.4% of variance in T2 expressive communication outcomes, with more adaptable children obtaining better outcomes. A profile of low adaptability has been reported in children with slow expressive communication development (Kubicek and Emde, 2012) and in young children who stammer (Anderson et al., 2003).

It is important to note that not all researchers have identified the same contribution of inflexibility to poorer language outcomes (Henrichs et al.,2012; Reilly et al.,2007; Zubrick and Taylor, 2007) and in this current study the effect is small. These results

need to be interpreted with caution, since the sample size used is relatively small and drawn from a specific geographical area. However, this study used direct expressive language assessment across both time points and this adds to the quality of that data in comparison to the variation that is integral to postal returned language checklists used in large cohort studies (Henrichs et al.,2012; Reilly et al.,2007; Zubrick and Taylor, 2007). A further complication in deriving a secure interpretation lies in the different language and temperament measures used in these research studies as discussed in 2.5 and 2.12.6, removing the ability to make direct comparisons.

Anderson et al. (2003) proposed that low adaptability in children could impact on stuttering behaviour by requiring the recruitment of significant emotional resources to manage changes in their environment, resulting in fewer available resources for communication. Whilst the authors apply this potential causal sequence to issues of stammering, a similar effect could plausibly impact on expressive language development if the child's interest and motivation was directed to maintaining sameness such that it reduced the child's ability to access the same number and frequency of language learning opportunities as their more adaptable peers. This argument is predicated on a dimensional model of language development (Dollaghan, 2004) (see section 2.3). Whilst it outlines a potential route of impact for low adaptability to influence expressive language outcomes, this hypothesis does not explain why expressive, but not receptive, language skills would be differentially affected. It may be that expressive skill development requires more active engagement and participation from the child, whilst receptive language skill development opportunities are more available even when the child takes time to change and accept

a new activity. Indeed, it may be that a child's reluctance to change from one activity to the next results in an increase in commentary and explanation to give the child time to adapt and that this is facilitative to language learning. Data to test out such hypotheses are not available from this study but the results yielded here identify that children with ELD who were low in adaptability had poorer 12 month expressive communication outcomes than those whose temperament was typically adaptable.

5.6.2.2 Persistence

The cohort profile was low in persistence at both time points as discussed in 5.6.2.2, replicating conclusions drawn by Prior et al. (2011) who reported that low persistence was associated with language difficulties. Harrison and McLeod (2010) gathered data on children's auditory comprehension and expressive language at four years of age and noted that the likelihood of concern about communication difficulties was modestly reduced by increased persistence (see section 2.10.5).

However, in this study there was a negligible correlation between T2 expressive communication scores and T1 persistence (r =-.02) (see Table 4.30 *Correlation matrix for T1 auditory comprehension, T1 expressive communication, T1 adaptability, T1 persistence and T2 expressive communication*), though in regression analysis persistence did reach significance (p>.04) and thus added to prediction of outcome scores by 2.8% (see Table 4.31). Persistence appeared to be functioning as a suppressor variable and whilst it did not correlate with T2 expressive communication, it shared significant correlations with other predictor variables that contributed to the model.

5.6.2.3 Additional temperament variables

Having considered the impact of persistence and adaptability, the impact of the approach temperament variable on T2 expressive language is now explored in reference to current literature, since it had been identified in the literature as being associated with language outcomes.

In this study, approach did not add to prediction of T2 expressive communication outcomes and it had a negligible correlation with T2 expressive communication. Previous research had however associated low approach in children with poorer expressive language skills (Paul and Kellogg 1997; Reynolds and Evans, 2009; Spere et al., 2004) leading to a hypothesis that a reinforcing relationship exists between slower language development and low approach resulting in lower motivation to communicate and consequent reduced experiences. These studies all had small sample sizes (<30) and are therefore difficult to generalise. Coplan and Armer's (2005) study with a larger sample of typically developing children also revealed that positive ratings of social skill were correlated with better expressive language performance. These findings gained support from Prior et al. (2008) with a large community cohort of very young children however, at follow up when the children were four years of age, approach no longer differentiated children with typical from delayed expressive language development (Prior et al., 2011). As I have contended previously (see section 2.13.6), some differences in results across studies are likely to relate to the different language and temperament measures used, in addition to different cut off points for group inclusion, sample sizes and cohort ages. In the current study, the children exhibited a profile of approach that was at the lower end of typical but did not reach

significance and this was maintained across the study period. This is an area for further research since if low approach was identified as contributing to expressive language delays this would be useful to take into account when planning and implementing language support.

5.7 Research aim 5

The fifth aim of the study was to investigate any relationships between cohort auditory comprehension and expressive communication T2 outcomes and parent ratings of child manageability.

5.7.1 Parents' ratings of their child's manageability

Parent ratings of their child's manageability at entry to the study were predominantly positive. Parents reported 44% of the children as easy or very easy to manage. This suggested that parenting a child with ELD fitted with the child meeting the age and cultural expectations of the parent. Only 3% of children (*n* =2) attracted a rating of very difficult. One year later, manageability ratings remained stable, with no significant difference in the means and a strong positive correlation (see 4.5.5.3). Further, the manageability change scores emphasised the stability of the data (see 4.5.5.4). However, there was a distinct skew towards more positive scores at both data collection points such that the data fell outside a typical normal distribution and

although the data is stable, there is no clear way of measuring the presence or direction of any individual's response bias. Some confidence for the validity of this data comes from noting that the range of scores was fully used. However, it may be that there is a degree of social response bias (Fischer, 2003) in these reports, since parents may have felt reluctant to provide ratings that suggest their child was difficult or that they were in some way unskilful because they found the child difficult to manage, therefore caution is needed in drawing conclusions from the data.

5.7.2 The relationship between auditory comprehension and expressive communication outcome scores and parents' ratings of manageability

Lower auditory comprehension scores at the end of the study were moderately associated with lower manageability ratings at entry to the study (r = -.33, p = .006), whilst there was a negligible relationship evident between manageability ratings and expressive communication outcomes (r = -.19. p =.113). This finding is interesting and may point to parents finding it more difficult to accommodate, in their parenting, for poor auditory comprehension, which may consequently be perceived negatively in relation to the child's behaviour, for example as being naughty or not paying attention, in contrast to expressive difficulties which are typically more overt and oftentimes less context dependent than following instructions. Further research to confirm or dispute this trend and to interrogate my preliminary explanatory hypothesis is needed to increase understanding of the nature of the relationship between children and significant adults as a basis for tailoring evidence based support for children who are learning language more slowly.

Goodness of fit is associated in the literature with positive psychosocial outcomes (Antshel et al., 2007; Churchill, 2003). For preschool children, the main carer primarily embodies the parameters that set such expectations (see section 2.12.3.1). Antshel et al., (2007) argued that insight into goodness of fit may allow for effective parent focussed educational based interventions to support parents in managing potentially difficult temperament features more effectively.

The temperament profiles of parents of children with language delay have not attracted research interest and so no direct information to support the development of hypotheses was available. Goodness of fit as a concept for this study was operationalised as a child parent dyad where the parent reported the child as easy to manage.

In line with other researchers, I have found goodness of fit (Chess and Thomas, 1984) a challenging and ethereal concept to pin down into robust data (McClowry et al., 2008), despite its appeal as a potentially useful concept to capitalise upon in intervention. This is particularly important since the child's communication environment is primary in early language acquisition in comparison to more general socio-economic contexts (Reilly et al., 2009; Roulstone et al., 2011; Zubrick and Taylor 2007). There are a range of methods used to capture this concept and all are reductionist in that they are translating a complex relationship between parent and child into a single variable (Antshel, 2007;Churchill, 2003; De Schipper at al., 2004; Fisher, 2005; Lerner, 1983). As such, measures take on the characteristics of what is important about goodness of fit

from the framework of the research questions, for example a good fit for learning language may have a different nuance to goodness of fit for behavioural expectations.

5.7.3 Relationship between change in T1 to T2 auditory comprehension and expressive communication scores and change in T1 to T2 manageability ratings

The cohort improved in both their auditory comprehension and expressive communication standardised scores over the 12 month period.

Concerns about the data validity of manageability ratings have been discussed in 5.7.2., and needed to be borne in mind in judging the reliability of this data, nonetheless similar social desirability response biases would be likely to operate across both time points and thus the data should have internal validity. The mean scores for manageability showed no significant differences and there were significant moderate positive correlations between T1 and T2 ratings.

The progress in language scores made by the cohort was not accompanied by any significant change in the manageability ratings. This indicated that as children's language improved, parents did not find them easier to manage. There are several possible explanations for the null relationship between language progress and ease of manageability. It may be that the time frame of one year was insufficiently sensitive to pick up any change using a Likert scale, or that the social biases potentially involved in this question contributed more to scoring than any changes noticed by the parents. Alternatively, since this is a time of rapid developmental and social challenge and growth for children, improved language skills, which may contribute to ease of

manageability, may be offset, for example, by children becoming more assertive and demanding. Further data in this area could usefully be pursued in future studies.

5.7.4 Contributions from parental ratings of manageability at T1 to the prediction of auditory comprehension scores at T2

Parent ratings of ease of manageability at entry to the study were significantly associated with better auditory comprehension both at entry to the study and after 12 months (see 4.5.5.9). However, in multiple regression analysis, manageability did not add to the predictive model for T2 auditory comprehension outcomes. This finding is difficult to interpret for reasons already discussed (see 5.7.1), relating to the data captured and used in the analysis being narrow and open to bias.

It may be that the effect size of the relationship between ease of manageability and auditory comprehension is not sufficiently large to add a contribution to the prediction of outcomes given the large contribution of T1 auditory comprehension skills. Further, ratings of manageability were largely positive for the entire cohort.

At a clinical level, information about families who report that they find their child difficult to manage may be useful as a potential signal that the parent child relationship is under stresses which may impact on language facilitation and learning. A more detailed measure of goodness of fit or alternative framework may be better suited to do this in the context of language learning. At the start of this study I viewed goodness of fit as having potential to illuminate the ways in which parents and children 'fitted well' and I recognise that my ideas and conceptualisations were naïve and narrow in focus at the planning stage of this enquiry. It now seems to me that there

are multiple 'goodness of fits' and that typical temperament is both flexible and individual such that 'fit' is an experience dependent on context as much as a 'measurement' and varies according to the situational context of the participating dyad. An example of this could be that a parent and child who both have high activity may deliver a good fit at the park but a poor fit waiting at the doctors. Goodness of fit applied to *language learning* might suggest that a good fit for a child would involve a responsive parent who has a positive mood and a good degree of adaptability to facilitate language learning and practice opportunities for the child. The good fit for the parent may be a child who has moderate approach, adaptability and persistence to take advantage of the language learning opportunities facilitated by the parent.

Current literature in relation to goodness of fit *for language learning*, could be argued to be already situated in theories of maternal responsiveness. Brady and Warren (2007) assert that child temperament forms part of the tapestry of variables integral to this concept:

> 'Parenting style itself is related to a number of variables including parental emotional state (e.g., depression, stress), beliefs and values, maternal education level as well as variables such as the child's temperament and developmental level. ' p330

Interestingly, the temperament of the parent does not feature as part of this description and it is likely to be subsumed within parental style. Looking at temperament more centrally prioritises the individuality of a person's behavioural style rather than emphasising the role, in this case being a parent, inhabited by the person in particular aspects of their lives, as is the focus in using the concept of

parental responsiveness. As such, a temperament lens would expect a unifying and stable behavioural style across contexts and life roles whilst the concept of maternal sensitivity is less tightly bound to behavioural style whilst carrying out life roles outside the parental context. Exploring the similarities and differences in the concepts of goodness of fit and maternal responsivity would be fruitful to inspect more carefully. It may lead to productive synergies to enable enhanced measurement of goodness of fit which would address the needs of the clinical temperament research community who are concerned to establish the effectiveness of goodness of fit interventions (Antshel et al., 2007; Feagans et al., 1991; Lerner and Lerner, 1987; McClowry et al., 2008).

5.7.5 Contributions from parental ratings of manageability at T1, to the prediction of expressive communication scores after 12 months (T2)

Parent ratings of ease of manageability at entry to the study were not significantly correlated with better expressive communication either at entry to the study or after 12 months (see 4.5.5.10). Despite no significant correlation being present, it was entered into a multiple regression in case it was acting as a suppressor variable.

A significant association did exist between manageability and T1 adaptability, which did contribute to outcome variance. However, manageability did not add to prediction of T2 expressive communication outcomes. The utility of manageability as a proxy for goodness of fit has been discussed in section 5.7.4. In summary, manageability is a complex construct and with hindsight, reducing it to a measurement by one single question has not allowed an adequate inspection of goodness of fit, although it has

shown a thought provoking differential association with auditory comprehension rather than expressive communication.

5.8 Research aim 6

The sixth aim of the study was to investigate relationships between biographical and demographic variables, alongside the previously identified predictors of auditory comprehension and expressive communication T2 outcomes. Here, the analysis considered the contributions to language progress of bio-demographic risk factors which conferred initial increased risk for 'caseness' i.e. having a language delay, as identified in previous literature(Law et al, 2000; Nelson et al., 2006).

5.8.1 Associations between biographical and demographic variables, T2 auditory comprehension and T2 expressive communication scores

The general lack of correlations, in this study, between outcome scores and variables identified in the literature as being associated with ELD is interesting and may point to an important difference between risk and outcome trajectory once a child has ELD (see Table 4.37). This difference is underlined in the literature that attests to high rates of resolution for ELD, particularly expressive communication difficulties (Dale et al., 2003; Law et al., 2008; Reilly 2007; Rescorla et al., 2000). Demographic and biographic risk factors seem to operate at a level of heightening risk for inclusion in the ELD category, but it may be that maintenance of language delay relates to different influences.

The most robust associations of risk for ELD, are being a boy and having a family history of language difficulties (Bishop et al., 2003; Law et al., 2000; Nelson et al., 2006). Other reported factors have more inconsistent findings in respect of their association with ELD in published research, as discussed in section 2.7.

Although a high proportion of this cohort had a family history of language difficulties, a negligible correlation was found for both auditory comprehension and expressive communication in relation to family history. This finding is in conflict with Reilly et al. (2010) who reported that family history was associated with poorer language outcomes at 4 years. With such a high proportion of children having such a history it could be that there was insufficient variation within the cohort to reveal a correlation but equally this finding may reflect risk for inclusion in the group but not progress within it.

5.8.1.1 Auditory comprehension

Higher T1 auditory comprehension and expressive communication scores were positively related to better T2 outcome scores. These results added support to previous large cohort studies and have been discussed in sections 2.8 and 5.3.6 (Chiat and Roy, 2008; Flax et al., 2009; Reilly et al., 2007). In addition, significant correlations existed with T1 persistence (higher ratings were associated with higher scores), being younger at referral to SLT and having more educated parents.

5.8.1.1.1 Age

There is a wide variation in the age and rate at which children develop language (Dale, 1996; Fenson et al., 2007) and this cohort had all been identified as slow to develop communication skills. Their ages ranged between 24-45 months (mean=32 months). Lower age at entry to the study was associated with higher auditory comprehension outcome scores (r = -.27, p < 0.5). This finding is difficult to relate to previous literature since studies typically do not report in detail about auditory comprehension (Reilly et al., 2007) or have a narrow age band of participants (Everitt et al., 2013). However, it is noteworthy that most of the children referred into the study had expressive language delays rather than auditory comprehension concerns (see Figure 4.22). It may be that expressive difficulties are picked up as a concern rather earlier than auditory comprehension difficulties so that the younger children had expressive difficulties whilst older children had a more mixed profile.

5.8.1.1.2 Parent education

A weak but significant positive correlation was found between higher parent education level and higher T2 auditory comprehension (r = .29, p <. 010). At T1, an association between parent education and T1 auditory comprehension was also evident, and indeed stronger (r = .41, p < .001), evidencing that the relationship between parental education and auditory comprehension was weakening over time. It would be interesting to explore if this was influenced by children's environments widening, as they began to attend nursery. The data collected in my study does not allow a clear inspection of this multivariate hypothesis. It would be inappropriate to assume that

these additional environments offset the lower educational qualifications of parents or to make assumptions about why some parents had not achieved formal qualifications since this is a complex area with qualifications reflecting specific curricula and educational practices over time. It was these issues that influenced my choice of the MDI as a measure of socioeconomic position as a more global measure of advantage or disadvantage. However, Law et al. (2013) comment that,

> 'Recent research has shown that both genetic and environmental factors have a role to play, environmental influences playing a stronger part in the early years – this is especially true of verbal comprehension, or the child's ability to understand what is said to them. Genetic factors play an increasing role as the children reach middle childhood. In terms of environmental factors, there is strong evidence that the degree to which the child is spoken to and the way in which they are spoken to makes a difference, but there are various other related factors that contribute, including the type of positive language learning experiences to which the child is exposed.' p viii

There is some mixed evidence in the literature that maternal education (and most parents in this cohort were mothers) is associated with child language. Dollaghan et al. (1999) identified that higher levels of maternal education were significantly associated with higher expressive language measures at three years, but not speech measures. Receptive language skills were not included in their study. In contrast, Dale et al.

(2003) reported no substantial improvement in outcome prediction from the addition of parental education.

Law et al. (2012) in a large cohort of young children from the Millenium cohort study found that maternal education was related to child language measures. Law et al. (2012) used maternal education as a proxy for socio-demographic status (see section 2.7.3.1 for a discussion of socio-demographic measures), using the same operational definition of above and below five grade C GCSEs as this study uses (see section 3.6.2.1 iv). Law et al. (2012), like Dollaghan et al. (1999), did not address auditory comprehension and so no direct support can be gained for the findings in my study.

Further, for my study cohort no such significant association existed between expressive language and parent education (r = .19). Since Law et al. (2012) used education as a proxy for socio-demographic status , it is also interesting to look at the correlation for my cohort between the Multiple Deprivation Index and parent education; there was a negligible correlation here (r = -.04). There is no consensus around how to measure socioeconomic deprivation but it seems, from this study, that the two measures do not fit closely for this cohort.

5.8.1.2 Expressive communication

For T2 expressive communication, none of the additional biographic or demographic variables showed a significant association. As previously considered in sections 5.3.5 and 5.6.2.1 respectively. T1 auditory comprehension and expressive communication

scores along with T1 adaptability ratings were significantly predictive of T2 expressive communication outcomes.

5.8.2 Other bio-demographic variables

None of the demographic variables other than age and parents' education were directly associated with outcome measures for either auditory comprehension or expressive communication. Of the remaining variables, a family history of language impairment and perinatal difficulties have been most regularly reported (Nelson et al., 2006) with family history showing some consistency across studies that it is associated with children's outcomes. Meanwhile, the evidence for perinatal difficulties being related to outcomes is scarce and confounded by wide variation in the criteria used to operationalise the variable (see section 5.2.2).

5.8.2.1 Family history of language difficulties

A positive family history of language difficulties is one of the most reported risk factors for ELD, and this was confirmed by the current cohort (see section 5.2.3). Positive family history at entry to the study did show a weak correlation with T1 expressive communication ($r = .22$, $p < .050$) but by the end of the study the association was negligible. The initial association is likely to reflect the role of positive family history of language impairment as a risk factor for ELD (Reilly, 2007) (see section 5.2.3). However, there are several studies which have reported that positive family history is associated with poorer *outcomes* for young children and this study does not support this. Reilly et al. (2007) identified that lower scores on the CSBS were associated with a family history of language impairment in two year olds and that this was predictive of poorer language outcomes at 4 years (OR=1.8) (Reilly et al., 2010). This was confirmed

by Zambrana et al. (2013), who calculated that for children with a positive family history of language difficulties the risk for persistent language difficulties was 'almost tripled'. Both of these studies involved large community cohorts. In a small scale study of just twenty-four children, Bishop et al. (2012) found a significant positive association between family history and persisting difficulties in language at 4 years. It is therefore somewhat surprising that no association was found for this study cohort, though these studies focussed their findings on expressive language skills only. In contrast, Sylvestre et al. (2012) reported a similar finding to my study, in that family history did not contribute to outcomes in regression analyses. Within my cohort, it may be that the high percentage of children with a family history masked any existing relationship whilst larger community cohort data provides sufficient data variation for the relationship to be seen more clearly. Alternatively, as Law et al. (2013) assert, auditory comprehension skills may be differentially more susceptible to social, rather than genetic, factors:

> 'Environmental influences, particularly human relationships and interactions, play a strong role in the early years, and that this is especially true of verbal comprehension .' p25

5.8.3 The contribution of biographical and demographic variables to the prediction of T2 auditory comprehension scores

The multiple regression analysis confirmed that no contribution to a predictive model for T2 auditory comprehension outcomes was made by the biographic or demographic variables. A model which included auditory comprehension scores and distractibility ratings at entry to the study was confirmed as the most robust model for anticipating outcomes after one year.

Auditory comprehension for this cohort was a very robust indicator of 12 month outcome, contributing 76.6% of variance. In addition, T1 distractibility improved the predictive model to 78.4%, despite having a negligible direct relationship with T2 auditory comprehension scores as was debated in section 5.6.1.3.

Distractibility also showed a change across time (section 4.5.2.5.2 and *Figure 4.52*) with the mean at T2 being congruent with the normative means provided for the temperament questionnaire. Within this pattern of change, paired correlation showed a moderate positive relationship indicative of the cohort becoming less over- focussed in their behavioural style, rather than distractible.

This is a finding worthy of note and further investigation since despite the range of influences operating within the child and across their living contexts, auditory comprehension seems largely immune to their impact. This makes the role of the distractibility dimension all the more surprising as the only other variable explaining outcome. Further interrogation and analysis is needed to relate distractibility to concepts of executive function which link to attentional control that in turn can act to promote language processing. This study is not furnished with sufficiently detailed data to do this and in setting the research within the framework of temperament I have not encompassed an analysis of other supporting frameworks from psychology which overlap with the constructs described as part of temperament. It is interesting to see that temperament can illuminate new angles into thinking about the development of children's auditory comprehension particularly since it is accepted to be slower to resolve, or more likely to persist, than expressive language difficulties.

The robust predictive value of current auditory comprehension skills to later performance has been established in previous recent research. Reilly et al. (2007) reported that auditory comprehension at 12 months explained one fifth of the variation at 24 months and similar findings have been reported by Everitt et al. (2013), Roulstone et al. (2003), Chiat and Roy (2008), Flax et al. (2009), Watt et al. (2006) and Zambrana et al. (2013).

This current study identifies far higher rates of explanation in a moderately sized clinical group of children. Using direct standardised assessment and the age band at which the sensitivity of the assessment is at its peak, is likely to account for a proportion of this enhanced rate.

5.8.4 The contribution of biographical and demographic variables to the prediction of T2 expressive communication scores

The multiple regression analysis confirmed that a contribution to a predictive model for T2 expressive communication outcomes was made by family history of language impairment, whilst none of the other biographic or demographic variables added to the model.

The final model, which included initial auditory comprehension and expressive communication scores, adaptability and persistence ratings at entry to the study and a family history of language difficulties was confirmed as the most robust model for anticipating outcomes after one year. It explained 59.7% of the variance in expressive communication 12 month outcome scores.

The contributions of initial language skills and of adaptability and persistence have been debated in sections 5.3.6.2 (language skills) and 5.6.2 (temperament).This final model also included family history of language difficulties. Having no family history of language difficulties significantly added to variance and predicted better 12 month outcomes for children, adding 3% of variance to the model, the same amount as persistence.

Current studies, which have investigated family history, have established a robust connection between a child having a first degree relative with language impairment and being at higher risk of having an expressive language difficulty themselves. Importantly this includes increased risk for persistent language delay (Bishop et al., 2012; Prior et al., 2011 ; Reilly et al., 2010; Zambrana et al., 2014; Zubrick et al., 2007) and is reported across different methodologies including direct assessment and parent report. This study supports such previous research, identifying that children with a first degree family history of language or literacy difficulties were more likely to have lower expressive communication outcome scores after one year than children with no such history.

Whilst the majority of explained variance was attributable to initial auditory comprehension and expressive communication scores (47.9%), family history added 3% to the model so that initial language scores and family history explained over half of the variance in outcome.

Given that this study specifically sought to identify contributions of temperament to early language, it is important to note that the adaptability and persistence dimensions also made similar moderate additions to the predictive model of 5.6% and 3.1%

respectively. Whilst information about family history is routinely collected to contextualise studies about prevalence, incidence and outcomes of language delay, the contribution of children's temperament is often ignored or reduced to one or two traits that are proposed to be of potential interest. Studies may use different temperament measures across time and rarely use the full instrument, since in large cohort studies trade-offs in collecting multiple data sets put pressure on methodologists to shorten the time taken and thus prioritise the data to be collected.

This study makes an initial contribution in using broad measures of language, temperament and bio-demographic information to provide a multivariate model of some of the factors influencing language outcomes in young children with language delays. Within this, temperament makes an important contribution since like language itself, it is amenable to change and growth with tailored support (Chess et al., 1965; Chess, and Thomas, 1996; McClowry et al., 2008).

5.9 Strengths and limitations of the study

In this section I report on limitations that have impacted my study and therefore the quality of and confidence in the findings and my ability to effectively address the research questions. Despite such issues the study also has balancing strengths and these too are considered to provide a holistic perspective on the study and its effectiveness.

5.9.1 Longitudinal design

The study has some strengths in its design and the way it was implemented. Several researchers have called for studies that are longitudinal in design to allow the natural history of language delay to be revealed (Conture, et al., 2013; Nelson et al., 2006; Roulstone et al., 2003) and this study, in collecting data at two time points has usefully added to knowledge about language development within a population of young children with language delay. Although described as a strength, having had an additional point of data collection beyond this one year period would have strengthened the study much further by allowing trends of movement in variables to be seen more clearly. However, this would have lengthened the study time such that it may not have been completable within the timeframe of PhD registration.

Many longitudinal studies have examined only expressive language delays (Mossabeb et al., 2012; Zambrana et al., 2013). In my study, the follow-up of children with receptive and mixed language delays too, enabled me to determine demographic and temperament factors influencing the trajectory of the range of ELDs over a one year period for a moderately sized cohort.

5.9.2 Sampling

It was important to obtain a sample which was as representative of the population of children with ELDs as possible, in order to limit sample selection bias. The cohort of children for this study was recruited as a result of opportunity sampling, in that children were referred through a gatekeeper as discussed in section 3.6.3.2. The gatekeeper, a senior SLT, was briefed about the purpose of the study and the inclusion

and exclusion criteria and the aspiration to recruit any children who met the inclusion criteria. Some previous cohort studies of late talkers have relied on families responding to advertisements (Anderson et al., 2003; Law et al., 2000), or have defined late talkers by their relative language position in the cohort rather than cut off scores (extreme groups design) (Kubicek and Emde, 2012; Spere et al., 2004). The participant characteristics show that a wide range of individual characteristics, socioeconomic positions, parent age and family sizes formed the cohort and this was important to allow inspection of a range of variables that may contribute to risk and outcome in ELD. However, despite this diversity, not all parents decided for their children to take part and this may have introduced bias in ways I am unable to account for.

It is also possible that the SLT gatekeepers introduced some selection bias, for example at times when they chose not to ask or forgot to ask certain families to take part. To my knowledge, there were some children who were thought by the SLT to have suitable language characteristics for the study but whose parent/carer(s) were not invited to take part because the SLT thought the family vulnerable in some way. I did not ask the SLTs to keep a log of families who were approached, or not, to take part and therefore cannot know the extent or direction to which results will have been affected by the selection process. It would have been interesting to have accessed this information, although the consent issues involved would have been complex and access to client notes would have also been required.

The study sample size of eighty children reflects a robust, if moderate, clinical group size and is larger than cohorts reported in many clinical SLT studies (Everitt et al., 2013; Bishop et al., 2012). Evaluation of the language abilities and temperament of a different sample of eighty children might have provided different results. However, care has been taken to provide 95% CIs and report the characteristics of the distribution. Whilst a larger sample would have been preferable, I believe the sample size was adequate for the analyses undertaken.

5.9.3 Control group

Though the size of the sample represents a strength of this study, it was however traded off against the lack of a control group. At the outset of the study, I felt confident that, in using standardised measures for language and temperament data collection, this was a viable trade off. In considering the gathered results, this has been adequate for the language data but I have become aware of the limitation of not having a control group for the temperament data. For the temperament measure there is no available UK standardised data to act as a sensitive comparator, and this has limited the interpretations I have been able to draw from the data. I cannot be sure that the differences in temperament profile from the standardised measure are because of a profile associated with language delay rather than any cultural variation and was able to find only one paper reporting similarity across USA and UK temperaments (Klein and Ballantine, 1991).

The inclusion of a control group matched for age and gender and socioeconomic position would have very valuably added to the construal of these findings. In future studies looking at temperament in UK populations, benchmarking of any temperament measure would be important to establish for the cultural population since societal values are known to influence the expression and ratings of temperament (De Schipper et al., 2004; Klein and Ballantine, 1991; Sanson et al., 2004). Without this information for my cohort I am restricted in knowing whether the temperament findings relate to ELD or to the cultural expressions of temperament in the area the cohort families live.

5.9.4 Instruments of data collection

5.9.4.1 Preschool Language Scales 3-UK

The use of the PLS3-UK allowed for children's language to be assessed across both points of data collection using the same instrument. This facilitated analysis of change across time Importantly, both receptive and expressive language skills were assessed. This was valuable as few studies have reported on receptive language skills (see section 5.3.1). Additionally, it was a strength of the study that, with parent consent, this data was shared with the child's SLT to add to their case notes. Both parents and SLTs commented that they valued this exchange of information.

5.9.4.2 Carey Temperament Scales

In contrast to the PLS3-UK, the TTS and BSQ had a less broad age range and so for a proportion of the children different instruments were used across the two data

collection points. If it had been possible, using an identical instrument would have added rigour, but the same constructs were evaluated at both points. This limits confidence in the study findings and the inclusion of a control group of children would have been useful to provide comparison for results across the two instruments.

The language used in the questionnaires was sufficiently complex to require confident use of English and so I made a decision that parents without English as first language would be excluded from the study, although I was able to include bilingual speakers. This is a limitation that could have been overcome if translators had been available to me but I did not have funding to provide this. I am aware that many studies employ uni-lingual samples but within the context of our multicultural and multilingual society including the children of parents who have English as a second language is preferable and surmountable with additional resources.

The questionnaires were developed in America and included vocabulary and phrasing that did not fit with local ways of expression. This may have limited participants' engagement and understanding of the questions. Questionnaires were completed face to face and there was opportunity to clarify questions during completion but some parents may have misunderstood questions without realising this or not wanted to seek clarification. Adaptation of the instrument for a UK population would require a huge undertaking and another way forward would be to undertake some international comparison studies using UK and USA groups to identify the applicability or differences in the use of the questionnaires across the two countries.

In this study temperament data was obtained from the parent who identified themselves as the main carer. This may have biased the information in unknown ways

in comparison to obtaining data from the other parent or from both. Anderson et al. (2003) did use parent report via consensus in their study (see section 2.10.1) and report this as a strength. However, temperament is most effectively rated by the person who knows the child in the widest range of situations and this is likely to be the main carer. Adding the dynamics of agreed ratings may not in fact increase validity, though obtaining separate ratings from all significant adults in a child's life may yield interesting information.

5.9.5 Data management

The study had a high completion rate of 90% and this added to the robustness of the multivariate analyses. Further, the characteristics of the sample with the missing cases did not significantly alter its composition. Data quality is always important in enabling confident results and for this study, this was maintained by all data collection and analysis being done by me. In particular, because data collection took place over a minimum of two visits, any inadvertent missing data from questionnaires or lack of clarity was checked for and quickly followed up on the next visit or by telephone conversation. Data entry took place very soon after data collection (within a maximum of two weeks) which is unusual in quantitative research and was influenced by my experiences as a clinician and qualitative researcher where ongoing data analysis is routine. I was keen that taking part in the research study was a positive experience for participants and providing timely feedback to them was central to this. Parents were keen to receive feedback from the temperament questionnaires and providing this

(see appendix 15) was a strength of the study which may have increased completion rates, as well as valuing the contribution made by the participants. I am aware however, that as a sole researcher there was no formal inter-rater reliability for the language assessment. To balance this a little, since all the language assessments were undertaken with the child's parent present, I always asked parents if they felt the child's performance was a reasonable reflection of their typical skill to offset lack of inter-rater reliability with ecological validity. Parents rated the language assessment of their child as appropriate, with a few parents showing surprise that their child performed better than they expected. No parent felt their child had not demonstrated their usual language skills. There may be some social bias in these reports but I would expect that this was low.

5.9.6 Cognitive measures

The study did not have access or seek to measure cognitive development in the children and this is a potentially serious limitation of the study since cognitive ability is likely to contribute to variance in outcomes for children with ELDs. Whilst children with identified primary cognitive delays were excluded from the study and only children reflecting the consensus definition of language delay in the SLT services (see appendix 19) were recruited, a cognitive measure would have been a valuable to add to the regression models to examine its contribution to outcomes for young children. Sylvestre et al. (2012), in their sample of French speaking children with language delay, found that lower cognitive performance using the Mental Development Index of the Bayley Scales of Infant and Toddler Development—II (Bayley, 1993) predicted lower performance on both receptive and expressive language assessments. The inclusion of

such cognitive data could have further developed and strengthened the utility of the resulting models for this study.

Obtaining such measures in a standardised way would have required a qualified practitioner in cognitive assessment and would have added to the amount of direct assessment these young children were asked to participate in. For this study, this was not possible but in larger scale studies this would be a valuable asset in understanding the trajectories of language delay. Relying solely on referring SLTs to judge whether the participants had cognitive difficulties was a practicable way forward since these gatekeepers were very experienced and had another care pathway for children more likely to have language delay associated with cognitive difficulties. In such young children all cut off points in development are rather blurred and so I believe the approached was reasonable though not 'gold standard'. In contrast, temperament is believed to be largely independent of cognitive skills (Hatton, 1999) and so is unlikely to be affected by the absence of cognitive measures.

5.9.7 Content

Finally, perhaps the major strength of this study is its specific focus on an under researched area of influence on language development. Previous studies have included temperament variables as part of epidemiological investigations (Roulstone et al., 2003; Reilly et al., 2010), or included language assessment as part of investigation into a particular dimension of temperament (Kubikek and Emde, 2012; Spere et al., 2004). In including both receptive and expressive language measures, along with a broad

range of temperament constructs, this study has sought to give a more equal, exploratory treatment of these two important developmental areas in relation to children who have early language difficulties. To my knowledge, this is the first UK study to use full temperament instruments coupled with direct language assessment. As such, it contributes new information about associations between language delay and temperament and argues for the predictive role of persistence, adaptability and distraction in outcome trajectories for children with ELD.

Chapter 6 Conclusions.

At the outset of this research enquiry, I identified its purpose and focus and here at the end of my account it is pertinent to reflect on the extent to which I have been able to meet these.

The study was designed to be exploratory and my criteria for success centered on developing a more informed understanding of associations between language and temperament within ELD, rather than to develop definitive answers.

The study arose from an aspiration to understand about any role of temperament in influencing children's language development trajectories and thus begin to answer the question 'Does temperament make a difference?' For this cohort, temperament did make a modest, but significant, impact to language outcomes over the period of one year. Specifically, having mid-range levels of distractibility was associated with better auditory comprehension scores whilst being more adaptable and having mid-range persistence was associated with better expressive communication scores for the cohort children.

6.1 Key findings

6.1.1 Auditory comprehension

For children's language progress in respect of their auditory comprehension skills the most influential predictor of auditory comprehension score at the end of the study was auditory comprehension score at entry to the study. This predicted 76.5% of the variance in outcome score, whilst not having a temperament with an intense focus (i.e. being higher in distractibility) added a further 1.6% to the prediction of outcome score.

None of the other temperament or demographical variables significantly contributed to progress in auditory comprehension skills.

6.1.2 Expressive communication

Expressive communication scores after one year were significantly predicted by a combination of five variables: auditory comprehension (34%), expressive communication (13.8%), adaptability (5.6%), persistence (3.1%) and negative family history of language difficulties (3%). Children with higher auditory comprehension and expressive communication scores along with increased flexibility and persistence and no family history of language difficulties achieved the best outcomes.

6.1.3 Children's temperament profile

The cohort of children with language delay had a distinctive temperament profile, characterised by slow adaptability to changes in their environment and low persistence, meaning that they were more likely to 'give up' if faced with tasks that were difficult for them and did not finish activities before moving on to something new.

6.1.4 Adults' temperament profile

The temperament of the parents, who have children with ELD, showed a profile which was high in distractibility and low in approach (less outgoing).

6.1.5 Goodness of fit

Parents' ratings of their child's manageability were significantly ($p < .01$) associated with auditory comprehension skills, such that children with higher auditory

comprehension scores were rated as easier to manage than children with lower scores. This association did not hold for expressive communication skills.

6.2 Implications arising from the study findings

The analysis of this data does lend support to a view that child temperament is influential in the progress children with ELD make in their language development, such that I believe this is an area worthy of further investigation. Temperament is not a fixed commodity and so it may be that interventions that support the development of specific aspects of the self-regulatory functions of temperament could protect or promote language learning. It is this amenability to change that gives temperament potential power to enhance current speech and language strategies. Indeed, SLT is notable for its eclectic nature in drawing on a range of supporting academic disciplines to develop its own theories and resulting pathways of management for individuals with speech language and communication difficulties. Temperament is a construct essentially concerned with reactivity and self-regulation (Rothbart, 2011). Consideration of the supports and demands placed on dimensions of temperament during assessment and management of language delay within speech therapy services, and making adaptations in response to these could potentially support greater efficacy. However, at this point, there is insufficient information to proceed clearly and consideration of the robust evidence needed prior to designing clinical intervention studies needs to be scoped.

6.3 Directions for future research

In this young area of research, it is important to report clear details about how data have been generated prior to analysis so that work can proceed in a maximally informative way. Language measures are typically confined to expressive language report by a familiar adult, sometimes with very few questions asked, for example the PEDS (Glascoe, 2000) uses just six key questions. In order to build robust knowledge about associations between language and temperament, data from both areas needs to be detailed enough to show variability so that relationships between language and temperament can be accurately mapped and contextualised.

The research literature has gone some way to identifying associations between language performance and temperament features. On one level, this is no surprise since with a range of language skills to measure, different labels for temperament features and ways to measure these variables it is likely that studies will have found both spurious and perhaps more salient associations. However, in order for the field to move forward I would argue that a more systematic approach is now needed so that individual studies have resonance with others and start to build a more robust picture of children's temperament and language development. Such work would have the power to build and test hypotheses, thus developing theories about the interactions between language and temperament, which may prove useful in supporting young children and their families in the early years, to allow success in both areas to meet the developmental needs of the child.

Further exploration of the associations between temperament and language have the potential to provide a more informed understanding of this arena and are indicated from the results of the current exploratory study.

As has been identified in section 5.9, this study had some limitations which have compromised its findings and would be useful to address in future research.

The temperament questionnaires used proved useful but have not been standardised on a UK population. Research into the specific temperament variability for a UK population would facilitate a further exploration of temperament and language delay from a firmer standpoint and would also facilitate interaction with the wider temperament research community in cross-cultural studies.

The findings of this study need to be tested by similar studies which would furnish information about the replicability and thus reliability of the findings for both language, temperament and their associations.

Longitudinal studies, which follow children across the pre-school period and into their school years, would reveal important insights into the trajectories of language and temperament. Such studies would be most useful where a control group was recruited, matched for age, gender, SEP and cognitive ability and in multi-site locations.

Until this foundation knowledge is carefully constructed, it is premature to focus studies on potential intervention adaptations based on the temperament dimensions which have predicted outcomes in this current study.

6.4 Concluding comments

This study is the first UK longitudinal study to explore the language progress and full temperament profiles of a cohort of young children with clinically significant language delay over the period of one year, along with the temperament profiles of their main carer parent. This study has contributed to current understandings of the associations between language outcomes and temperament characteristics that this population of children exhibited and to knowledge about the early impact of ELD on parents' experience of their child's manageability (goodness of fit).

Since ELD is a high prevalence condition with known impacts on quality of life, academic and psychosocial outcomes there is a mandate for exploring ways in which to enhance language development at an early age in an effort to reduce negative impacts. Exploring further the role and utility of temperament in relation to language development and delay may add fruitfully to this agenda.

'Tapping persistently breaks the stone.' (Welsh proverb)

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Appendices

Appendix 1: Local Research Ethics Committee approval

NHS

National Research Ethics Service

Stockport Research Ethics Committee
Room 181, Gateway House
Piccadilly South
Manchester
M60 7LP

Telephone: 0161 237 2585
Facsimile: 0161 237 2383

27 June 2007

Private & Confidential
Ms J Phillips, Senior Lecturer in Speech Pathology
Manchester Metropolitan University
School of Health, Psychology and Social Care
Gaskell Site, Hathersage Road
Manchester
M13 0JA

Dear Ms Phillips

Full title of study: **Children with delayed language development: Does temperament make a difference?**
REC reference number: **07/Q1401/32**

Thank you for your letter of 19 June 2007 responding to the Committee's request for further information on the above research and submitting revised documentation. The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA.) There is no requirement for other Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully. **Please note in particular the requirements relating to the submission of progress and other reports in points 4 and 10.**

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Application	5.6	04 May 2007
Investigator CV	Juliet Goldbart	27 April 2007
Investigator CV	Julie Phillips	25 April 2007
Protocol	1	04 May 2007

This Research Ethics Committee is an advisory committee to North West Strategic Health Authority

The National Research Ethics Service (NRES) represents the NRES Directorate within the National Patient Safety Agency and Research Ethics Committees in England

Summary/Synopsis		
Compensation Arrangements		24 April 2007
Questionnaire: Participant initial questionnaire schedule		
Questionnaire: Adult Temperament Questionnaire		
Questionnaire: Behavioural Style Questionnaire		
Questionnaire: Toddler Temperament scale		
Participant Information Sheet	2	19 June 2007
Participant Consent Form	2	19 June 2007
Opt-in slip	1	

R&D approval

All researchers and research collaborators who will be participating in the research at NHS sites should apply for R&D approval from the relevant care organisation, if they have not yet done so. R&D approval is required, whether or not the study is exempt from SSA. You should advise researchers and local collaborators accordingly. Guidance on applying for R&D approval is available from http://www.rdforum.nhs.uk/rdform.htm.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

Feedback on the application process

Now that you have completed the application process you are invited to give your view of the service you received from the National Research Ethics Service. If you wish to make your views known please use the feedback form available on the NRES website at: https://www.nresform.org.uk/AppForm/Modules/Feedback/EthicalReview.aspx

We value your views and comments and will use them to inform the operational process and further improve our service.

07/Q1401/32	**Please quote this number on all correspondence**

With the Committee's best wishes for the success of this project

Yours sincerely

Elaine Hutchings

pp **Mr Simon Jones**
Chair

Email: elaine.hutchings@northwest.nhs.uk

Enclosure: Standard approval conditions

Copy to: Professor B Plumb, Deputy Vice Chancellor
Manchester Metropolitan University
All Saints
Oxford Road
Manchester
M15 6BH

Appendix 2: Research Contracts

The Greater Manchester Honorary Research Contract

Honorary Research Contract

between

Stockport PCT

and

Ms Julie Phillips

Fixed term contract from:
16th July 2007 – 16th July 2010

Study Title: **Children with delayed language development: Does temperament make a difference?**
I.D Ref No. **RMG/07/057**

Signatures

Researcher .....Julie Phillips..... Date 12th July 2007

Trust Director
or
Manager of Research
& Development .....[illegible]..... Date 20th July 2007

Effective Date: **16th July 2007**

GM PC ReGrouP

Greater Manchester NHS
Primary Care Research Governance Partnership

Salford Royal NHS
NHS Foundation Trust

University Teaching Hospital

safe • clean • personal

R&D Director Professor Sarah O'Brien

R&D Lead Dr Lloyd Gregory
ReGrouP Manager Mrs Linda Dack
ReGrouP Information Officer Beverley Greenhalgh
Beverley.greenhalgh@manchester.ac.uk
Tel: 0161 206 7050 Fax: 0161 206 4205

Our ref: RMG/07/057

13 August 2008

Ms Julie Phillips
Senior Lecturer
Prof. Registration Division
Faculty of Health, Social Care & Education
MMU, Elizabeth Gaskell Site
Hathersage Road
Manchester
M13 0JA

Existing Honorary Research Contract issued by Stockport PCT

Thank you for submitting a copy of your main honorary research contract with Stockport PCT and your Research Passport. I am now pleased to offer you an honorary research contract with Manchester PCT on the same terms as the above contract except as detailed below. Please accept this letter as confirmation of such an arrangement.

The contract if accepted by you will be effective from 13 August 2008 to 30 July 2010 unless terminated earlier in accordance with the clauses in the contract. Please note that you cannot start the research until the Principal Investigator for the research project has received a letter from us giving permission to conduct the project.

Amendments to the existing honorary research contract issued by Stockport PCT are as follows:

- While undertaking research through Manchester PCT you will remain accountable to your employer but you will follow the reasonable instructions of the head of the relevant NHS Department in this NHS organisation or those given on her/his behalf in relation to the terms of this right of access.

- The Trust will not reimburse any expenses you incur in the course of your research unless by prior arrangement we have agreed to do so. Similarly, the Trust accepts no responsibility for damage to or loss of personal property.

- Your Research Passport may be subject to random checks carried out by Stockport or Manchester PCTs within the lifetime of the project. The information it contains must therefore be accurate and remain up to date.

- If your circumstances change in relation to your health, criminal record, professional registration or any other aspect that may impact on your suitability to conduct research, or your role in research changes, you must inform your employer through its normal procedures. You must also inform your nominated manager in this NHS organisation.

Yours sincerely

L M Dack

Linda Dack (Mrs)
ReGrouP Manager

Appendix 3: Extension to Research Contract

GM PC ReGrouP | Greater Manchester Primary Care Research Governance Partnership | NHS

NHS SalfoR+D
Acute & Primary Care Research

NHS SalfoR+D Director: Professor Bill Ollier
NHS SalfoR+D Associate Director: Dr Lloyd Gregory
ReGrouP Manager: Rachel Georgiou

Enquiries: Email: Salford-Regroup-RD@manchester.ac.uk
Tele: 0161 206 8343
Fax: 0161 206 4205

SalfoR+D web address: http://www.nhssalfordrd.org.uk/
ReGrouP web address: http://www.gmregroup.nhs.uk/index.html

8th July 2010

Ms Julie Phillips
Senior Lecturer
Prof. Registration Division
Faculty of Health, Social Care & Education
MMU, Elizabeth Gaskell Site
Hathersage Road
Manchester
M13 0JA

Dear Ms Phillips,

Study Title: Children with delayed language development: Does temperament make a difference?
R&D No: RMG/07/057
REC No: 07/Q1401/32

This letter confirms your right of access to conduct research through the following organisation for the purpose and on the terms and conditions set out below:

- Manchester PCT
- Stockport PCT

This right of access commences on 8th July 2010 and ends on 30th August 2011 unless terminated earlier in accordance with the clauses below.

You have a right of access to conduct such research as confirmed in writing in the letter of permission for research from this NHS organisation. Please note that you cannot start the research until the Principal Investigator for the research project has received a letter from us giving permission to conduct the project.

The information supplied about your role in research at the above mentioned NHS Organisation has been reviewed and you do not require an honorary research contract with these NHS organisations. We are satisfied that such pre-engagement checks as we consider necessary have been carried out.

You are considered to be a legal visitor to the Trust premises. You are not entitled to any form of payment or access to other benefits provided by the Trust to employees and this letter does not give rise to any other relationship between you and this NHS organisation, in particular that of an employee.

While undertaking research through the Trust you will remain accountable to your employer but you are required to follow the reasonable instructions of the heads of the relevant NHS Departments in this NHS organisation or those given on her/his behalf in relation to the terms of this right of access.

Where any third party claim is made, whether or not legal proceedings are issued, arising out of or in connection with your right of access, you are required to co-operate fully with any investigation by this NHS organisation in connection with any such claim and to give all such assistance as may reasonably be required regarding the conduct of any legal proceedings.

You must act in accordance with the PCT's policies and procedures, which are available to you upon request, and the Research Governance Framework.

You are required to co-operate with the PCT in discharging its duties under the Health and Safety at Work etc Act 1974 and other health and safety legislation and to take reasonable care for the health and safety of yourself and others while on the PCT premises. You must observe the same standards of care and propriety in dealing with patients, staff, visitors, equipment and premises as is expected of any other contract holder and you must act appropriately, responsibly and professionally at all times.

You are required to ensure that all information regarding patients or staff remains secure and *strictly confidential* at all times. You must ensure that you understand and comply with the requirements of the NHS Confidentiality Code of Practice (http://www.dh.gov.uk/assetRoot/04/06/92/54/04069254.pdf) and the Data Protection Act 1998. Furthermore you should be aware that under the Act, unauthorised disclosure of information is an offence and such disclosures may lead to prosecution.

You should ensure that, where you are issued with an identity or security card, a bleep number, email or library account, keys or protective clothing, these are returned upon termination of this arrangement. Please also ensure that while on the premises you wear your ID badge at all times, or are able to prove your identity if challenged. Please note that this NHS organisation accepts no responsibility for damage to or loss of personal property.

We may terminate your right to attend at any time either by giving seven days' written notice to you or immediately without any notice if you are in breach of any of the terms or conditions described in this letter or if you commit any act that we reasonably consider to amount to serious misconduct or to be disruptive and/or prejudicial to the interests and/or business of this NHS organisation or if you are convicted of any criminal offence. Your substantive employer is responsible for your conduct during this research project and may in the circumstances described above instigate disciplinary action against you.

The Trust will not indemnify you against any liability incurred as a result of any breach of confidentiality or breach of the Data Protection Act 1998. Any breach of the Data Protection Act 1998 may result in legal action against you and/or your substantive employer.

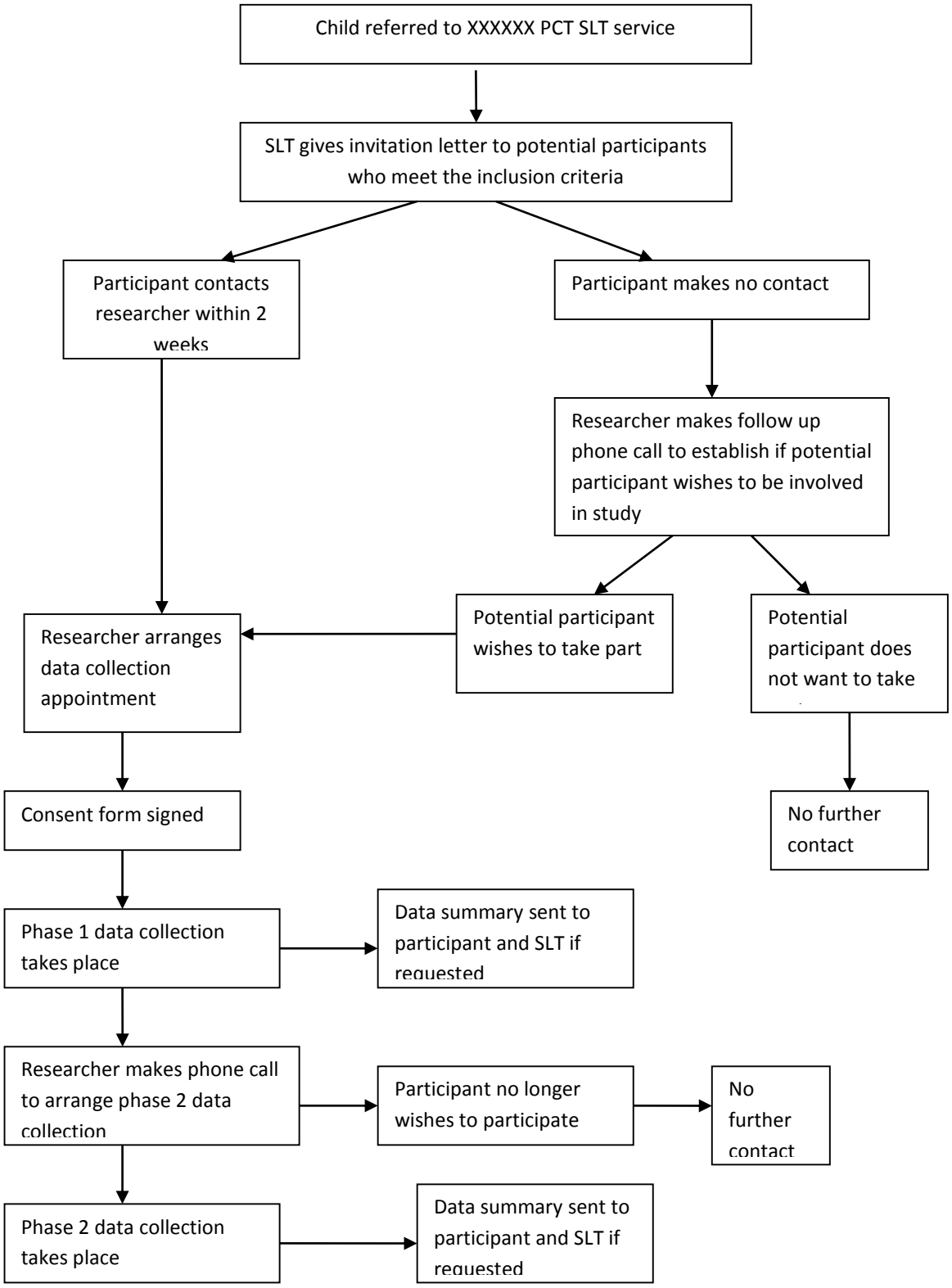
If your current role or involvement in research changes, or any of the information provided in your Research Passport changes, you must inform your employer through their normal procedures. You must also inform your nominated manager in this NHS organisation.

Yours sincerely

Rachel Georgiou
RM & G and ReGrouP Manager

Research & Development
Clinical Sciences Building, SRFT, Stott Lane, Salford, Manchester, M6 8HD

Appendix 4: Procedural Flowchart



Appendix 5: Participant Invitation Letter

Invitation Letter for Participants (version1)

Primary Care Trust logo

Faculty of Health, Psychology & Social Care
Department of Professional Registration
Manchester Metropolitan University
Elizabeth Gaskell Campus
Hathersage Rd
Manchester
M13 0JA
Email: j.m.phillips@mmu.ac.uk
Tel: 0161 247 2575

Children with delayed language development: Does temperament make a difference?

Dear Parent,

We are conducting a study to investigate if children's temperament – often called personality- has an effect on their language development and the way they respond to advice and treatment from speech and language therapists. Our reason for undertaking this is to help improve interventions and advice for young children with delayed language development. We would like to invite you to participate in the study.

Please read the enclosed information sheet to decide if you would be willing to take part in the study. We will contact you within the next few weeks to ask whether you wish to take part in the study or not, or you can contact us by returning the enclosed form, phoning or emailing.

If you agree to take part you will be asked to attend two appointments where you will:

- be asked some questions about your child
- complete a temperament questionnaire about you and your child
- your child will complete a language assessment

One year later we will contact you again to repeat these assessments. That would end your involvement in the study.

We estimate that the time commitment for you, not including travel, would be approximately 1 hour on each occasion. The venue would be either a local clinic or your own home if you prefer. If you have any questions about this study please contact me, Julie Phillips, and I will be happy to answer them. We would greatly appreciate your help in this study.

Yours faithfully

Julie Phillips
Research Speech and Language Therapist

Appendix 6: Participant Information Sheet

Primary Care Trust logo

Manchester Metropolitan University

Information about the Research

Children with delayed language development: Does temperament make a difference?

I would like to invite you to take part in a research study. Before you decide you need to understand why the research is being done and what it would involve. Please take time to read the following information carefully. Talk to others about the study if you wish.
This leaflet tells you the purpose of this study and what you will be asked to do if you take part. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

This research is taking place with the Speech and Language Therapy Department of XXXXX PCT. It wants to find out if any relationships exist between children's temperament (sometimes called personality) and the way their language is developing.

Why is this study being done?
Slow language development is a common problem in early childhood though we do not fully understand why it affects some children and not others. Temperament is the term used to refer to a person's individual way of behaving e.g. outgoing, reliable, timid or inquisitive. Previous research has found that parents can often see a link between their child's temperament and the way their language develops. For example, some parents feel their child would talk more if they were not so shy and others say they would learn more words if they were calmer.

- This research will test out these ideas with a large number (250) of pre-school children who have been referred to speech and language therapy because their language is developing more slowly than expected for their age.

Sometimes parents feel they and their child are alike and others that their temperaments seem to clash.

- The research will also find out about the similarities and differences in temperament between the children and their parent or main carer and look to see if this has any effect on language progress.

The research study will ask these questions:

- Is there a link between language difficulties and temperament (personality)?
- Do children with different temperaments make different amounts of progress in language development over the period of one year
- Do children and parents whose temperaments match each other make different amounts of progress compared to those who have different temperaments from each other?

If the study shows that there is a link between temperament and language, more suitable services for children with different temperaments could be developed.

Who is in charge of the study?
The study is being carried out by Julie Phillips.
I am an experienced researcher and speech and language therapist. I work at Manchester Metropolitan University (MMU) and with children at XXXXX Nursery in XXXXX. I can be contacted at MMU by:

- Telephone: 0161 247 2575
- email: j.m.phillips@mmu.ac.uk

post: Julie Phillips, Speech and Language Therapy Clinic Manager, Faculty of Health, Psychology and Social Care, Manchester Metropolitan University, Hathersage Road, Manchester, M13 OJA.
XXXXXX is the speech and language therapist who is coordinating the study in XXXXX. She can be contacted by:

- Telephone: XXXXXX
- Post: Children's Therapy Services, XXXXXXX

I am carrying out this study as a PhD project and I am being supervised by Dr Juliet Goldbart (psychologist). Juliet Goldbart can be contacted by:

- telephone: 0161 247 2578
- email: j.goldbart@mmu.ac.uk
- post: Dr J. Goldbart, Reader in Psychology and Speech Pathology, Faculty of Health, Psychology and Social Care, Manchester Metropolitan University, Hathersage Road, Manchester, M13 OJA

How do I know the study is safe to take part in?
All research in the NHS is looked at by independent group of people, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given favourable opinion by XXXXXX Research Ethics Committee.

Why are my child and I being invited to take part?
You and your child are being asked if you would like to join the study because:

- Your child is between 2½ and 4½ years old
- Your child has been referred to speech and language therapy because of slower than expected language development
- You are the main carer for your child
- You and your child can provide important information to the study

Do we have to take part in the study?
No, you don't. It is up to you to decide. Your decision to be part of the study is voluntary.
When you have had time to think about the information, I will ask you to sign a consent form to show you have agreed to take part. You are free to withdraw at any time, without giving a reason. If you do not want to take part there will be no difference in your child's speech and language therapy care.

What if we do decide to take part?
If you decide to take part in the study you will need to contact me or XXX(SLT) to tell us that you have decided to take part. You can do this by returning the attached reply slip, or using the phone numbers or email addresses included in this leaflet. I will contact you within two weeks to arrange to meet you and your child in a place that suits you (usually your local clinic or own home). Taking part in the study will involve you and your child meeting with me so I can:

a) Ask some questions about your child and his/her development
b) complete a questionnaire about your child's temperament
c) complete a questionnaire about your temperament
d) carry out an assessment of your child's speech and language skills

This will take 2 visits of about 1hour each at the start of the study and 2 more visits one year later to repeat the same procedures to measure any change. This will be the end of your involvement in the study. **This means 4 visits in total**.

I will share the information from the temperament and language procedures with you. This may give you some interesting information about your child.

Who will see my/my child's information?
All the information from the study will be kept carefully in locked cabinets and computers that only I have the password for. It will be seen only by me and my research supervisors. The information will be kept anonymously; this means it will not have your child's or your names on it.
However, I will ask you if you would like a copy of the speech and language assessment information to be passed on to your child's speech and language therapist. This will be up to you to decide.
If any information you give me causes me serious concern about the wellbeing of you or your child, I will discuss this with you and may need to pass this information on for your own or your child's safety.

Are there any benefits to taking part?
There are no direct benefits to you and your child from taking part in the study.
The main benefits will come if a link between language and personality is found. You will be contributing to developing new understanding about children's language progress.
There may be a small benefit to you because you will receive some additional language and personality assessments for your child. These may be useful and interesting for you.

What if I don't want to carry on with the research study?
If you decide this, you can change your mind by contacting me or your child's speech and language therapist. You can do this at any time and it will not affect your child's care. You won't have to continue to take part but the information that has already been collected will be used anonymously.

What if I have a complaint or concern about the research study?
If you have a concern or complaint about any aspect of this study, please to speak to me by telephoning - 0161 247 2575. I will do my best to respond to your concern. If you remain unhappy and wish to take the matter further you can contact Juliet Goldbart who is responsible for supervising my behaviour during the study. Her details are on page 2 of this leaflet. You might prefer to speak to someone who is independent from the study. If so you can contact the Patient Advice and Liaison Service (P.A.L.S.) at XXXX. Telephone: XXXXX

What if I still have questions about the study?
If you would like to ask any questions or get some more information about the study, I would be pleased to talk to you. Contact me using the details on page 2 of this leaflet.

Thank you for reading this information sheet.
I wish you and your child well for the future.
Julie Phillips 25 June 2007

Appendix 7: Consent Form

Primary Care Trust logo

Manchester Metropolitan University

Email: j.m.phillips@mmu.ac.uk
Tel: 0161 247 2575

CONSENT FORM

Children with delayed language development: Does temperament make a difference?

Name of Researcher: Julie Phillips

Please initial box

1. I confirm that I have read and understand the information sheet dated June 2007 (version 2) for the above study and have had the opportunity to ask questions. ☐

2. I understand that my /the child's participation is voluntary and that we are free to withdraw at any time, without giving any reason and that the child's medical care or legal rights will not be affected. I understand that information provided up to the point of withdrawal may have already been used in the study on an anonymised basis. ☐

3. I confirm that I consent for the child to take part in the study ☐

4. I consent to take part in the above study. ☐

5. I consent to provide information about the child in my capacity as parent/carer. ☐

6. I understand that data collected during the study may be looked at by individuals from Manchester Metropolitan University, where it is relevant to my taking part in this research. I give permission for these authorised individuals to have access to my data. ☐

7. I would like to receive information about my child arising from the study Yes/No (circle)

8. I would like my child's speech & language therapist to receive the language assessment results Yes/No (circle)

9. I would like to receive a summary about the study results Yes/No (circle)

_____	_____	_____
Name of Participant (Child)	Date	Signature (parent /carer)
_____	_____	_____
Name of Participant (Adult)	Date	Signature
_____	_____	_____
Name of Person taking consent	Date	Signature

Appendix 8: Follow up letter for phase 2.

NAMES HAVE BEEN CHANGED

Invitation Letter for Participants (version1)

Primary Care Trust logo

Faculty of Health, Psychology & Social Care
Department of Professional Registration
Manchester Metropolitan University
Elizabeth Gaskell Campus
Hathersage Rd
Manchester
M13 0JA
Email: j.m.phillips@mmu.ac.uk
Tel: 0161 247 2575
Mobile: 07944572153

6th May 2009

Children with delayed language development: Does temperament make a difference?

Dear Nina,

I am writing to you about the research project that you and Eric took part in last year.

You may remember that I came to your home, once to meet Eric and give you some personality questionnaires to fill in and the second time to carry out a language assessment with Eric – helped by you!

At the time you kindly said that I could contact you to follow up Eric's progress. I am writing to ask if we can meet up again to repeat the questionnaires and language assessment. The phone number I have for you is no longer working, so I'd be very grateful if you could ring/text/email or write to let me know if you can still participate. If so we can arrange a time to suit you and your family.

I very much hope we can meet up – it would be lovely to see Eric again and hear how he is developing.

With very good wishes

Yours sincerely

Julie Phillips
Research Speech and Language

Appendix 9: Participant initial questionnaire schedule

Phase one – entry to the study

1. Confirm details of:
    a. Adult Name age
    b. Child Name age
    c. Address
    d. phone number
    e. email

2. Are you the main carer for the child?

3. Does your child attend nursery/daycare?

4. What is the main language spoken at home?

5. What ethnic group do you belong to?

6. What are the ages and gender of any brothers or sisters

7. Why was your child referred to speech and language therapy

8. Has the child had any coughs and colds that lasted longer than a week – how many

9. Has your child passed all his/her hearing tests

10. Are you worried about his/her hearing?

11. Did your child have any medical problems in the first few months?

12. Has anyone else in the family ever had problems with their talking or reading and writing

13. What were the last qualifications child's parents got?
    a. GCSE/o-level
    b. Vocational qualifications
    c. GCE/A-level
    d. Further education qualification
    e. Higher education qualification

14. Would you like a summary of the information about your child's temperament and your own temperament to be sent to you?

15. Would you like information about your child's language assessment given to your child's speech therapist?

Appendix 10: Participant background information, Phase two

12 months after initial entry to the study

1. Confirm details of:
    a. Adult Name age
    b. Child Name age
    c. Address
    d. phone number
    e. email
2. What SLT services have you received since we last met 12 months ago
3. Has your child had any coughs and colds that have lasted longer than a week since we last met
4. Has your child passed all hearing tests
5. Have you any worries about your child's hearing
6. Has anyone in the family ever had problems with talking/reading /writing
7. Do you think your child's temperament has changed over the past year
8. Do you think your personality has changed
9. What things have helped your child make progress with language this year
10. Do you have any worries about your child's communication development
11. Would you like a summary of the information about your child's temperament and language assessment, and your own temperament to be sent to you?
12. Would you like information about your child's language assessment given to your child's speech therapist?

Appendix 11: Toddler Temperament Scale

Carey Temperament Scales™

Toddler Temperament Scale

for 1-and-2-year-old children

by William Fullard, PhD, Sean C. McDevitt, PhD, and William B. Carey, MD

Child's Name _____ **Gender** _____

Child's Date of Birth _____/_____/_____ **Present Age** _____
Month Day Year

Rater's Name _____

Rater's Relationship to Child _____

Date of Rating _____/_____/_____
Month Day Year

Instructions

1. There are no right or wrong or good or bad answers, only descriptions of your toddler.
2. Please base your rating on your toddler's recent and current behavior (the last four to six weeks).
3. Rate each question separately. Some items may seem alike but are not the same. Do not purposely try to present a consistent picture of your toddler.
4. Use extreme ratings where appropriate. Try to avoid rating only near the middle of each scale.
5. Rate each item quickly. If you cannot decide, skip the item and come back to it later.
6. Rate every item. Please skip any item that you are unable to answer due to lack of information or any item that does not apply to your toddler.
7. Consider only your own impressions and observations of the toddler.

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Using the scale below, please darken the circle in the space that tells how often the todder's recent and current behavior has been like the behavior described by each item.

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
1. The child gets sleepy at about the same time each evening (within 1/2 hour).	1	①	②	③	④	⑤	⑥
2. The child fidgets during quiet activities (story telling, looking at pictures).	2	①	②	③	④	⑤	⑥
3. The child takes feedings quietly with mild expressions of likes and dislikes.	3	①	②	③	④	⑤	⑥
4. The child is pleasant (smiles, laughs) when first arriving in unfamiliar places.	4	①	②	③	④	⑤	⑥
5. A child's initial reaction to seeing the doctor is acceptance.	5	①	②	③	④	⑤	⑥
6. The child pays attention to games with parent for only a minute or so.	6	①	②	③	④	⑤	⑥
7. The child's bowel movements come at different times from day to day (over 1-hour difference).	7	①	②	③	④	⑤	⑥
8. The child is fussy on waking up (frowns, complains, cries).	8	①	②	③	④	⑤	⑥
9. The child's initial reaction to a new babysitter is rejection (crying, clinging to mother, etc.).	9	①	②	③	④	⑤	⑥
10. The child reacts to a disliked food even if it is mixed with a preferred one.	10	①	②	③	④	⑤	⑥
11. The child accepts delays (for several minutes) for desired objects or activities (snacks, treats, gifts).	11	①	②	③	④	⑤	⑥
12. The child moves little (stays still) when being dressed.	12	①	②	③	④	⑤	⑥
13. The child continues an activity in spite of noises in the same room.	13	①	②	③	④	⑤	⑥
14. The child shows strong reactions (cries, stamps feet) to failure.	14	①	②	③	④	⑤	⑥
15. The child plays continuously for more than 10 minutes at a time with a favorite toy.	15	①	②	③	④	⑤	⑥
16. The child ignores the temperature of food, whether hot or cold.	16	①	②	③	④	⑤	⑥
17. The child varies from day to day in wanting a bottle or snack before bedtime at night.	17	①	②	③	④	⑤	⑥
18. The child sits still while waiting for food.	18	①	②	③	④	⑤	⑥
19. The child is easily excited by praise (laughs, yells, jumps).	19	①	②	③	④	⑤	⑥
20. The child cries after a fall or bump.	20	①	②	③	④	⑤	⑥
21. The child approaches and plays with unfamiliar pets (small dogs, cats).	21	①	②	③	④	⑤	⑥
22. The child stops eating and looks up when a person walks by.	22	①	②	③	④	⑤	⑥
23. The child seems unaware of differences in taste of familiar liquids (type of milk, different juices).	23	①	②	③	④	⑤	⑥
24. The child moves about actively when he/she explores new places (runs, climbs or jumps).	24	①	②	③	④	⑤	⑥
25. The child fusses or whines when bottom is cleaned after bowel movement.	25	①	②	③	④	⑤	⑥
26. The child smiles when played with by unfamiliar adults.	26	①	②	③	④	⑤	⑥
27. The child looks up from play when mother enters the room.	27	①	②	③	④	⑤	⑥
28. The child spends over an hour reading a book or looking at the pictures.	28	①	②	③	④	⑤	⑥
29. The child responds intensely (screams, yells) to frustration.	29	①	②	③	④	⑤	⑥
30. The child eats about the same amount of solid food at meals from day to day.	30	①	②	③	④	⑤	⑥
31. The child remains pleasant when hungry and waiting for food to be prepared.	31	①	②	③	④	⑤	⑥
32. The child allows face washing without protest (squirming, turning away).	32	①	②	③	④	⑤	⑥
33. The amount of milk or juice the child takes at mealtime is unpredictable from meal to meal (over 2 oz. difference).	33	①	②	③	④	⑤	⑥
34. The child practices physical activities (climbing, jumping, pushing objects) for under 5 minutes.	34	①	②	③	④	⑤	⑥
35. The child vigorously resists additional food or milk when full (spits out, clamps mouth closed, bats at spoon, etc.).	35	①	②	③	④	⑤	⑥
36. The child plays actively (bangs, throws, runs) with toy indoors.	36	①	②	③	④	⑤	⑥

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
37. The child ignores voices when playing with a favorite toy.	37	①	②	③	④	⑤	⑥
38. The child approaches (moves toward) new visitors at home.	38	①	②	③	④	⑤	⑥
39. The child plays outside on hot or cold days without seeming to notice differences in temperature.	39	①	②	③	④	⑤	⑥
40. The child continues playing with other children for under 5 minutes and then goes elsewhere.	40	①	②	③	④	⑤	⑥
41. The child continues to look at a picture book in spite of distracting noises (car horns, doorbell).	41	①	②	③	④	⑤	⑥
42. The child wants a snack at a different time each day (over 1- hour difference).	42	①	②	③	④	⑤	⑥
43. The child is pleasant (smiles) when put down for nap or at night.	43	①	②	③	④	⑤	⑥
44. The child takes several days to get used to (show usual behavior in) new situations away from parent (play group, day care center, sitter).	44	①	②	③	④	⑤	⑥
45. The child speaks (or vocalizes) right away to unfamiliar adults.	45	①	②	③	④	⑤	⑥
46. The child reacts strongly (cries or screams) when unable to complete a play activity.	46	①	②	③	④	⑤	⑥
47. The child enjoys games with running and jumping more than games done sitting down.	47	①	②	③	④	⑤	⑥
48. The child notices wet clothing and wants to be changed right away.	48	①	②	③	④	⑤	⑥
49. The child is fussy or moody throughout a cold or an intestinal virus.	49	①	②	③	④	⑤	⑥
50. The child ignores parent's first call while watching a favorite TV program.	50	①	②	③	④	⑤	⑥
51. A child loses interest in a new toy or game within an hour.	51	①	②	③	④	⑤	⑥
52. The child runs to get where he/she wants to go.	52	①	②	③	④	⑤	⑥
53. For the first few minutes in a new place (store, home, or, vacation place) the child is wary (clings to mother, holds back).	53	①	②	③	④	⑤	⑥
54. The child takes daytime naps at differing times (over 1/2-hour difference) from day to day.	54	①	②	③	④	⑤	⑥
55. The child reacts mildly (frown or smile) when his/her play is interrupted by parent.	55	①	②	③	④	⑤	⑥
56. The child accepts being dressed and undressed without protest.	56	①	②	③	④	⑤	⑥
57. The child is outgoing with adult strangers outside the home.	57	①	②	③	④	⑤	⑥
58. The child runs ahead when walking with the parent.	58	①	②	③	④	⑤	⑥
59. The child's period of greatest physical activity comes at same time of day.	59	①	②	③	④	⑤	⑥
60. The child can be coaxed out of a forbidden activity.	60	①	②	③	④	⑤	⑥
61. The child stops play and watches when someone walks by.	61	①	②	③	④	⑤	⑥
62. The child goes back to the same activity after brief interruption (snack, trip to toilet).	62	①	②	③	④	⑤	⑥
63. The child laughs or smiles when meeting other children.	63	①	②	③	④	⑤	⑥
64. The child sits still while watching TV or listening to music.	64	①	②	③	④	⑤	⑥
65. The child will avoid repetition of misbehavior if punished firmly once or twice.	65	①	②	③	④	⑤	⑥
66. The child continues to play with a toy in spite of sudden noises from outdoors (car horn, siren, etc.).	66	①	②	③	④	⑤	⑥
67. The child ignores dirt on himself/herself.	67	①	②	③	④	⑤	⑥
68. The child's time of waking in the morning varies greatly (by 1 hour or more) from day to day.	68	①	②	③	④	⑤	⑥
69. The child has moody or "off" days when he/she is fussy all day.	69	①	②	③	④	⑤	⑥
70. The child reacts mildly (frown or smile) when another child takes his/her toy.	70	①	②	③	④	⑤	⑥
71. The child stays with a routine task (dressing, picking up toys) up to 5 minutes or more.	71	①	②	③	④	⑤	⑥
72. The child stops eating and looks when he/she hears an unusual noise (telephone, doorbell).	72	①	②	③	④	⑤	⑥
73. The child sits still (moves little) during procedures like hair brushing or nail cutting.	73	①	②	③	④	⑤	⑥
74. The child shows much body movement (stomps, writhes, swings arms) when upset or crying.	74	①	②	③	④	⑤	⑥

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS		ALMOST NEVER					ALMOST ALWAYS
75. The child is pleasant (smiles, laughs) during face washing.	75	①	②	③	④	⑤	⑥
76. The child's initial reaction at home to approach by strangers is acceptance (looks at, reaches out).	76	①	②	③	④	⑤	⑥
77. The child is hungry at dinner time.	77	①	②	③	④	⑤	⑥
78. The child continues to get into forbidden areas or objects in spite of parents' repeated warnings.	78	①	②	③	④	⑤	⑥
79. The child stops to examine new objects thoroughly (5 minutes or more).	79	①	②	③	④	⑤	⑥
80. The child ignores odors (cooking, smoke, perfume) whether pleasant or not.	80	①	②	③	④	⑤	⑥
81. The child looks up from an activity when he/she hears the sounds of children playing.	81	①	②	③	④	⑤	⑥
82. The child falls asleep in about the same length of time after being put to bed.	82	①	②	③	④	⑤	⑥
83. The child greets babysitter loudly with much expression of feeling, whether positive or negative.	83	①	②	③	④	⑤	⑥
84. The child is moody for more than a few minutes when corrected or disciplined.	84	①	②	③	④	⑤	⑥
85. The child sits still (little squirming) while traveling in car or stroller.	85	①	②	③	④	⑤	⑥
86. The child watches TV for under 10 minutes, then turns to another activity.	86	①	②	③	④	⑤	⑥
87. The child is shy (turns away or clings to mother) on meeting another child for the first time.	87	①	②	③	④	⑤	⑥
88. The child is still wary of strangers after 15 minutes.	88	①	②	③	④	⑤	⑥
89. The child frets or cries when first learning a new task (dressing self, picking up toys).	89	①	②	③	④	⑤	⑥
90. The child sits quietly in the bath.	90	①	②	③	④	⑤	⑥
91. The child practices a new skill (throwing, piling, drawing) for 10 minutes or more.	91	①	②	③	④	⑤	⑥
92. The child ignores differences in taste or consistency of familiar foods.	92	①	②	③	④	⑤	⑥
93. The child sleeps poorly (restless, wakeful) in new places for first two or three times.	93	①	②	③	④	⑤	⑥
94. Child is fearful of being put down in an unfamiliar place (supermarket cart, new stroller, playpen) with parent present.	94	①	②	③	④	⑤	⑥
95. The child frowns or complains when left to play by self.	95	①	②	③	④	⑤	⑥
96. The child accepts within 10 minutes (feels at home, at ease) new surroundings (home, store, play area).	96	①	②	③	④	⑤	⑥
97. The child looks up from play when the telephone or doorbell rings.	97	①	②	③	④	⑤	⑥

GENERAL IMPRESSIONS OF TODDLER'S TEMPERAMENT

In comparison with other children you know who are the same age as your toddler, how would you rate your toddler in the following areas? Mark 1 to 6 on the right to correspond to the descriptions below.

1. Activity level-the amount of physical motion during daily routine. 1-very inactive 2-inactive 3-somewhat inactive 4-somewhat active 5-active 6-very active	1	①	②	③	④	⑤	⑥
2. Rhythmicity-regularity of bodily functioning in sleep, hunger, bowel movements, etc. 1-very regular 2-regular 3-somewhat regular 4-somewhat irregular 5-irregular 6-very irregular	2	①	②	③	④	⑤	⑥
3. Approach-responses to new persons,places,events. 1-not hesitant 2-very slightly hesitant 3-somewhat hesitant 4-moderately hesitant 5-hesitant 6-very hesitant	3	①	②	③	④	⑤	⑥
4. Adaptability-the ease/difficulty with which your toddler can change to socially acceptable behavior. 1-very quick to adapt 2-adaptable 3-somewhat adaptable 4-somewhat slow to adapt 5-slow to adapt 6-very slow to adapt	4	①	②	③	④	⑤	⑥
5. Intensity-the amount of energy in a response, whether negative or positive. 1-very mild 2-mild 3-somewhat mild 4-somewhat intense 5-intense 6-very intense	5	①	②	③	④	⑤	⑥
6. Mood-general amount of pleasant or unpleasant feelings. 1-very pleasant 2-pleasant 3-somewhat pleasant 4-somewhat unpleasant 5-unpleasant 6-very unpleasant	6	①	②	③	④	⑤	⑥
7. Persistence/Attention Span-how long your toddler stays with a task or activity. 1-very persistent 2-persistent 3-somewhat persistent 4-somewhat nonpersistent 5-nonpersistent 6-very nonpersistent	7	①	②	③	④	⑤	⑥
8. Distractibility-the effect of external stimuli (sounds, persons, etc.) on ongoing behavior. 1-rarely distracted 2-seldom distracted 3-sometimes distracted 4-regularly distracted 5-often distracted 6-very often distracted	8	①	②	③	④	⑤	⑥
9. Threshold-general sensitivity or insensitivity to stimuli (sound, odor, taste, light, etc.). 1-very nonreactive 2-nonreactive 3-somewhat nonreactive 4-somewhat sensitive 5-sensitive 6-very sensitive	9	①	②	③	④	⑤	⑥
10. How manageable is this toddler? 1-very easy 2-easy 3-somewhat easy 4-somewhat difficult 5-difficult 6-very difficult	10	①	②	③	④	⑤	⑥

Appendix 12: Behavioural Style Questionnaire

The Carey Temperament Scales™

Behavioral Style Questionnaire

for 3-to-7 year-old children

by Sean C. McDevitt, PhD, and William B. Carey, MD

Child's Name _____ Gender _____

Child's Date of Birth ____/____/____ Present Age _____
Month Day Year

Rater's Name _____

Rater's Relationship to Child _____

Date of Rating ____/____/____
Month Day Year

Instructions

1. There are no right or wrong or good or bad answers, only descriptions of your child.
2. Please base your rating on your child's recent and current behavior (the last four to six weeks).
3. Rate each question separately. Some items may seem alike but are not the same. Do not purposely try to present a consistent picture of your child.
4. Use extreme ratings where appropriate. Try to avoid rating only near the middle of each scale.
5. Rate each item quickly. If you cannot decide, skip the item and come back to it later.
6. Rate every item. Please skip any item that you are unable to answer due to lack of information or any item that does not apply to your child.
7. Consider only your own impressions and observations of the child.

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Using the scale below, please darken the circle in the space that tells how often the child's recent and current behavior has been like the behavior described by each item.

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
1. The child is moody for more than a few minutes when corrected or disciplined.	1	①	②	③	④	⑤	⑥
2. The child seems not to hear when involved in a favorite activity.	2	①	②	③	④	⑤	
3. The child can be coaxed out of a forbidden activity.	3	①	②	③	④	⑤	⑥
4. The child runs ahead when walking with the parent.	4	①	②	③	④	⑤	⑥
5. The child laughs and smiles while playing.	5	①	②	③	④	⑤	⑥
6. The child moves slowly when working on a project or activity.	6	①	②	③	④	⑤	⑥
7. The child responds intensely to disapproval.	7	①	②	③	④	⑤	⑥
8. The child needs a period of adjustment to get used to changes in school or at home.	8	①	②	③	④	⑤	⑥
9. The child enjoys games that involve running or jumping.	9	①	②	③	④	⑤	⑥
10. The child is slow to adjust to changes in household rules.	10	①	②	③	④	⑤	⑥
11. The child has bowel movements at about the same time each day.	11	①	②	③	④	⑤	⑥
12. The child is willing to try new things.	12	①	②	③	④	⑤	⑥
13. The child sits calmly while watching TV or listening to music.	13	①	②	③	④	⑤	⑥
14. The child leaves or wants to leave the table during meals.	14	①	②	③	④	⑤	⑥
15. Change in plans bother the child.	15	①	②	③	④	⑤	⑥
16. The child notices minor changes in mother's dress or appearance (clothing, hairstyle, etc.).	16	①	②	③	④	⑤	⑥
17. The child does not acknowledge a call to come in if involved in something.	17	①	②	③	④	⑤	⑥
18. The child responds to mild disapproval by the parent (a frown or shake of the head).	18	①	②	③	④	⑤	⑥
19. The child settles arguments with playmates within a few minutes.	19	①	②	③	④	⑤	
20. The child shows strong reaction to things, both positive and negative.	20	①	②	③	④	⑤	⑥
21. The child had trouble leaving the mother the first three days when he/she entered school.	21	①	②	③	④	⑤	⑥
22. The child picks up the nuances or subtleties of parental explanations (example: implied meaning).	22	①	②	③	④	⑤	⑥
23. The child falls asleep as soon as he/she is put to bed.	23	①	②	③	④	⑤	⑥
24. The child moves about actively when he/she explores new places.	24	①	②	③	④	⑤	⑥
25. The child likes to go to new places rather than familiar ones.	25	①	②	③	④	⑤	⑥
26. The child sits quietly while waiting.	26	①	②	③	④	⑤	⑥
27. The child spends over an hour reading a book or looking at the pictures.	27	①	②	③	④	⑤	⑥
28. The child learns new things at his/her level quickly and easily.	28	①	②	③	④	⑤	⑥
29. The child smiles or laughs when he/she meets new visitors at home.	29	①	②	③	④	⑤	⑥
30. The child is easily excited by praise.	30	①	②	③	④	⑤	⑥
31. The child is outgoing with strangers.	31	①	②	③	④	⑤	⑥
32. The child fidgets when he/she has to stay still.	32	①	②	③	④	⑤	⑥
33. The child says he/she is "bored" with his/her toys and games.	33	①	②	③	④	⑤	⑥
34. The child is annoyed at interrupting play to comply with a parental request.	34	①	②	③	④	⑤	⑥
35. The child practices an activity until he/she masters it.	35	①	②	③	④	⑤	⑥
36. The child eats about the same amount at supper from day to day.	36	①	②	③	④	⑤	
37. Unusual noises (sirens, thunder, etc.) interrupt the child's behavior.	37	①	②	③	④	⑤	⑥
38. The child complains when tired.	38	①	②	③	④	⑤	⑥

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS

		ALMOST NEVER					ALMOST ALWAYS
39. The child loses interest in a new toy or game the same day.	39	①	②	③	④	⑤	⑥
40. The child becomes engrossed in an interesting activity for one half hour or more.	40	①	②	③	④	⑤	⑥
41. The child cries intensely when hurt.	41	①	②	③	④	⑤	⑥
42. The child reacts strongly to kidding or light-hearted comments.	42	①	②	③	④	⑤	⑥
43. The child approaches children his/her age that he/she doesn't know.	43	①	②	③	④	⑤	⑥
44. The child plays quietly with his/her toys and games.	44	①	②	③	④	⑤	⑥
45. The child is outwardly expressive of his/her emotions.	45	①	②	③	④	⑤	⑥
46. The child is enthusiastic when he/she masters an activity and wants to show everyone.	46	①	②	③	④	⑤	⑥
47. The child is sleepy at his/her bed-time.	47	①	②	③	④	⑤	⑥
48. The child stops an activity because something else catches his/her attention.	48	①	②	③	④	⑤	⑥
49. The child is hungry at dinner time.	49	①	②	③	④	⑤	⑥
50. The child holds back until sure of himself/herself.	50	①	②	③	④	⑤	⑥
51. The child looks up when someone walks past the door-way.	51	①	②	③	④	⑤	⑥
52. The child becomes upset if he/she misses a regular television program.	52	①	②	③	④	⑤	⑥
53. The child reacts strongly (cries or complains) to a disappointment or failure.	53	①	②	③	④	⑤	⑥
54. The child accepts new foods within one or two tries.	54	①	②	③	④	⑤	⑥
55. The child has difficulty getting used to new situations.	55	①	②	③	④	⑤	⑥
56. The child will avoid misbehavior if punished firmly once or twice.	56	①	②	③	④	⑤	⑥
57. The child is sensitive to noises (television, doorbell) and looks up right away.	57	①	②	③	④	⑤	⑥
58. The child prefers active outdoor play to quite play inside.	58	①	②	③	④	⑤	⑥
59. The child dislikes milk and other drinks if not ice cold.	59	①	②	③	④	⑤	⑥
60. The child notices differences or changes in the consistency of food.	60	①	②	③	④	⑤	⑥
61. The child adjusts easily to changes in his/her routine.	61	①	②	③	④	⑤	⑥
62. The child eats about the same amount at breakfast from day to day.	62	①	②	③	④	⑤	⑥
63. The child seems to take setbacks in stride.	63	①	②	③	④	⑤	⑥
64. The child cries and whines when frustrated.	64	①	②	③	④	⑤	⑥
65. The child repeats behavior for which he/she has previously been punished.	65	①	②	③	④	⑤	⑥
66. The child looks up from playing when the telephone rings.	66	①	②	③	④	⑤	⑥
67. The child is willing to try new foods.	67	①	②	③	④	⑤	⑥
68. The child needs encouragement before he/she will try new things.	68	①	②	③	④	⑤	⑥
69. The child cries or whines when ill with a cold or upset stomach.	69	①	②	③	④	⑤	⑥
70. The child runs to get where he/she want to go.	70	①	②	③	④	⑤	⑥
71. The child's attention drifts away or lapses when listening to parental instructions.	71	①	②	③	④	⑤	⑥
72. The child becomes angry with one of his/her playmates.	72	①	②	③	④	⑤	⑥
73. The child is reluctant to give up when trying to do a difficult task.	73	①	②	③	④	⑤	⑥
74. The child reacts to mild approval from the parent (a nod or smile).	74	①	②	③	④	⑤	⑥
75. The child requests "something to eat" between meals and regular snacks.	75	①	②	③	④	⑤	⑥
76. The child rushes to greet the parent or greets loudly after absence during the day.	76	①	②	③	④	⑤	⑥
77. The child looks up when he/she hears voices in the next room.	77	①	②	③	④	⑤	⑥

1 = ALMOST NEVER 2 = RARELY 3 = VARIABLE, USUALLY DOES NOT 4 = VARIABLE, USUALLY DOES 5 = FREQUENTLY 6 = ALMOST ALWAYS		ALMOST NEVER					ALMOST ALWAYS
78. The child protests when denied a request by the parent.	78	①	②	③	④	⑤	⑥
79. The child ignores loud noises when reading or looking at pictures in a book.	79	①	②	③	④	⑤	⑥
80. The child dislikes a food that he/she had previously seemed to accept.	80	①	②	③	④	⑤	[illegible]
81. The child stops what he/she is doing and looks up when the parent enters the room..	81	①	②	③	④	⑤	⑥
82. The child cries for more than a few minutes when hurt.	82	①	②	③	④	⑤	⑥
83. The child watches a long (1 hour or more) TV program without getting up to do something else.	83	①	②	③	④	⑤	⑥
84. The child spontaneously wakes up at the usual time on the weekends and holidays.	84	①	②	③	④	⑤	⑥
85. The child responds to sounds or noises unrelated to his/her activity.	85	①	②	③	④	⑤	⑥
86. The child avoids new guests or visitors.	86	①	②	③	④	⑤	⑥
87. The child fidgets when a story is being read to him/her.	87	①	②	③	④	⑤	⑥
88. The child becomes upset or cries over minor falls or bumps.	88	①	②	③	④	⑤	⑥
89. The child interrupts an activity to listen to conversation around him/her.	89	①	②	③	④	⑤	⑥
90. The child is unwilling to leave a play activity that he/she has not completed.	90	①	②	③	④	⑤	⑥
91. The child is able to fall asleep when there is conversation in a nearby room.	91	①	②	③	④	⑤	⑥
92. The child becomes highly excited when presented with new toy or game.	92	①	②	③	④	⑤	⑥
93. The child pays attention from start to finish when the parent tries to explain something to him/her.	93	①	②	③	④	⑤	⑥
94. The child speaks so quickly that it is sometimes difficult to understand him/her.	94	①	②	③	④	⑤	⑥
95. The child wants to leave the table during meals to answer the doorbell or phone.	95	①	②	③	④	⑤	⑥
96. The child complains of events in school or with playmates that day.	96	①	②	③	④	⑤	⑥
97. The child frowns when asked to do a chore by the parent.	97	①	②	③	④	⑤	[illegible]
98. The child tends to hold back in new situations.	98	①	②	③	④	⑤	⑥
99. The child laughs hard while watching television cartoons or comedy.	99	①	②	③	④	⑤	⑥
100. The child has "off" days when he/she is moody or cranky.	100	①	②	③	④	⑤	⑥

GENERAL IMPRESSIONS OF CHILD'S TEMPERAMENT

In comparison with other children you know who are the same age as your child, how would you rate your child in the following areas? Mark 1 to 6 on the right to correspond to the descriptions below.

1. Activity level - the amount of physical motion during daily routine. 1-very inactive 2-inactive 3-somewhat inactive 4-somewhat active 5-active 6-very active	1	①	②	③	④	⑤	⑥
2. Rhythmicity - regularity of bodily functioning in sleep, hunger, bowel movements, etc. 1-very regular 2-regular 3-somewhat regular 4-somewhat irregular 5-irregular 6-very irregular	2	①	②	③	④	⑤	⑥
3. Approach - responses to new persons,places,events. 1-not hesitant 2-very slightly hesitant 3-somewhat hesitant 4-moderately hesitant 5-hesitant 6-very hesitant	3	①	②	③	④	⑤	⑥
4. Adaptability - the ease/difficulty with which your child can change to socially acceptable behavior. 1-very quick to adapt 2-adaptable 3-somewhat adaptable 4-somewhat slow to adapt 5-slow to adapt 6-very slow to adapt	4	①	②	③	④	⑤	⑥
5. Intensity - the amount of energy in a response whether negative or positive. 1-very mild 2-mild 3-somewhat mild 4-somewhat intense 5-intense 6-very intense	5	①	②	③	④	⑤	⑥
6. Mood - general amount of pleasant or unpleasant feelings. 1-very pleasant 2-pleasant 3-somewhat pleasant 4-somewhat unpleasant 5-unpleasant 6-very unpleasant	6	①	②	③	④	⑤	⑥
7. Persistence/Attention Span - how long your child stays with a task or activity. 1-very persistence 2-persistent 3-somewhat persistent 4-somewhat nonpersistent 5-nonpersistent 6-very nonpersistent	7	①	②	③	④	⑤	⑥
8. Distractibility - the effect of external stimuli (sounds, persons, etc.) on ongoing behavior. 1-rarely distracted 2-seldom distracted 3-sometimes distracted 4-regularly distracted 5-often distracted 6-very often distracted	8	①	②	③	④	⑤	[illegible]
9. Threshold - general sensitivity or insensitivity to stimuli (sound, odor, taste, light, etc.). 1-very nonreactive 2-nonreactive 3-somewhat nonreactive 4-somewhat sensitive 5-sensitive 6-very sensitive	9	①	②	③	④	⑤	⑥
10. How manageable is this child? 1-very easy 2-easy 3-somewhat easy 4-somewhat difficult 5-difficult 6-very difficult	10	①	②	③	④	⑤	⑥

Appendix 13: Adult Temperament Questionnaire

Adult Temperament Questionnaire

by Stella Chess, MD & Alexander Thomas, MD

Name _____ Gender _____

Date of Birth _____

Date of Rating _____

Scored by _____

Instructions

1. There are no right or wrong or good or bad answers, only descriptions of behavior.
2. Base your ratings on your recent and current behavior.
3. Rate each question separately. Some items may seem alike but are not the same.
4. Rate every item. If you haven't had the experience or the item does not apply, imagine how you would respond in the situation.
5. Consider only your own impressions; do not discuss the items or ask for the opinions of others.

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Using the scale below, please circle the number that tells how often your recent behavior or reactions have been like that described in each item:

1=HARDLY EVER 2=RARELY 3=ONCE IN A WHILE 4=SOMETIMES 5=OFTEN 6=VERY OFTEN 7=ALMOST ALWAYS

		Hardly Ever						Almost Always
1.	I prefer a hobby which has a lot of activity and movement, rather than one which requires a lot of sitting 1	1	2	3	4	5	6	7
2.	I get hungry for lunch at the same time daily even if my daily work routine varies 2	1	2	3	4	5	6	7
3.	When I travel and have to change to a different airplane, bus, or train, it takes me only a few minutes to get used to the new one 3	1	2	3	4	5	6	7
4.	I am comfortable wearing clothing with a wide range of softness or roughness 4	1	2	3	4	5	6	7
5.	If someone in my group invites me to his/her house for the first time, I am quite uncomfortable. 5	1	2	3	4	5	6	7
6.	If I'm with a group, even if I'm busy doing something, I pay attention to what everybody else is doing 6	1	2	3	4	5	6	7
7.	If I make a bad play in a game or sport, I get very angry. 7	1	2	3	4	5	6	7
8.	If I am learning something new, I stick to it for hours at a time. 8	1	2	3	4	5	6	7
9.	I can tolerate faults and annoyances in my friends cheerfully 9	1	2	3	4	5	6	7
10.	If an outing or athletic activity (tennis, swimming) is called off by bad weather, I don't mind staying at home without any exercise. 10	1	2	3	4	5	6	7
11.	My sleep needs are quite variable, from a few to many hours 11	1	2	3	4	5	6	7
12.	If my school or work schedule is suddenly changed I get used to it quickly, usually within a few days 12	1	2	3	4	5	6	7
13.	If I'm doing something with a rough material, like wool or cloth, my skin gets sensitive very quickly 13	1	2	3	4	5	6	7
14.	I like to experiment with something new and different in my hobbies and interests, rather than sticking to the same thing 14	1	2	3	4	5	6	7
15.	When I'm reading something interesting, I don't notice if someone comes into the room. 15	1	2	3	4	5	6	7
16.	When traveling, if I have to wait a long time for a bus, train, or airplane, I shrug it off and it gets me only a little upset. 16	1	2	3	4	5	6	7
17.	If I am cleaning or washing at home and it takes a long time, I quit when I begin to feel tired, even if I am far from finished 17	1	2	3	4	5	6	7
18.	If I am playing a game or sport and someone begins to fool around or joke, I get the spirit of it and enjoy the fooling around 18	1	2	3	4	5	6	7
19.	If I play ball, I prefer an active position (infield vs. outfield); if I swim, I move energetically and don't like to float or tread water 19	1	2	3	4	5	6	7
20.	I seem to get sleepy just about the same time nightly 20	1	2	3	4	5	6	7
21.	When my work or study task changes, it takes more than 2 weeks to feel natural with what I must do 21	1	2	3	4	5	6	7
22.	When I am driving or riding in a car I am the first to want the car heater turned on, if it gets cold 22	1	2	3	4	5	6	7

1=HARDLY EVER 2=RARELY 3=ONCE IN A WHILE 4=SOMETIMES 5=OFTEN 6=VERY OFTEN 7=ALMOST ALWAYS

		Hardly Ever						Almost Always
23.	I like to go to parties where I meet new people because I make friends quickly 23	1	2	3	4	5	6	7
24.	If I am talking to someone and another conversation begins nearby, I find it hard to keep my concentration on my own conversation 24	1	2	3	4	5	6	7
25.	I feel calm when problems arise even though others get upset 25	1	2	3	4	5	6	7
26.	If I am solving a problem while doing a hobby or other activity I enjoy, I stick to it for hours even if I am having trouble figuring out a solution 26	1	2	3	4	5	6	7
27.	I get annoyed when someone is careless and find it hard to forgive it 27	1	2	3	4	5	6	7
28.	I prefer group activities with a lot of movement, like active sports and games to those with mostly sitting around. 28	1	2	3	4	5	6	7
29.	There is no set time when I go to sleep, sometimes it's early and sometimes it's late. 29	1	2	3	4	5	6	7
30.	When I buy a new piece of furniture it takes a long time to feel at home with it 30	1	2	3	4	5	6	7
31.	I can't wear rough clothing because it irritates my skin 31	1	2	3	4	5	6	7
32.	I feel shy in any group of strange people 32	1	2	3	4	5	6	7
33.	At a movie or the theater, my attention gets distracted if someone makes a noise or moves 33	1	2	3	4	5	6	7
34.	If someone messes up my room or apartment I get very angry and tell that person how I feel 34	1	2	3	4	5	6	7
35.	When I start to work on a difficult problem or puzzle, if I can't work it out quickly I lose interest and give it up 35	1	2	3	4	5	6	7
36.	People think I am a cynic because I am negative about many things 36	1	2	3	4	5	6	7
37.	I prefer to sit and watch a game rather than play in it myself. 37	1	2	3	4	5	6	7
38.	If I am home I cook lunch or dinner at the same time because I get hungry at the same time each day 38	1	2	3	4	5	6	7
39.	If my assigned work is suddenly changed, I feel uncertain for a long time 39	1	2	3	4	5	6	7
40.	When I am with my group and someone complains that it is too hot or too cold, I am surprised because I hadn't noticed it. 40	1	2	3	4	5	6	7
41.	I prefer to meet with a few old friends instead of gatherings where I will meet new people 41	1	2	3	4	5	6	7
42.	When I concentrate on something I am doing, noises and other people's activity don't disturb me 42	1	2	3	4	5	6	7
43.	When driving or riding in a car and the car breaks down I get very upset, even if others tell me to relax 43	1	2	3	4	5	6	7
44.	If I am working on something and get interrupted, even several times, I return to the work until I finish it 44	1	2	3	4	5	6	7
45.	I get annoyed if I'm with a group and there is a lot of joking and kidding around 45	1	2	3	4	5	6	7
46.	I don't enjoy physically active sports. I would rather sit and watch such a game 46	1	2	3	4	5	6	7

1=HARDLY EVER 2=RARELY 3=ONCE IN A WHILE 4=SOMETIMES 5=OFTEN 6=VERY OFTEN 7=ALMOST ALWAYS

	Hardly Ever						Almost Always
47. I usually can't predict when I will want lunch or dinner, in contrast to the people who get hungry at the same time each day.....47	1	2	3	4	5	6	7
48. When I travel if the bus or train is very crowded and uncomfortable I get used to it after a few minutes or so.....48	1	2	3	4	5	6	7
49. When I travel by train or bus I don't mind if it is very warm or cold, even if others are complaining.....49	1	2	3	4	5	6	7
50. I like to go to a party or gathering where I will meet new people.....50	1	2	3	4	5	6	7
51. No matter how many people are talking around me, I have no trouble concentrating on the people to whom I am talking.....51	1	2	3	4	5	6	7
52. If I'm criticized or treated unfairly, I show very little annoyance.....52	1	2	3	4	5	6	7
53. I don't like to concentrate on a job or project a long time. I prefer to take frequent breaks, even if I am enjoying the activity.....53	1	2	3	4	5	6	7
54. If someone does a stupid thing, I don't get annoyed but can see the funny side of it.....54	1	2	3	4	5	6	7

GENERAL IMPRESSIONS OF TEMPERAMENT: In comparison with other adults you know, how would you rate yourself in the following areas?

Activity level-the amount of physical motion or movement shown during the day. 1=very active; 2=active; 3=somewhat active; 4=somewhat inactive; 5=inactive; 6=very inactive	1	2	3	4	5	6
Rhythmicity-the regularity of bodily functions such as eating, sleeping and elimination. 1=very irregular; 2=irregular; 3=somewhat irregular; 4=somewhat regular; 5=regular; 6 very regular	1	2	3	4	5	6
Adaptability-the ease with which a person adjusts to changes in routine or to life changes. 1=very adaptable; 2=adaptable 3=somewhat adaptable; 4=somewhat nonadaptable; 5=nonadaptable; 6=very nonadaptable	1	2	3	4	5	6
Approach-response to new things-curiosity vs. caution in dealing with the unfamiliar. 1=very approaching; 2=approaching; 3=somewhat approaching; 4=somewhat withdrawing; 5=withdrawing; 6=very withdrawing	1	2	3	4	5	6
Intensity-the amount of energy expressed in responses to situations,whether positive or negative. 1=very mild; 2=mild; 3=somewhat mild; 4=somewhat intense; 5=intense; 6=very intense	1	2	3	4	5	6
Mood-the quality of emotions expressed; either positive or negative in tone. 1=very positive; 2=positive; 3=somewhat positive; 4=somewhat negative; 5=negative; 6=very negative	1	2	3	4	5	6
Persistence-the degree to which the person continues activities without interruption. 1=very persistent; 2=persistent; 3=somewhat persistent; 4=somewhat nonpersistent; 5=nonpersistent; 6=very nonpersistent	1	2	3	4	5	6
Distractibility-the ease with which ongoing behavior is interrupted by unrelated sights, sounds or other stimuli. 1=very nondistractible; nondistractible; somewhat nondistractible; 4=somewhat distractible; 5=distractible; 6=very distractible	1	2	3	4	5	6
Threshold-sensitivity to changes or differences in light, sound, taste and texture. 1=very nonreactive; 2=nonreactive; 3=somewhat nonreactive; 4=somewhat sensitive; 5=sensitive; 6=very sensitive	1	2	3	4	5	6

Appendix 14: Syntax for aligning items in the same direction

```
DO IF (casecode = 4).

RECODE

T1Q12 T1Q18 T1Q64 T1Q73 T1Q85 T1Q90  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1).

COMPUTE T1ACTMEAN = (T1Q2 + T1Q12 + T1Q18 + T1Q24 + T1Q36 + T1Q47 + T1Q52 + T1Q58
+ T1Q64 + T1Q73 + T1Q85 + T1Q90) / 12 .

COMPUTE T1ACTZ = ((T1ACTMEAN - 3.99)/0.86).

RECODE

  T1Q11 T1Q32 T1Q56 T1Q60 T1Q65  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1ADAPTMEAN = (T1Q11 + T1Q32+ T1Q44 + T1Q56 + T1Q60 + T1Q65 + T1Q78 +
T1Q88 + T1Q93) / 9 .

COMPUTE T1ADAPTZ = ((T1ADAPTMEAN - 3.04)/0.79).

RECODE

T1Q5 T1Q21 T1Q26 T1Q38 T1Q45 T1Q57 T1Q76 T1Q96  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1APPROACHMEAN = (T1Q5 + T1Q9 + T1Q21 + T1Q26 + T1Q38 + T1Q45 + T1Q53 +
T1Q57 + T1Q76 + T1Q87 + T1Q94 + T1Q96) / 12 .

COMPUTE T1APPROACHZ = ((T1APPROACHMEAN - 2.91)/1.04).

RECODE

T1Q66 T1Q50 T1Q41 T1Q37 T1Q13  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1DISTRACTMEAN = (T1Q13 + T1Q22 + T1Q27 + T1Q37 + T1Q41 + T1Q50 + T1Q61 +
T1Q66 + T1Q72 + T1Q81 + T1Q97) / 11 .

COMPUTE T1DISTRACTZ = ((T1DISTRACTMEAN - 4.20)/0.53).

RECODE

T1Q70 T1Q55 T1Q3  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1INTENSEMEAN = (T1Q3 + T1Q14+ T1Q19 + T1Q29 + T1Q35 + T1Q46 + T1Q55 +
T1Q70 + T1Q74 + T1Q83) / 10 .

COMPUTE T1INTENSEZ = ((T1INTENSEMEAN - 4.06)/0.82).

RECODE
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```
  T1Q75 T1Q63 T1Q43 T1Q31 T1Q4  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1MOODMEAN = (T1Q4 + T1Q8+ T1Q20 + T1Q25 + T1Q31 + T1Q43 + T1Q49 +
T1Q63 + T1Q69 + T1Q75 + T1Q84 + T1Q89 + T1Q95) /  13 .

COMPUTE T1MOODZ = ((T1MOODMEAN - 2.90)/0.65).

RECODE

  T1Q71 T1Q79 T1Q91 T1Q62 T1Q28 T1Q15  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1PERSISTMEAN = (T1Q6 + T1Q15 + T1Q28 + T1Q34 + T1Q40 + T1Q51 + T1Q62 +
T1Q71 + T1Q79 + T1Q86 + T1Q91) / 11 .

COMPUTE T1PERSISTZ = ((T1PERSISTMEAN - 2.82)/0.75).

RECODE

  T1Q1 T1Q30 T1Q59 T1Q77 T1Q82  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1RHYTHMEAN = (T1Q1 + T1Q7 + T1Q17 + T1Q30 + T1Q33 + T1Q42 + T1Q54 +
T1Q59 + T1Q68 + T1Q77 + T1Q82) / 11 .

COMPUTE T1RHYTHZ = ((T1RHYTHMEAN - 2.78)/0.77).

RECODE

  T1Q92 T1Q80 T1Q67 T1Q39 T1Q23 T1Q16  (1=6)  (2=5)  (3=4)  (4=3)  (5=2)  (6=1)  .

COMPUTE T1THRESHMEAN = (T1Q10 + T1Q16 + T1Q23 + T1Q39 + T1Q48 + T1Q67 + T1Q80 +
T1Q92) / 8 .

COMPUTE T1THRESHZ = ((T1THRESHMEAN - 4.43)/0.87).

END IF .

EXECUTE .
```

Appendix 15: Sample feedback letter to participants at Time one.

NAMES HAVE BEEN CHANGED

NHS Primary Care Trust logo

Manchester Metropolitan University
Elizabeth Gaskell Site
Hathersage Road
M13 OJA
Phone: 0161 247

4th November 2008

Dear Jane

This letter gives you some feedback on the questionnaires you filled in about Milo's temperament.

The questions are divided into several different areas of developing personality and give a snapshot of how you felt Milo was behaving at the time you filled in the questionnaire. It will be interesting to see if this is the same or different when we meet up in a year's time.

As you know at this age children can be very different in different situations and on different days so this just gives a 'flavour' of how Milo usually is in relation to other children of a similar age.

Milo's temperament profile

Where a name is at either end, you are more likely to notice this aspect of temperament - both its plus points and negative aspects! Every characteristic has its own strengths and challenges depending on the situation e.g. having a low activity level is useful for a long journey but a challenge if going to the park with more active friends.

Overall, you felt that Milo's temperament makes him quite easy to manage. The answers you gave suggest that Milo is a child who becomes very focussed on his chosen activity, though he can get frustrated if he is trying to do something that doesn't work. He is not as active as many other children his age.

The word Mum represents your own temperament profile based on your questionnaire – it seems that at the moment you and Milo are rather different - you match on 4 out of the nine temperament areas and are at opposite ends on two!

Temperament area	**Questionnaire result**		
Activity levels	Low **Milo**	Average	High **Mum**
Daily rhythms **(eating, sleeping, toileting)**	Irregular	Average **Milo**	Very regular **Mum**
Distraction levels	Easily distracted	Average **Mum**	Very focussed **Milo**
Emotional reactions	Mild	Average **Milo / Mum**	Strong
Reactions to new things	Unsure	Average **Milo / Mum**	Very positive
Fitting in (adaptability)	Gradual	Average **Milo / Mum**	Quick
General mood	Gets 'worked up'	Average **Milo / Mum**	Positive
Persistence levels	Gives up **Milo**	Average	Keeps going **Mum**
Sensory awareness **(noticing light, noise and smells)**	Very sensitive	Average **Mum**	Very insensitive **Milo**

I hope this information is interesting for you and that Milo continues to do well. As you know I will contact you in a year's time to arrange to meet for the next stage. I'm really looking forward to seeing you both again.

Do contact me if you have any questions

Best wishes
Julie Phillips

Appendix 16: Sample feedback letter to participants at Time two

NAMES HAVE BEEN CHANGED

NHS Primary Care Trust logo

Manchester Metropolitan University
Elizabeth Gaskell Site
Hathersage Road
M13 OJA
Phone: 0161 247 2575

1st December, 2009

Dear Jane,

It was really lovely to meet up with you and Milo and Sarah again. This letter gives you some feedback on the questionnaires you filled in about Milo's temperament and your own.

The questions are divided into several different areas of developing personality and give a snapshot of how you felt Milo was behaving at each time you filled in the questionnaire.

As you know at this age children can be very different in different situations and on different days so this just gives a 'flavour' of how Milo usually is in relation to other children of a similar age.

Milo's temperament profile

Milo's recent temperament questionnaire suggests his temperament has broadly stayed the same (5/9 areas). This year, all his scores now put him in the average range for children his age.

The word **Mum** represents your own temperament profile based on your questionnaire – it seems that you and Milo are a little more similar than last year – you match on five out of the nine temperament areas! The questionnaire picks up that you have not changed very much at all– with 8/9 areas staying the same.

Temperament area	**Questionnaire results**	
	November 08	**November 09**
Activity level	**Milo -** Low **Mum -** High	**Milo** - Average **Mum**- High
Daily rhythms **(eating, sleeping)**	**Milo -** Average **Mum –** Very regular	**Milo -** Average **Mum –** Very regular
Distraction level	**Milo –** Very focussed **Mum** - Average	**Milo** – Average **Mum** - Average
Emotional reactions	**Milo** - Average **Mum** - Average	**Milo** – Average **Mum** - Average
Reactions to new things	**Milo** - Average **Mum** - Average	**Milo -** Average **Mum –** Average
Fitting in **(adaptability)**	**Milo -** Average **Mum –** Average	**Milo -** Average **Mum –** Average
General mood	**Milo -** Average **Mum –** Average	**Milo -** Average **Mum –** Negative
Persistence level	**Milo -** Gives up **Mum –** Keeps going	**Milo -** Average **Mum –** Keeps going
Sensory awareness **(e.g. light, noise, smells)**	**Milo -** Very insensitive **Mum –** Average	**Milo -** Average **Mum –** Average

Match on :-	4/9	5/9

I hope this information is interesting for you and that Milo continues to do well. I will send a summary of the research findings when they are complete, but that won't be for a few years.

Do contact me if you have any questions.

Thank you so much for taking part, without your support we couldn't develop this type of new knowledge which I hope will help children with slow language development. It has been a real pleasure to meet with you.

Best wishes

Julie Phillips

PLS-3 (UK)

PRESCHOOL LANGUAGE SCALE-3(UK)

Name _____ Address _____

Age _____ Gender F ___ M ___ School _____

Teacher _____ Examiner _____

	Day	Month	Year
Date of Test			
Date of Birth			
Chronological Age			

	RAW SCORE CALCULATION		NORM-REFERENCED SCORES					
			Standard Score (SS)	SS Confidence Interval (–% level)	Percentile Rank (PR)	PRs for SS Confidence Interval values	Age Equivalents	Age Equivalent Confidence Interval
Auditory Comprehension	Last AC task administered							
	Minus number of 0 scores	–						
	AC RAW SCORE			to		to		to
Expressive Communication	Last EC task administered							
	Minus number of 0 scores	–						
	EC RAW SCORE			to		to		to
Total Language Score	AC Standard Score							
	plus EC Standard Score	+						
	STANDARD SCORE TOTAL			to		to		
	AC Raw Score + EC Raw Score							to

Supplementary Measures

Articulation Screener Raw Score _____
- ☐ indicates performance typical of age-peers
- ☐ may indicate need for further evaluation
- ☐ strongly indicates need for further evaluation

Language Sample Checklist
- ☐ reinforces information obtained on PLS-3 (UK)
- ☐ differs greatly from information obtained on PLS-3 (UK)

Background Information Form
- ☐ reinforces information obtained on PLS-3 (UK)
- ☐ differs greatly from information obtained on PLS-3 (UK)

Other test scores/relevant data

Standard Scores		AC Score	EC Score	Total Score	Standard Scores
	150	•	•	•	150
+3SD	145	•	•	•	145
	140	•	•	•	140
	135	•	•	•	135
+2SD	130	•	•	•	130
	125	•	•	•	125
	120	•	•	•	120
+1SD	115	•	•	•	115
	110	•	•	•	110
	105	•	•	•	105
Mean	100	•	•	•	100
	95	•	•	•	95
	90	•	•	•	90
–1SD	85	•	•	•	85
	80	•	•	•	80
	75	•	•	•	75
–2SD	70	•	•	•	70
	65	•	•	•	65
	60	•	•	•	60
–3SD	55	•	•	•	55
	50	•	•	•	50

See Chapter 5 in the *Examiner's Manual* to determine whether the difference between AC and EC scores is significant.

Harcourt Assessment

Starting point: Begin testing at the age level one year below the child's chronological age. Exceptions: Begin with task 1 for children under 1 year, 6 months. Begin with task 37 for children over 5 years, 11 months.
To score: Mark "✓" (correct response), "–" (incorrect response) or "NR" (no response) in the blanks. Pass criteria for numbered tasks are shown in parentheses below the task stimulus. Score "1" in the box if the pass criterion is met; score "0" if the pass criterion is not met.
Baseline: Three consecutive "1" scores prior to the first "0" score. (See manual if double baseline obtained.)
Ceiling: Five consecutive "0" scores.

Note: Items with an asterisk (*) can be scored as a "1" if you observe the child performing the behaviour spontaneously.

0 – 0 to 0 – 5 (Birth to 5 months)

Auditory Comprehension

1. *Looks intently at a speaker _____
   (Pass: Watches the speaker's face during play)
2. Reacts to the sound of kitchen foil
   Materials: Kitchen foil
   Keep the foil out of the child's reach _____
   (Pass: Reacts to the sound of foil)
3. *Turns head to locate the source of sound _____
   (Pass: Turns head to locate any sound)
4. Discriminates one sound from another _____
   Materials: Kitchen foil, keys
   (Pass: After getting used to and ignoring the foil, reacts to the keys)

Expressive Communication

1. *Vocalizes a variety of pleasure and displeasure sounds
   Pleasure: laughs ___ gurgles ___ giggles ___ squeals ___
   chuckles ___ other: _____
   Displeasure: cries: ___ screams ___ fusses ___
   other: _____
   (Pass: Vocalizes a minimum of two pleasure or displeasure sounds)
2. *Vocalizes when talked to (vocal contagion) _____
   (Pass: Responds to speech by vocalizing)
3. *Laughs
   Materials: Teddy
   Tickle or play with the child ___
   (Pass: Smiles and makes any sound showing pleasure)
4. *Engages in solitary vocal play ___
   (Pass: Coos or babbles)

0 – 6 to 0 – 11 (6 to 11 months)

5. Anticipates an event or a signal
   Materials: Teddy
   Repeat four times: **"Teddy's going to kiss the baby!"** Move Teddy towards the child. **"Kiss the baby!"** ___
   (Pass: Anticipates Teddy's movement)
6. Follows line of regard (joint attention)
   Materials: Teddy
   Walk Teddy across the table. **"Teddy's going for a walk."**
   Drop Teddy off the edge. **"Uh-oh!"**
   Look over the edge. **"Is Teddy over there?"** ___
   (Pass: Follows your gaze when you look *away* from where Teddy disappeared)
7. *Responds to "No" ___
   Materials: Ball
   (Pass: Withdraws or pauses before reaching for ball when you say **"No"**)
   Note: Observe the child's response to **"No"** if the child's caregiver happens to tell the child **"No"** spontaneously during the testing.
8. *Understands a specific word or phrase (other than "No") ___
   Write the word or phrase here:
   _____
   (Pass: Responds to a specific word or phrase)

5. *Combines sounds to form syllables ___
   Write examples below:
   _____
   (Pass: Produces two different sound combinations)
6. *Approximates sounds made by another person ___
   (Pass: Vocalizes similar sounds when someone vocalizes to him/her)
7. *Communicates nonverbally, using gestures or pushing and pulling behaviours ___
   (Pass: Spontaneously gestures without a model from you or the caregiver; pushes or pulls someone to communicate a message)
8. *Produces at least four different consonant-like sounds _____
   Write the sounds produced below:
   _____
   (Pass: Produces four or more different consonant-like sounds)

1 – 0 to 1 – 5 (12 to 17 months)

9. *Maintains attention for two minutes ___
Materials: Toys or books
(Pass: Plays with you, a toy, or a book for two or more minutes)

10. Follows simple instructions with cues
Materials: Ball, shoe box, keys
a. Place the keys near the child. **"Give me the keys."** ____
b. Place the box on the table. Hand the ball to the child. **"Put the ball in the box."** ____
c. Roll the ball to the child, then hold out your hands. **"Throw the ball."** ____
(Pass: Two correct)

11. Identifies familiar objects
Materials: Spoon, mug, sock, ball
"Give me the ...."
a. **ball** ____ b. **sock** ____ c. **spoon** ____
(Pass: Consistently identifies one object)

12. Identifies pictures
Materials: *Picture Manual*, p. 1
"Look at the pictures. Where is the ...?" a. **dog** ____ b. **baby** ____
(Pass: Consistently points to one picture)

9. *Has a vocabulary of at least one word ____
Sound combination: _____
Word represented: _____
(Pass: Consistently uses the same sound combination for an object or a person)

10. *Initiates a game or social routine ___
Describe what the child does below:
_____
_____
(Pass: Initiates play with examiner or caregiver)

11. *Varies the sounds produced in syllable strings ___
Write examples below:
_____
(Pass: Produces three to four syllables in one breath, varying the sounds produced within the sequence)

12. *Imitates a word
"Can you say ...?"
Tick the words the child imitates:
a. **Mummy** ____ b. **ball** ____
c. **bye-bye** ____ d. **doggie** ____
e. **biscuit** ____ f. other: _____
(Pass: Imitates one word)

1 – 6 to 1 – 11 (18 to 23 months)

13. Follows simple instructions without gestural cues
Materials: Brick, shoe box
a. **"Put the brick on the table."** ____
b. **"Put the brick in the box."** ____
c. **"Give the brick to me."** ____
(Pass: Two correct)

14. Identifies pictures
Materials: *Picture Manual*, p. 2
"Show me the ...."
a. **ball** ____ b. **shoe** ____ c. **spoon** ____ d. **mug** ____
(Pass: Two correct)

15. Indicates body parts on self
"Where is your ...?" a. **hair** ____ b. **eye** ____ c. **nose** ____ d. **foot** ____ e. **ear** ____ f. **hand** ____ g. **mouth** ____ h. **tummy** ____
(Pass: Four correct)

16. Understands verbs in context
Materials: Teddy, spoon, mug
a. **"Teddy's hungry. Give him something to *eat*."** ____
b. **"Teddy's thirsty. Give him something to *drink*."** ____
c. **"Teddy wants to sleep. Let teddy go to *sleep*."** ____
(Pass: Two correct)

13. *Has a vocabulary of at least 10 words ____
Write the words below:
_____
_____
_____
(Pass: Spontaneously says at least 10 different words)

14. Names objects
Materials: Sock, ball, mug, brick
"What is this?" a. ball ____ b. sock ____ c. mug ____ d. brick ____
(Pass: Two correct)

15. *Produces a succession of single word utterances ____
(Pass: Produces a succession of two or three words to talk about an event, with a one- to two-second pause between words)
Note: If the child produces three words in one breath (no pauses between words), credit this task and task 18.

16. *Uses one pronoun
Point to the child's shoe. **"Is this *my* shoe?"** ____
(Pass: Uses *my, mine, you,* or *me* spontaneously in response to the question presented)

2 – 0 to 2 – 5 (24 to 29 months)

Auditory Comprehension

17. Understands spatial concepts
Materials: Shoe box, seven bricks
Arrange the bricks around the box: two in front, two beside, and two in the box.
Hand a brick to the child. a. **"Put the brick *in* the box."** ____
Turn the box upside down. Place two bricks on it, two in front, and two beside it. b. **"Take the bricks *off* the box."** ____
Place two bricks in the box and two bricks beside the box. c. **"Take the bricks *out of* the box."** ____
(Pass: Two correct)

18. Understands several pronouns
Materials: Teddy, three mugs, three spoons
"We're having a picnic. Everyone gets a mug. You take a mug."
a. **"Now give one to *me*."** ____ b. **"Give one to *him*."** ____
c. **"You take a spoon. Now give a spoon to *me*."** ____ d. **"Give one to *him*."** ____
e. **"Show me *your* spoon."** ____ f. **"Where's *my* spoon?"** ____
Pretend to eat, then say, **"The picnic's over! Let's put everything away!"**
(Pass: Four correct)

19. Understands quantity concepts
Materials: Eight bricks, shoe box
a. **"Give me just *one*."** ____ b. **"Put *some* bricks here."** ____
c. **"I'll put these bricks here. Put *the rest* of the bricks over there."** ____
d. **"Now put *all* the bricks in the box."** ____
(Pass: Two correct)

20. Recognizes action in pictures
Materials: *Picture Manual*, p. 3
"Point to ...." a. **washing** ____ b. **playing** ____ c. **blowing** ____
(Pass: Two correct)

Expressive Communication

17. *Can express negation using negative forms (e.g., "no", "not", "no more") in a phrase.
Write examples below:
_____
_____
_____
(Pass: Expresses a negative form plus at least one further word)

18. *Combines three or four words in spontaneous speech _____
Write examples below:
_____
_____
_____
(Pass: Produces a three- or four-word phrase or sentence)

19. Name pictures
Materials: *Picture Manual*, p. 51
"What is this?"
a. book ____ b. car ____ c. bottle ____ d. banana ____ e. cat ____
(Pass: Four correct)

20. *Uses plurals
Materials: *Picture Manual*, p. 52
"What are these?"
a. socks ____
b. bricks ____
c. shoes ____
(Pass: One correct)

2 – 6 to 2 – 11 (30 to 35 months)

21. Understands use of objects
Materials: *Picture Manual*, p. 4
"Show me what ...."
a. **you can ride** ____ b. **we use to sweep the floor** ____
c. **you use to do your hair** ____ d. **we use to cut paper** ____
(Pass: Two correct)

22. Understands descriptive concepts
Materials: *Picture Manual*, pp. 5–7
"Which one is ...?" a. **big** ____ b. **wet** ____ c. **little** ____
(Pass: Two correct)

23. Understands part/whole relationships
Materials: *Picture Manual*, p. 8
"Show me the ...."
a. **door of the car** ____ b. **nose of the cow** ____
c. **tail of the horse** ____ d. **wheels of the train** ____
(Pass: Three correct)

24. Understands pronouns
Materials: *Picture Manual*, pp. 9–11
"Show me ...." a. **They are playing.** ____
b. **She is on the stairs.** ____ c. **He is in the pool.** ____
(Pass: Two correct)

21. Answers *what*, *where*, and *yes/no* questions
Materials: *Picture Manual*, p. 53
a. **"What is he holding?"** (pillow) ____
b. **"Is he sleeping?"** (no) ____
c. **"Where is the boy?"** (in the car) ____
(Pass: Two correct)

22. *Uses *verb* + '*–ing*'
Materials: *Picture Manual*, p. 54
"The boy is playing."
a. **"Tell me about the girl."** (eating) ____
b. **"Tell me about *this* girl."** (sleeping) ____
(Pass: One correct)

23. *Produces basic sentences
"Tell me about your pets." or **"Tell me about your (toys/sister/baby)."** ____
(Pass: Uses two or more four- to five-word sentences to answer)

24. *Uses possessives
Materials: *Picture Manual*, p. 55
a. **"This is the boy's cat. Whose cat is this?"** ____
b. **"This is the dog's food. Whose food is this?"** ____
(Pass: One correct; uses a possessive pronoun or the 's ending)

Auditory Comprehension

25. Understands descriptive concepts
Materials: *Picture Manual*, pp. 12–14
"Show me the ...."
a. **one that is heavy** ____ b. **one that is empty** ____
c. **ones that are the same** ____
(Pass: Two correct)

26. Groups objects
Materials: *Picture Manual*, p. 15
"Show me all the ...."
a. **things we eat** ____ b. **animals** ____
c. **toys** ____
(Pass: Two correct)

27. Understands negatives (*not* + *location* and *not* + *verb*)
Materials: *Picture Manual*, pp. 16–17
a. **"Which toy is not in the box?"** ____
b. **"Who is not eating?"** ____
(Pass: Two correct)

28. Identifies colours
Materials: *Picture Manual*, p. 18
"Show me the ... one."
a. **red** ____ b. **orange** ____ c. **yellow** ____
d. **purple** ____ e. **green** ____ f. **blue** ____
(Pass: Four correct)

Expressive Communication

25. Describes how an object is used
"Tell me what you do with a ...."
a. **spoon** _____
b. **towel** _____
c. **coat** _____
(Pass: Two correct)

26. Answers questions logically
"What do you do when ...."
a. **you're sleepy** _____
b. **your hands are dirty** _____
c. **you're cold** _____
(Pass: Two correct)

27. *Uses several pronouns spontaneously
Uses *I, he, she, we,* and *they* in spontaneous conversation ____
(Pass: Uses any three pronouns listed)

28. Talks about remote events
a. **"What do you do when you've lost something?"** ____
b. **"What do you do before you cross the road?"** ____
(Pass: One correct)

3 – 6 to 3 – 11 (42 to 47 months)

29. Compares objects
Materials: *Picture Manual*, p. 19
"Which one is heavier, a ... or a ...?" a. **boot, shoe** ____
b. **bed, chair** ____ c. **lock, leaf** ____ d. **car, lorry** ____
(Pass: Three correct)

30. Makes inferences
Materials: *Picture Manual*, pp. 20–23
a. **"Charlie played outside and got his shoes all wet. What was it like outside?"** ____
b. **"Annie grazed her knees and elbows. How do you think Annie got hurt?"** ____
c. **"Rachel came home from school. She was very hungry. What do you think she did first?"** ____
d. **"Ben's dog was very dirty. What should Ben do?"** ____
(Pass: Three correct)

31. Identifies pictures
Materials: *Picture Manual*, pp. 24–27
"Show me the ...."
a. **caterpillar** ____ b. **doctor** ____ c. **toolbox** ____ d. **triangle** ____
(Pass: Three correct)

32. Indicates body parts on self
"Show me your ...."
a. **head** ____ b. **arm** ____ c. **knee** ____ d. **elbow** ____
e. **thumb** ____ f. **chin** ____ g. **eyebrow** ____
(Pass: Six correct)

29. Completes analogies
Say, **"Finish this for me."**
a. **"A ladybird is little. An elephant is...."** (big) ____
b. **"Ice cream is cold. Fire is ...."** (hot) ____
c. **"You're awake during the day. You sleep at ...."** (night) ____
(Pass: Two correct)

30. Repeats sentences
"Say this back to me."
a. **"We saw Jim riding his bike."** ____
b. **"We can go to the park when the cartoons are over."** ____
c. **"I like to go swimming with my friends."** ____
(Pass: One correct)

31. *Uses auxiliaries
Materials: *Picture Manual*, p. 56
"Here Johnny is telling Mum, 'I can ride a bike'. Here Johnny is saying, 'I can turn on the lights'. What is Johnny saying here?"
_____
(Pass: Uses any auxiliary before the verb)

32. Answers *when* questions
a. **"When do you eat breakfast?"**
_____
b. **"When does it get dark outside?"**
_____
(Pass: One correct)

4 – 0 to 4 – 5 (48 to 53 months)

Auditory Comprehension

33. Understands spatial concepts
Materials: Brick, Teddy
Place the brick on the table. **"Put the brick … Teddy."**
a. **under** ____ b. **behind**____ c. **next to** ___ d. **in front of** ____
(Pass: Three correct)

34. Compares animals
Materials: *Picture Manual*, p. 28
"Which one has …?" a. **the longest nose** ____
b. **a long, thin tail** ____ c. **a bushy tail** ____ d. **pointed ears** ____

35. Understands complex instructions
Materials: *Picture Manual*, p. 29
a. **"Point to a kitten that is not black."** ____
b. **"Point to the white kitten that is sleeping."** ____
c. **"Point to the small black kitten in the box."** ____
d. **"Point to the kitten with black ears and a white face."** ____
(Pass: Three correct)

36. Identifies pictures
Materials: *Picture Manual*, pp. 30–32
"Show me the …."
a. **parachute** ____ b. **wheelbarrow** ____ c. **stamp** ____
(Pass: Two correct)

Expressive Communication

33. * Uses prepositions
Materials: Teddy
"Tell me where Teddy is." Place Teddy …
a. on the chair ____ b. behind the chair ____
c. next to the chair ____ d. in front of the chair ____
(Pass: Two correct)

34. Repeats irregular and regular forms of past tense
"Say this back to me." a. **"James *ran* fast and *won* the race."** ____
b. **"Annie *fell* and *dropped* her milk."** ____
c. **"George *listened* to the radio and *danced*."** ____
(Pass: Two correct)

35. Describes a procedure
a. **"Tell me how to make a sandwich."** ____
b. **"Tell me what you do when you get dressed in the morning."** ____
(Pass: One correct)

36. Name members of the category 'animals'
Materials: *Stopwatch*
"Name all the animals you can think of until I tell you to stop." ____
Write the responses produced within one minute below:
_____
_____
(Pass: Names at least six animals)

4 – 6 to 4 – 11 (54 to 59 months)

37. Understands descriptive concepts
Materials: *Picture Manual*, pp. 33–35
a. **"Can you see the paper chains? Point to the one that is long."** ____
b. **"Look at their hair. Whose hair is curly?"** ____
c. **"Look at the children. Point to the one who is short."** ____
(Pass: Two correct)

38. Understands time concepts
Materials: *Picture Manual*, p. 36
a. **"Which pictures show *night*?"** ____
(If the child points to only one appropriate picture, say "Any more?")
b. **"Which pictures show *day*?"** ____
(If the child points to only one appropriate picture, do not prompt)
(Pass: Two correct)

39. Understands quantity concepts
Materials: *Picture Manual*, pp. 37–8
a. **"Count the fish. Which fish-tank has three fish?"** ____
b. **"Count the strawberries on the plates. Which plate has five?"** ____
(Pass: Two correct)

40. Understands passive voice sentences
Materials: *Picture Manual*, pp. 39–40
"Show me …."
a. **"Grandad was kissed by the baby."** ____
b. **"The dog was chased by the goat."** ____
(Pass: Two correct)

37. Defines words
"Tell me what a … is."
a. **fork** _____
b. **car** _____
c. **shoe** _____
(Pass: Two correct)

38. Repeats complex sentences
"Say this back to me."
a. **"Bob washed the dishes, then watched TV."** ____
b. **"The boy who has red hair is my neighbour."** ____
c. **"Mum is reading the newspaper and Dad is sleeping in the chair."** ____
(Pass: One correct)

39. Names categories
"Listen: dog, cat, horse, pig, goat—these are all *animals*.
Tell me what these are."
a. **"Lego, doll, ball, puzzle—these are all …."** ____
b. **"Hat, shirt, dress, shorts, jeans—these are all …."** ____
c. **"Beefburgers, cereal, oranges, mashed potatoes, pizza—these are all …."** ____
(Pass: Two correct)

40. Responds to *why* questions by giving a reason
a. **"Why do you brush your teeth?"**
_____
b. **"Why do you wear shoes?"**
_____
c. **"Why do you keep ice-cream in the freezer?"**
_____

Auditory Comprehension

41. Understands *noun + two modifying adjectives*
Materials: *Picture Manual*, p. 41
a. **"Point to the furry white dog."** ____
b. **"Point to the small black dog."** ____
(Pass: Two correct)

42. Understands quantity concepts
Materials: *Picture Manual*, p. 42
a. **"Jack shared half a biscuit with his brother. Which picture shows *half* a biscuit?"** ____
b. **"Which picture shows a *whole* biscuit?"** ____
(Pass: Two correct)

43. Understands *–er* ending as "one who acts/carries out an action"
Materials: *Picture Manual*, pp. 43–44
"Find the ...."
a. **skater** ____
b. **bowler** ____
(Pass: Two correct)

44. Understands time/sequence concepts
Materials: *Picture Manual*, p. 45
"These pictures show a boy having a bath."
a. **"What happened *last*?"** ____
b. **"What happened *first*?"** ____
(Pass: Two correct)

Expressive Communication

41. *Uses adjectives to describe people and objects
Materials: *Picture Manual*, p. 57
"Now you be the teacher."
a. **"Tell me which car to point to."**
b. **"Tell me which girl to point to."**
(Pass: One correct)

42. Builds sentences
"I'm going to make up something about a cat and a mouse. Listen: The cat chases the mouse. Now *you* make up something about ...."
a. **a *girl* and *flowers***
b. **a *cow* and a *farm***
c. **a *boy* and a *bicycle***
(Pass: Two correct; uses both *italicized* words in the sentence)

43. Defines words
"I'm going to ask you what some words mean. What is a ...? Tell me *two* things about a ...."
a. **banana**
b. **telephone**
c. **piano**
(Pass: Two correct)

44. Uses words that express quantity
Materials: *Picture Manual*, p. 58
Point to each picture.
a. **"This girl's glass is *full*. This girl's glass is ..."** (empty) ____
b. **"Sam didn't get much spaghetti. He got *less* than she did. She got ..."** (more, loads, etc) ____
(Pass: Two correct)

6 – 0 to 6 – 11 (72 to 83 months)

Auditory Comprehension

45. Adds and subtracts numbers to five
    a. **"If you had three pounds and lost one, how many would you have?"** ___
    b. **"If you have two crayons and I give you two more crayons, how many will you have?"** ___
    c. **"If you have three sweets and I give you two more sweets, how many will you have?"** ___
    (Pass: Two correct; shows correct number of fingers or tells answer)

46. Indicates body parts on self
    "Show me your ...."
    a. **wrist** ___
    b. **heel** ___
    c. **ankle** ___
    (Pass: Two correct)

47. Understands time concepts
    Materials: *Picture Manual*, p. 46
    "These pictures show the different times of year. Point to the picture that shows ...."
    a. **autumn** ___
    b. **summer** ___
    (Pass: Two correct)

48. Identified pictures
    Materials: *Picture Manual*, pp. 47–50
    "Show me the ...."
    a. **flask** ___
    b. **thorns** ___
    c. **compass** ___
    d. **choir** ___
    (Pass: Three correct)

Expressive Communication

45. Uses comparative and superlative forms (*–er*, *–est*)
    "Listen. I want you to finish this sentence for me."
    a. **"A chair is heavy, but a bed is even ...."** (heavier) ___
    b. **"A light is bright, but the sun is even ...."** (bright*er*) ___
    c. **"A bike is fast, a car is faster, but a plane is the ...."** (fast*est*) ___
    d. **"A telephone is loud, a car horn is louder, but an ambulance siren is the ...."** (loud*est*) ___
    (Pass: Three correct; uses *–er* or *–est* as a suffix where appropriate)

46. Retells a story with visual support
    Materials: *Picture Manual*, pp. 59–60
    "This is a story about a girl and her dog, Rover. Listen to the story. I want you to tell *me* the story after I've finished."

    a. **"Jenny had a dog named Rover. Rover liked to sleep on an old blanket by the door.**

    b. **One night it rained and rained. Rover got soaking wet!**

    c. **Jenny talked to her dad. 'Dad, Rover got all wet in the rain. Can you build a kennel for Rover?' Dad said, 'O.K.! And you can help me build it.'**

    d. **The next day, Jenny and her dad started work. Rover sniffed around. He wondered what was going on.**

    e. **Soon the new kennel was finished. Jenny painted Rover's name over the door. She said, 'Look, Rover! How do you like your new home?'**

    f. **Jenny was surprised when Rover ran off. Jenny said, 'Hey Rover! Where are you going?'**

    g. **Rover dragged his blanket from the porch and put it inside the kennel. Then he arranged his blanket just the way he liked it.**

    h. **Now when it rains, Rover is snug and dry in his new home! Now you tell me the story."**

    Introduction ___ Sequence ___ Conclusion ___
    (Pass: Story has introduction, sequence, and conclusion)

47. Uses *–er* ending to indicate "one who acts/carries out an action"
    "A person who *teaches* is a teacher."
    a. **"A person who *sings* is a ...."** (singer) ___
    b. **"A person who *dances* is a ...."** (dancer) ___
    c. **"The person who *wins* a game is the ...."** (winner) ___
    (Pass: Two correct)

48. Uses irregular plurals
    Materials: *Picture Manual*, p. 61
    Point to each picture.
    a. **"This girl lost one tooth. This girl lost two ...."** (teeth) ___
    b. **"Here is one man. Here are two ...."** (men) ___
    c. **"Here is one mouse. Here are two ...."** (mice) ___
    (Pass: Two correct)

Appendix 18: Demographic characteristics of children who did not participate in the second phase of data collection

Biographic/demographic factor	**Study children who did not take part at T2**
Gender	100% (8) were boys
Ethnicity	75% (6) were white, 12.5% (1) Asian, 12.5% (1) mixed race
Family history	75% (6) of the children had a first degree relative with a history of language or literacy difficulty, 25% (2) did not.
Perinatal difficulties	25% (2) had needed additional medical support in their first two months of life, 75% (6) did not.
Birth order	87% (7) of the children had siblings 38% (3) of them were first born.
URTIs	50% (4) experienced three or more colds within the previous year.
Maternal education	87% (7) of the parents had qualifications that met the national expected minimum.
Socioeconomic position	25% (2) of children live in the most deprived quarter of areas of England.

Appendix 19: Speech and Language Therapy Service eligibility

Children's Therapy Services

Speech and Language Therapy

(SaLT/SLT)

The Speech and Language Therapy Service will take referrals to assess children's speech, language, communication and swallowing. The service is funded by NHS XXXX to provide therapy after assessment to children who have a XXXXX GP, or their GP is on the contract list and who meet the following the criteria:-

- **Pre-school** children with severe speech or language delay including stammering
  Severe usually means children with a delay in their language of over 12 months. If a child is stammering they should be referred immediately.

- Children showing signs of being selective mute. These children should be referred immediately.

- Children with complex social communication needs including Autism Spectrum Conditions. These children will be seen for specific work on social and conversational communication skills providing no other service can meet the child's communication needs.

- Children with language delay or disorder which is so severe they have a statement of special educational need where Speech and Language Therapy is defined in part 3 of their statement.

- School age children with severe **speech sound** difficulties including stammering
  A child would have at least two sounds that they are mixing up which would be expected to be in place for their age. If a child is stammering they should be referred immediately.

- Children with feeding and swallowing difficulties, referrals would be to the Speech and Language therapist at the Child Development Unit, XXXXXX.

This criteria has been agreed with the Local commissioners of services, if you any queries regarding this please contact:

Patients and Customer Services/Complaints Manager The email address is complaints@.xxxxxx nhs.uk
Head of Patient & Customer Services, . Telephone number: XXXXXXX.