

Emotional Expression in Social
Interactions of Infants with and without
Down Syndrome

by

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Declaration

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

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Dissemination

The studies that comprise this thesis have been disseminated in the following ways:

1. The rationales for studies 1, 2 and 3 were orally presented at the Down Syndrome Education International Trust Forum in October 2008
2. Oral presentation of a collection of findings from studies 1 and 2.
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3. Elements of the thesis have been disseminated as contribution to projects to come out of the FEELIX GROWING Grant.
4. Oral presentation of emotional development in early infancy. Collections of findings from Study 2 presented at the Surestart Forum, 26 Nov. 2010.

Abstract

In this thesis I report on investigations of the early socioemotional development of 4-month-old infants with Down syndrome (DS) in dyadic and triadic interactions, and comparisons of aspects of socioemotional behaviour of infants with DS with those of typically developing (TD) infants. The thesis incorporates theories relating to positive emotion, early infancy and Down syndrome research. I investigate 3 main debates: when compared to typically developing infants 1) infants with DS may have differences in emotionality, and perhaps social and emotional strengths 2) that infants with DS may have may different patterns of attention, perhaps preferring attending to a social partner over object 3) that the environment within which the infant with DS is raised is somehow different. I investigate these debates with consideration that all may relate to each other.

I compare typically developing infants and infants with DS on measures of attention, emotion and sociocommunicative behaviour alongside measuring aspects of their environment. I analyse the behaviour of groups of infants in dyadic (TD: n=11, DS: n=10) and triadic social, and less social, situations (TD: n=10, DS: n=10). I investigate aspects of infant emotion and sociocommunicative behaviours and discuss how they may, or may not, be indicative of abilities in for example, social expectancy, person permanence and early joint attention. I also question whether different play partners relate to infant enjoyment. I report on data relating to infant temperament, and aspects of the very young infant's environment (maternal caregiving preferences, optimism and demographics) in order to consider the relation of these variables to group and individual differences. I integrate findings from all studies and discuss individual differences.

Key findings from the thesis were that DS infants were less fussy overall than TD infants, equally as positive and communicative, and demonstrated an ability to maintain longer social interactions compared to TD infants. DS infants had less interest in an object than TD infants,

and more interest in the social partner. This was not due to infants with TD being unable to shift gaze, as infants from both groups shifted gaze comparably. TD infants were able to follow gaze to some extent, and demonstrated sensitivity to the timing and structure of the game of peekaboo. This suggests that at 4 months of age, TD infants may have some level of social expectancy regarding the rules and structure of social exchange, and have emerging joint attentional skills. DS infants did not follow gaze as successfully (although some did) and did not demonstrate such sensitivity to the timing and structure of the peekaboo game (although some did, and some TD infants did not) however enjoyed the game as much as TD infants. TD infant and mother pairs played the game of peekaboo differently to TD infant and experimenter pairs. In the main, infants with DS and mothers played similarly, and infants enjoyed the game as much, as DS-experimenter pairs; and this was comparable to how TD infants and experimenters played and enjoyed the game. No differences emerged between groups on measures of temperament, nor in relation to maternal factors such as parenting system preference or optimism. Neither did any of these measures relate to levels of infant positive emotion during positive, dyadic play. It was concluded that the ability for infants with DS to maintain prolonged social interactions with another at 4-months of age could be interpreted as a strength, perhaps due to an increased focus on the building blocks of later emerging social and emotional skills, that occur during face-to-face interaction. My thesis emphasises the importance in recognising strengths for those with DS, and acknowledging similarities rather than differences with the typical population. The value of this cannot be underestimated for those families (and educators, health professionals and carers) involved with DS. Recognition of sameness promotes an inclusive attitude to enable those with DS to integrate and to develop within a positive environment.

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Chapter One: Introduction

In this thesis I examine the socioemotional functioning of 4-month-old infants with Down syndrome and compare this to typically developing infants. I focus on the role that positive emotion plays in very young infant development, drawing on the emerging understanding of the importance of positive emotion, not only with regard to personal wellbeing (Carver & Gaines, 1987; Seligman & Csikszentmihalyi, 2000; Fredrickson, 1998; 2001; 2003; Huppert, Bayliss & Keverne, 2005), but also in how increased positive emotionality may relate to infants reaching better developmental outcomes (e.g. Fredrickson, 2003; Nadel & Muir, 2005; Baker, Blacher & Olsson, 2005). The thesis is novel in its approach as it incorporates theories of the adaptive role of positive emotion with early infancy research. I discuss how positive emotion may, even in the early months, be shaping and optimising how young infants, both with and without Down syndrome, interact and thrive within their environment.

I study Down syndrome firstly for the clear benefits to contributing to research that may improve the developmental outcomes of those with Down syndrome. I also study Down syndrome due to my interest in socioemotional functioning, and how the development of this can be influenced through the developmental process. Down syndrome is almost always diagnosed at birth (Cicchetti & Beeghly, 1990). The developmental implications of the disorder can therefore be studied in the neonate and onwards. For the infancy and emotions researcher, the benefit of analysing potential atypical patterns of emotional development before cognition, language and motor delay interact too greatly is important to understand the flexibility and complexities of the early socioemotional system (see Cicchetti & Beeghly, 1990; Carvajal & Iglesias, 2002; Karmiloff-Smith, 1998).

The rationale for the thesis has developed from my understanding of the debates in the Down syndrome literature and from my undergraduate (where I examined the lateralisation of emotion and maternal cradling preferences) and Masters research (where I examined potential socio-communicative arm bids of 3-month-olds in interactions; see Trevarthen, 1996), especially concerning infant primary intersubjectivity (Trevarthen, 1979), where there is a theoretical stance that from birth, infants are active, social and intentional communicative beings (see for example Nadel & Muir, 2005; Reddy, 2008). Much of the current literature emerging in the infancy field is focused on identifying whether infants of a young age are more socially capable than historically thought. Despite this surge in typical development research, it is clear that research of the sort in relation to Down syndrome is very limited. Therefore, this thesis aims to contribute new and valuable knowledge relating to the socioemotional development of very young infants with Down syndrome. It is also aimed to contribute knowledge in relation to typical development.

The early socioemotional development of typically developing infants

The thesis is designed to enable the study of important aspects of the socioemotional functioning of very young infants, and to compare infants with Down syndrome with infants with typical development. I designed the research in recognition of the fact that very young infants are active, social communicators, motivated to interact with, influenced by and influencing, their own environment. Trevarthen (1979) stated that at birth, infants have an innate psychosocial state that enables them to be motivated to engage, and be sensitive to, the minds of others; naming this ‘primary intersubjectivity.’ Trevarthen (1998) discussed how the theory of intersubjectivity is “no less than a theory of how human minds, in human bodies, can recognise one another’s impulses, intuitively, with or without cognitive elaborations”

(pp 17). Trevarthen argued that this innate communicative capability of infants is embedded in emotion, in that infants' innate emotional consciousness dynamically interacts with mother's emotion. The infant is born ready and able to emotionally communicate with another emotional being. Research over the last 30 years has strengthened Trevarthen's claim, and in more recent years it is becoming better understood the extent to which infants are social, active agents. By the age of 2 to 3 months for example, there is evidence that infants have expectations regarding the rhythms and forms of interactions, and become upset when these expectations are violated (e.g. Murray & Trevarthen, 1985; Nadel, Carchon, Kervella, Marcelli & Reserbart-Plantey, 1999; Cohn & Tronick, 1987). Thus, infants have reached an understanding of how interactions should feel and they express negative emotion when interactions do not follow their expectations. From around 3 months of age, infants and mothers begin mutual engagement in face-to-face dyadic interaction; dyadic interaction which over time develops into a sophisticated social exchange. To note, throughout the thesis I talk about the mother-infant relationship, however, it is recognised that the family and caregiving situation for infants can be diverse. Thus, mother may easily be replaced to mean another familiar, primary caregiver.

The onset of face-to-face interaction provides infants the opportunity to discover how their social and emotional behaviours can influence the behaviours of their play partner, and that their emotions are central to the dynamics of interactions with others. In addition, infants are learning that their emotional experience during face-to-face interactions, as well as being affected by maternal initiatives, is related to a mutual responsiveness (Thompson, 2006).

From the first six months, where infants are in a period of primary intersubjectivity, the infant gradually develops "secondary intersubjectivity" (Trevarthen & Hubley, 1978). Secondary intersubjectivity defines the developmental level at which infant awareness of people's intentions and feelings shift, in that not only are infants able to share in dyadic

emotional exchange, they are also now able to share with another person one's attention, feelings and intentions towards a third pole of an object, event or action. Some term the shift from dyadic to triadic interaction as 'joint attention' (e.g. Gustafson, Green, & West, 1979; Tomasello, 1993). The latter researchers focus on joint attention as being demonstrative of an infant's ability to co-ordinate attention, to gesture (such as point) and to have an awareness that the other person has an intention to look at or refer to the same object to which their own attention is directed (Fogel & DeKoeper-Laros, 2007). Whilst Trevarthen & Hubley (1978) also recognise these capacities as a part of secondary intersubjectivity, their definition also encompasses the shift in infant emotional awareness of the feelings and intentions of another social being.

This shift in awareness and communication is considered a crucial socio-emotional and cognitive developmental milestone. It is seen as a leap towards the development of language, where the infant is able to gesture and communicate more comprehensively their desires and needs (Bruner, 1983). Furthermore, it is also thought that with joint attention, infants have developed some theory of mind, and understand that another being also is a social entity with thoughts and motivations of their own (Premack & Woodruff, 1978; Baron-Cohen, Leslie & Frith, 1985). Trevarthen (1979) argued that newborns are already born with an innate sensitivity to the minds of others, a view supported by others (e.g. Nadel & Muir, 2005; Reddy, 2008). Trevarthen (1979) and his supporters would argue that rather than theory of mind being developed once the 'joint attention' stage has been reached, in fact the understanding of other minds emerges at a younger age, and that interactions in the early months of life may rather build a foundation upon which the infant becomes more able to demonstrate joint attention, once emotional, social cognitive and motoric functioning has become more refined. The thesis investigates these foundations, studying very young infant behaviour in not only dyadic, but triadic interactions to ascertain whether aspects of

secondary intersubjectivity, or joint attention, are emerging in the early months of life. The thesis evolved from consideration of Trevarthen's and others' perspectives (see Nadel & Muir, 2005; Reddy 2008), supporting the premise that infants are active, social beings from birth.

Whilst the thesis was designed primarily as a comparative study of the behaviour of typically developing infants and infants with Down syndrome, throughout it is acknowledged that comparative studies, whilst valuable, are only a partial picture. My thesis is based around observations of infant socioemotional behaviours, yet observing behaviour alone without consideration of the influence that environmental factors and individual characteristics may bring is naive. The developmental process is one in which biological and environmental influences interact in determining the overall developmental trajectory for all infants (Sameroff, 1975; Greenfield, Keller, Fuligni & Maynard, 2003; Karmiloff-Smith, 2007). Consideration of groups by genetic make-up alone does not reflect what is known about the crucial role of environment and individual characteristics in the developmental process. The development of infants with Down syndrome is influenced by the interaction of environmental and individual characteristics just as it is for infants with typical development. Furthermore, differences in experience and functioning in the early months of life, when the brain is under such rapid development, can lead ultimately to quite divergent functioning in later life (Karmiloff-Smith, 2007). Identifying areas of delay, dysfunction or strength, at this early time in development could have far-reaching implications for the overall developmental trajectory of a child. Thus, the thesis also incorporated the study of a selection of factors that could enhance understanding of individual and group differences in development.

This brief review identifies key aspects in relation to early socioemotional development. I merge this knowledge with current understanding of these aspects of development for infants with Down syndrome.

Key debates relating to the early socioemotional development of very young infants with Down syndrome

Through reviewing the literature, I identified that the most current debates relating to the early socioemotional functioning of infants with Down syndrome are 1) that infants with Down syndrome may have particular deficits and perhaps strengths in relation to positive emotionality and other social and emotional skills (see Fidler, 2005); 2) that the attentional patterns of infants with Down syndrome may be different to the typical population in that they may be less able to shift gaze and may focus more on the social partner in the first year and less on objects when compared to the typical population (e.g. Berger & Cunningham, 1981; Carvajel & Iglesias, 2000); 3) that the environment within which the infant with Down syndrome is raised may somehow be different to the typical population (e.g. Buckhalt, Rutherford & Goldberg, 1978; Moore, Oates, Goodwin & Hobson, 2008). The variables that I choose to study in my thesis were informed by these three debates, with an understanding that all may interlink (when considering the transactional model of development; Sameroff, 1975).

Historically, it has been reported how Down syndrome has negatively affected socioemotional development. Berger and Cunningham (1981; 1986) and Berger (1990), for example, discussed how the smiling behaviour of infants with Down syndrome is dysfunctional; and that infants with DS are delayed in the onset of eye contact, and have atypical patterns of gaze throughout the first year. It has also been reported that infants with Down syndrome gaze less at an object and more at a social partner than typically developing infants (e.g. Carvajel & Iglesias, 2000). Berger and Cunningham (1981) stated that these patterns of attention were due to the inability of infants with DS to shift attention. In relation

specifically to the emotion of infants with Down syndrome, it has historically been understood that infants with Down syndrome are emotionally flat (e.g. Emde & Brown, 1978). If infants with Down syndrome are emotionally flat, and if eye contact, attention and smiling behaviour are particularly dysfunctional in the early months of life, what might this mean with respect to the mother-infant relationship and onwards throughout development, bearing the transactional model of development in mind (Sameroff, 1975)? The developmental implications of experiencing atypical, or different, emotional interactions in the early months of life, recognised as an important period in the development of social and emotional skills (e.g. Trevarthen, 1979; Stern, 1985; Cohn & Tronick, 1987; Field, 1998; Nadel & Muir, 2005), could have a profound impact on the overall developmental trajectory of an infant (Karmiloff-Smith, 2007).

Yet, rather than those with Down syndrome being emotionally flat, others report that they may have a more positive phenotype compared to the typical population. Fidler (2005) argued that it was mainly in early research that the smiling behaviour of infants and young children with Down syndrome were reported as dysfunctional (e.g. Berger & Cunningham, 1986, Emde & Brown, 1978). In fact, Fidler (2005) argued, when objective measures of smiling behaviour are utilised (for example FACS), it is possible that those with Down syndrome show comparable, or increased smiling compared to the typical population (e.g. Kasari, Mundy, Yirmiya & Sigman, 1990; Carvajal & Iglesias, 2000). Fidler (2005) argued further, and stated that those with Down syndrome may have social and emotional strengths that could be ‘tapped’ into to enhance development. Identifying these potential domains of strength at an early age may be of benefit. Karmiloff-Smith (1998) argued that small differences in early functioning can become magnified through development. Targeting these areas of small differences early on in development could enhance the developmental trajectory of a child. Fidler (2005) stated that “understanding how the Down syndrome

behavioural phenotype emerges over the first few years of early development may help shape effective, time-sensitive intervention for young children with Down syndrome and their families” (pp87), justifying the need for research of this sort.

Thus, it is possible that differences in emotionality in the early months of life could have long-lasting implications to the developmental process (Karmiloff-Smith, 1998). There is an emerging understanding of the role that positive emotionality may play in development. Fredrickson (2003) proposed the ‘broaden and build’ theory of positive emotions to demonstrate the adaptive function of ‘being happy’. The premise of the theory is that positive emotions broaden the mindset which in turn builds psychological resources. Fredrickson (2003) discussed how, “through experiencing positive emotions, then people transform themselves, becoming more creative, knowledgeable, resilient, socially-integrated and healthy individuals” (pp. 1369). Thus, for the infant who has a more positive temperament, and experiences more positive interactions, there is perhaps the opportunity to develop enhanced creativity, knowledge, resilience, social-integration and health, compared to those who do not. The value of increased positive emotionality to the developmental process may be substantial.

Thesis Structure

The thesis is designed to investigate the three debates (relating to infant emotionality, attention and environmental influences) with an integrative approach. Three original studies are included, forming chapters 2, 3 and 4. I developed these studies in order to address the questions I identified through gaining understanding, and critically evaluating, others’ work in the field. Reviewing the literature across a number of research fields, building thorough rationales for individual foci of study, as well as then reintegrate these together, was a core part of the research process.

I collected the data regarding my three foci of interest (dyadic interaction and positive emotionality, triadic interaction and infant attention, and infant / temperament and maternal characteristics) within a single participant visit to the laboratory, where breaks were factored in as required. The visit lasted approximately 1 – 1.5 hours. The decision to collect all data in one session was taken due to the known difficulties in recruiting very young infants with Down syndrome, as well as to some degree, the typical population. I also wished to examine the same group of infants on a variety of measures. I saw the infants once, and collected all data relating to each of the three foci of study in the one session. To this end, one could interpret the research reported within the thesis as one study of aspects of the early socioemotional functioning of infants with and without Down syndrome. To note, I recognise the implications of this approach in Chapter 5.

Within the one visit I ran two different interaction studies, dyadic and triadic, each of which had specific aims and theoretical underpinning. I also ran a questionnaire and interview based enquiry to collect data relating to maternal and infant characteristics, again justified by theory. In designing the research, I took account of how best to limit order effects without compromising power.

I report on each of the three areas of study in separate chapters in recognition of the three key debates in the literature (relating to emotionality, attention and environmental factors) and also due to the subject of each of these three foci requiring the discussion of separate literature, use different methodologies and use different analyses. The analysis of one observational study informed the decisions made in the next, and the third then enhanced the findings in the first two. Data from the third investigation (infant temperament and maternal characteristics) was merged with observational data from the second. In addition, in the fourth chapter (Study 3) I integrate the findings across the three areas of investigation in an examination of individual differences. For ease for the reader, and for the thesis design, I

refer to these as separate studies. Each form the subsequent three chapters (chapter, 2, 3 and 4), however, acknowledge that the reader may wish to interpret them as a single study.

Brief summaries of these studies are provided below. Detailed literature reviews and rationales are included in each of the subsequent chapters to place the studies in context. Chapters are written as stand alone pieces in preparation for future publishing and as some of the literature and rationale for each overlaps, there is inevitably some repetition. The final chapter of the thesis draws together the most relevant points I raise in the literature in conjunction with my findings and I discuss the impact these findings may have, both in terms of furthering knowledge of the processes of early socioemotional development but also discuss how my findings may contribute to improving outcomes for infants with Down syndrome.

Ethics considerations

Participants in this study were a sensitive population and as such, ethics considerations were paramount. As the data for the thesis was collected in one session, there was one research proposal submitted to the ethics committee for the entire thesis. Ethics protocols in this thesis were scrutinised and approved by the Department of Psychology, University of Portsmouth's Ethics Committee. The research strictly adheres to ethics guidelines set out by the British Psychological Society (2006). As the research involved replicating naturally occurring infant interactions, the studies were not considered as causing any undue distress. The researcher considered, in consultation with Professor Buckley and her staff, special issues that may arise when working with mothers and infants with Down syndrome and adopted appropriate measures to ensure that no mother or infant was negatively affected by this work

Study One (Chapter 2)

To investigate aspects of infant emotionality, focusing specifically on positive emotion, in Study One I observe and analyse infant positive emotion when within a heightened positive dyadic exchange, namely a peekaboo game. I use the game of peekaboo as it is a common game played with young infants and has a goal of play partner and infant sharing in positive affect. Furthermore, it is thought that peekaboo takes a particular structure and form that enables infants the opportunity to learn the timing and structure of social exchanges. It also has a socio-cognitive aspect to the game, with the concept of person permanence (which is thought to be a precursor to object permanence; Piaget, 1954; Bell, 1970) being practiced during the typical hide-reveal part of the game.

I discuss research relating to infant positive emotional behaviour in peekaboo play, where this paradigm has been used to assess the social expectancies and positive emotionality of very young infants (e.g. Rochat et al, 1999; Montague-Walker & Andrews, 2002). I identify methodological issues however that I wish to address in relation not only to the Down syndrome sample, but also for typically developing infants.

Whilst the peekaboo game has been used before in research, with claims that infants as young as four months are sensitive to the timing and structure of the game, and therefore to the timing and structure of social exchanges (Rochat, Querido & Striano, 1999), I question whether the methodology used in Rochat et al's (1999) study is valid to draw conclusions regarding infant social expectancies in interaction. Furthermore, I question whether the fact that infants played the game with the experimenter in Rochat et al (1999), as opposed to mother, may have influenced infants' enjoyment of the game. Thus, the current peekaboo study involves analysis of mother-infant peekaboo games and compares these with experimenter-infant peekaboo games in order to see whether play partner interacts with infant

enjoyment, and whether mother and experimenter play the game comparably. Furthermore, I discuss how the timing and structure of the peekaboo game compares with naturalistic, unstructured social interactions with infants at this age.

I investigate how infants with typical development and with Down syndrome enjoy the game. This is measured by the extent, quality and responsiveness of infant positive emotion. I measure the frequency of infant smiles (how many times infants smile), overall duration of smiling (how long infants spend smiling over the whole interaction) and smiling bout duration (how long each bout of smiling lasts). I examine whether infants enjoy playing the game more with mother compared to a stranger, as it is proposed that infants prefer maternal versus stranger interactions from a young age (see Bigelow, 1998). I investigate whether this is so for both TD and DS samples. I also report on which point of the game infants smile. I examine whether there are differences between groups relating to how they may 'enjoy' the game.

The peekaboo game has not been utilised before now to study the socioemotional functioning of very young infants with Down syndrome. The findings from the study contribute to knowledge regarding the emotional behaviour of infants with Down syndrome and how this may compare to the typical population, and contribute to our understanding of how infants at this very young age may gain experience and develop knowledge regarding expectancies of the structure and form of social interactions.

Study 2 (Chapter 3)

The second debate I identified in the literature is that infants with Down syndrome may have differential patterns of attention compared to the typical population, preferring to gaze more at a social partner, and less at an object, compared to the typical

population (e.g. Berger & Cunningham, 1981; Carvajel & Iglesias, 2000). It is reported that this atypical pattern of gaze may be due to a lessened ability for Down syndrome infants to be able to shift their attention (Berger & Cunningham, 1981).

I report on an experiment that aims to identify whether the gaze behaviour of very young infants with Down syndrome is comparable or not to the typical population in relation to social and object attention, and whether infants with Down syndrome have difficulties shifting gaze or not. The triadic study compares infant gaze and sociocommunicative behaviour (defined as infant body movements, facial and vocal expressions of emotion combined with socially directed gaze) when in a more social, person-person-person triadic situation to a less social, person-person-object triadic situation. Tremblay and Rovira (2007) suggested that typically developing infants as young as 3 months may be able to detect differences between the two conditions suggesting that early precursors of joint attention may be developing firstly within more social, triadic situations, compared to less social triadic situations, yet the data relating to this process in typical development is limited. The paradigm used in Tremblay and Rovira (2007) is ideal to explore aspects of gaze and social behaviour of infants with Down syndrome and compare this to the typical population.

Study 2 (chapter 3) investigates the idea that joint attention is perhaps not a skill that suddenly emerges towards the end of the first year, but rather that it may have a more gradual developmental history that emerges from the infant developing an understanding of his or her own and other's shared feelings and intentions. The shift from primary to secondary intersubjectivity, where the infant has the capability to share feelings and intentions with another about an object, action or event (Trevarthen & Hubley, 1978) is unlikely to be a suddenly acquired skill. Arguably, it stems from early foundations, built within dynamic social interactions. Other researchers have argued that this may be the case (Fivaz-Depeursinge, Favez, Lavanchy, de Noni & Frascarolo, 2005; Tremblay & Rovira, 2007).

The rationale for this experiment was clear. If joint attention is a skill that emerges once infants have developed the level of understanding that another being's intentions and feelings can share with theirs about an object, event or action, then it is possible that the foundations of this understanding are rooted in social interactions. Perhaps this occurs in the early months of life, when social interactions are the infant's primary focus. In the early months, the infant does not solely interact with one other, but often mother and another may play with the infant together, mother may turn away from the infant to talk with another person in the room and will herself be sharing emotions with another, third addition to the interaction. Thus, the environment within which an infant develops in the first six months is not just one of dyadic exchange but there is also the opportunity for the infant to experience more complex interactions.

For the developing infant with Down syndrome, research suggests that joint attention is a skill that ultimately is acquired (e.g. Kasari, Freeman, Mundy & Sigman, 1995; Legerstee & Weintraub, 1997), however it is unclear whether, and if so, to what extent, this may be an area of delay or dysfunction. If infants with Down syndrome demonstrate differential patterns of behaviour, or indeed not, when compared to typically developing infants in the two triadic situations, then this will offer valuable information regarding the socio-communicative capabilities of this group, including answering questions raised in previous research regarding gaze shifting behaviours (Berger & Cunningham, 1981) and whether this group is more passive and less intense with regard their facial and vocal expressions of emotion when in interaction (as claimed by Emde and Brown, 1978).

To measure whether infants with DS had difficulties shifting gaze (as proposed by Berger & Cunningham, 1981) gaze shifting rates are analysed. To measure whether infant attention differed across groups, and whether gaze was influenced by social or object triadic interaction, the rate infants looked towards the two other foci of attention in the triadic

interaction is reported. It is aimed that findings will contribute to the debate regarding the gaze behaviour of infants with DS in the early months, in particular relating to whether the attentional patterns of infants with Down syndrome are somehow different to the typical population in relation to object and social attention.

Alongside measuring infant gaze, the triadic interaction experiment reports on other aspects of the socioemotional behaviour of infants with DS and examines whether these are in some way different to the typical population. I measure and compare the socially directed behaviours of both groups in triadic interactions. Behaviours that were considered socio-communicative were those behaviours (such as limb movements, facial and vocal expressiveness) that coincided with social gazing. This process of analysis was supported by previous studies which adopted a similar approach (Tremblay & Rovira, 2007). Infant facial and vocal expressions of emotion were measured, alongside body movements and patterns of gaze. If infants produced more socio-communicative behaviours in the more social, triadic scenario then this would support the conclusion that at 4 months of age, infants behave more socially in more social, triadic situations than in less social, triadic situations. This would suggest that very young infants are in some way accessing and engaging in triadic social interactions from a young age, and that this may offer an explanation as to how the foundations of secondary intersubjectivity, and joint attention, may develop. If infants do not behave differently in the two scenarios, then it would be possible to assert that at 4 months of age, infant triadic interactional capabilities may not yet have developed, or in fact, it could be concluded that the third addition into an interaction, be it object or human, does not relate to observable infant behaviour.

It is aimed that findings from Study 2 will contribute to our understanding of how infants with Down syndrome may attend differently to people and objects in the early months, as well as contribute to understanding relating to the development of joint attention

for this group, and those with typical development . Tremblay and Rovira (2007) discussed how the development of joint attention (the ability to attend with another about something) may be rooted firstly in social triadic situations and may not emerge suddenly towards the end of the first year as historically thought (e.g. Bruner, 1983). Data from the study regarding the typical population will be valuable, providing much needed additional information to the field regarding early infancy triadic abilities.

Study 3 (Chapter 4)

In relation to the third debate (in that the environment within which an infant with Down syndrome is raised may somehow be different, or perhaps not, to the typical population) and with a knowledge of the transactional model of development (Sameroff, 1975), I incorporate into the thesis the measurement of aspects of the environment that may perhaps be different for infants with Down syndrome compared to the typical population. In Chapter 4 (Study 3) I report on a questionnaire and interview-based study that investigates various environmental and biological factors that may relate to an infant's development, for both typically developing infants and infants with Down syndrome. The rationale for Study 3 was based on the premise that the process of development is not based solely on either biological or environmental factors, but a relationship between the two (e.g. Sameroff, 1975). Particular maternal and infant variables were measured in order to consider whether these may play a role in the developmental process and also to identify if there are any factors or characteristics that are more or less group specific. Three variables were examined in study 3: a) infant temperament, b) maternal optimism, c) maternal parenting systems. Demographic data are also reported relating to maternal age, income and education, birth order and feeding preferences (breast or bottle) in order to compare and control for sociodemographic factors within the infant's environment that may also affect socioemotional behaviour. The data

collected in relation to each of the three variables (as well as aspects of demographics) were analysed in relation to the behavioural observations of young infants (typically developing and with Down syndrome) in dyadic play (in Study 2). I also summarise and integrate a selection of data from all studies in a discussion of individual differences.

Mother (or the primary caregiver) is arguably the most influential aspect of the environment for very young infants. Therefore, I compare whether aspects of the environment which a mother may provide her infant with DS is somehow different to the typical population. It is possible that mothers of infants with Down syndrome may show more 'assertive warmth' than mothers of typically developing infants (Moore et al, 2008) and be more directive in play (Buckhalt, Rutherford & Goldberg, 1978). Others report no differences in maternal behaviour (for a review see Carvajal & Iglesias, 2002).

In order to examine whether there are differences relating to maternal factors across the two groups, I measure maternal caregiving preferences (developed by Keller & Demuth, 2005) in order to compare if mothers place emphasis on different caregiving styles dependent on group. In relation to the caregiving environment a young infant may experience, I identified research that found cultural differences in relation to maternal caregiving preferences (Keller & Demuth, 2007). Keller (2007) emphasised that dependent on a mother's and infant's cultural needs and perspectives, mothers may place certain emphasis on particular caring strategies at different times of her infant's development.

Parenting is considered a significant feature of culture, as cultural practices and values are transmitted from generation to generation (Harkness & Super, 1995). Parents pass down their own cultural history, beliefs and values on to their infant, and provide a particular cultural environment within which a child is raised. Keller (2007) identified a set of parenting systems that, whilst universally wide, will receive different focus in the early months of life

dependent on the social requisites of the culture within which a young infant is raised. The caregiving style of mothers within a westernised, European-American culture tends to focus on enabling infants to best develop social and emotional competence, promoting a concept of self and independence. This is characterised, it is argued, by mothers in westernised cultures emphasising face-to-face social exchanges and stimulating cognitive development. In another culture, for example where the environment is particularly physically taxing, mothers may emphasise a focus on enhancing the development of an infant's physical attributes (Keller, 2007).

This raised the question as to whether infants with Down syndrome were perhaps encompassed within a nurturing environment that was somehow different to the typical population. From my work experience with infants with disabilities and families, this was particularly pertinent as I was aware of the possibility that mothers of infants with disabilities may place emphasis on different aspects of development over others. For the infant with a motor disability for example, mother may encourage and practice motor functioning, or perhaps might focus on other areas of strength. For those with difficulties in emotional engagement, mother may 'practice' this more, (e.g., early interventions with young children with autism spectrum disorder; Greenspan & Wieder, 2006). Giving birth to a child with a disability undoubtedly results in a difficult, stressful and emotional time for the new mother (and family). In the early months, alongside dealing with the emotional difficulties for themselves that having a child with disability can bring, mothers also have to adapt to meet their newborn's needs, giving care that will best enable their child to manage within their environment. Mothers of infants with Down syndrome may place emphasis on different parenting systems in order to best enable their infant to adapt to their environment, in a way that may be different to mothers of typically developing infants

I decided to measure the maternal caregiving preference of mothers of infants with and without Down syndrome using the approach developed by Keller & Demuth (2005). Mothers rate (using photographs) the importance they place on face-to-face or object play, on feeding, on cuddling, and on motor stimulation. Dependent on infant needs and cultural experience and expectations, mothers of infants with DS may place different emphasis on these caregiving preferences in order to provide what they interpret as the best caregiving environment for their infant. Findings were compared to the caregiving preferences of mothers of infants with typical development. No data have been previously collected regarding parenting system preference (using categorisations of Keller & Demuth, 2005) of infants in the South of England, either with Down syndrome or with typical development, and thus, the findings from the study offer new and valuable information.

I measure maternal optimism using the Life Orientation Test – Revised (LOT-R; Scheier, Carver & Bridges, 1994), to report on whether this personality trait that may relate to maternal positive emotionality (Seligman, 2001, Peterson, 2006) may be different across groups, with the justification that a more optimistic mother may potentially have a more positively interacting infant than a less optimistic mother. Another justification for measuring maternal optimism is that it is thought that optimism moderates depression (Carver & Gaines, 1987, Hasan & Power, 2002; Baker, Blacher & Olsson, 2005), a disorder that mothers of those with disabilities are considered at high risk of developing (Bailey, Golden, Roberts & Ford, 2007). Thus, measuring optimism in this group may identify those mothers who may benefit from clinical interventions. For mothers of infants with DS, increasing levels of optimism may therefore be of benefit (Seligman, 2001). Seligman and colleagues have long recognised the benefits of an optimistic personality trait in relation to health, wellbeing and development.

An optimistic attitude to events in life, affects both how you feel and how you interact with others, (Peterson, 2006) If optimism affects how you feel and interact (Peterson, 2006)

then the mother who is more optimistic may interact more positively with her infant, which in turn could have developmental implications due to the transactional process of development (Sameroff, 1975). A possible relationship between maternal optimism and infant development has been investigated, with maternal optimism being found to act as a moderator for behavioural problems of children with intellectual difficulties (e.g. Hasan & Power, 2002; Baker, Blacher & Olsson, 2005). Optimism is also thought to moderate maternal depression, and mothers of infants with disabilities are considered a high-risk group for the development of depression. Measuring optimism for this group could potentially inform the development of intervention strategies for those mothers who may be at risk.

In addition to behavioural observations of infant emotion, I compare the temperament of the two groups using the Infant Behaviour Questionnaire – Revised (IBQ-R; Rothbart & Gartstein, 2003). I measure infant temperament as it has been shown that infants demonstrate individual differences in temperament (Thomas & Chess, 1977; Rothbart & Derryberry, 1981), and in relation to infants with Down syndrome, there is evidence to suggest that those with Down syndrome may have differences in temperament compared to the typical population that relate to emotionality (see Fidler, 2005). I also investigate whether individual differences in temperament (measured by the IBQ-R) relate to infant smiles in dyadic play.

As discussed, it has been reported that those with Down syndrome may have an overriding positive personality (see Fidler, 2005). Temperament is considered a building block that contributes to the developing personality (Rothbart & Bates, 2006), thus it is possible that very young infants with Down syndrome may have a more positive temperament compared to typically developing infants. Studying the temperament of infants with Down syndrome may identify aspects of increased positivity, or in fact, it may be found that there is support for the assertion by Emde and Brown (1978) and Moore et al (2008) that

infants with Down syndrome are emotionally flat in comparison to the typical population. Thus, the thesis examines not only observable behaviours to address the debates raised, but also examines underlying individual variables that may influence socioemotional development.

Taking measures of temperament of the participating infants in this series of studies was important as even very young infants demonstrate individual differences in temperament (Thomas & Chess, 1977; Rothbart & Derryberry, 1981). Temperament is defined as constitutional differences in reactivity (responsiveness to change in the internal and external environment) and self-regulation (processes that moderate reactivity) influenced by heredity, maturation and experience (Rothbart & Derryberry, 1981; Rothbart & Bates, 2006). Infants will differ therefore, as a result of individual temperament characteristics, in how they function within a changing environment, be it emotionally, motorically or via attentional processes (Rothbart & Bates, 2006). Thus, as this thesis is investigating aspects of infant behaviour in dyadic, positively emotionally charged situations, and also a triadic, attentional situation, measuring infant temperament in conjunction with observational analysis of infant behaviour will add further knowledge to understanding whether infant temperament is related to the emotional aspects of infant behaviour when in these particular interactions. It will be possible to ask for example, whether there is evidence of a relationship between temperament levels of affectivity and behavioural observations of the same. Without measuring infant temperament as a baseline, conclusions drawn solely from observation of behaviour are limited.

Why four month olds?

In each of the three studies, the same 4-month-old infants and their mothers participate. I decided to study 4-month-olds as I wished to investigate infant emotional behaviour in dyadic, face-to-face interaction (Study 1), and also attentional behaviour and sociocommunicative behaviour in early triadic interactions (Study 2). At four months of age, infants with typical development have become skilled in face-to-face interaction. The rationales I develop relate specifically to the 4-month-old infant with typical development, and how at this age they may have developed aspects of social expectancy in dyadic interaction (e.g., Rochat et al, 1999). Furthermore, at 4 months of age, infants are in the beginnings of shifting their attention to objects, and becoming more interested in their wider environment (see Nadel & Muir, 2005; Reddy, 2008), thus investigating triadic attention at this period when infant attention may be in a state of change has not been investigated before, and will therefore contribute new information to the field. I decided to examine how the 4-month-old with Down syndrome compared to the typical population under the same conditions.

I took the decision to match groups by chronological age for three key reasons: 1) I was measuring aspects of socioemotional behaviour and therefore wished to control for the amount of social experience infants had; 2) nearly all social interaction studies relating to infants under 6 months compare DS and TD samples by chronological age; 3) there are difficulties with measuring the mental age of very young infants, and potentially more so for those with developmental difficulties.

Matching very young infants with Down syndrome to the typical population by chronological age is a common approach adopted by others who study aspects of very early socioemotional development. Carvajal & Iglesias (2002) conducted a review of face-to-face emotion interaction studies that have been published in relation to infants with Down

syndrome. Carvajel and Iglesias (2002) stated that “in the first year, there is a tendency to pair infants with and without Down syndrome according to chronological age.” In the second year and onwards, Carvajel and Iglesias (2002) discussed, there is a tendency to compare on the basis of mental age in order to control for possible language, motoric and cognitive difficulties. Of particular relevance for the current research, in Carvajel & Iglesias’ (2002) review, all of the studies relating to infants under the age of 6 months matched infants with DS to TD infants by chronological age (see Berger & Cunningham, 1981; 1986; Gunn, Berry & Andrews, 1982; Brooks, Gunn & Lewis, 1984; Crown, Feldstein, Jasnow, Beebe & Jaffe, 1992; Carvajel & Iglesias, 1997; 2000). Carvajel and Iglesias (2002) advise however, that researchers should take into account the point at which the development of infants with Down syndrome begins to differ from that of typically developing infants and the factors relating to this divergence. They acknowledge that from around the age of 6 months, important cognitive changes may take place in typically developing infants that may not affect, to the same extent, those with Down syndrome. Thus, Carvajel & Iglesias (2002) recommend that for infants 6 months and under, it is better to match by chronological age, and only from then may matching by mental age be appropriate, dependent on the focus of study.

Matching by mental age is the preferred method when comparing aspects of behaviour of older infants (aged sometimes older than 6 months, but more commonly over a year) and children with Down syndrome to the typical population. The most common developmental test used to measure mental age is the Bayley Scale for Infant Development (Bayley, 1969) which has since received further revisions (BSID –II, Bayley, 1993; BSID – III, Bayley, 1996). The most significant revision to the Bayley-III has been the introduction of five (compared to the previous 3) distinct scales. The BSID-II provided Mental, Motor, and Behavior scales, whereas the Bayley-III revision includes Cognitive, Language, Motor,

Social-Emotional, and Adaptive Behavior scales. Relevant to the current research, the social-emotional scale is measured by caregiver report, where caregivers are asked to rate the frequency of a particular behaviour. For 4-month-olds there are 13 questions. Eight out of these 13 relate to infant interest in surroundings – for example, “takes a calm and enjoyable interest in most sights, including colourful or bright things;” “looks at interesting sights such as your face or a toy;” looks at or turns towards interesting sounds;” “you can easily get your child’s attention by approaching him or her, or moving him or her around slowly.” One question specifically asks about positive emotion (only for infants aged older than 3 months, but younger than 5 months) – “seems happy or pleased when he or she sees a favourite person (e.g. looks or smiles, makes sounds, or moves arms in a way that expresses joy or delight). One question relates to whether the infant responds vocally when being played with, 2 questions relate to emotion regulation (e.g. how easy is your child to calm), and 2 more relate to responsiveness to touch. Albers and Grieve (2007) reviewed the 3rd Edition of the Bayley Scale and noted that there was a relative weakness in the reliability of scores relating to children aged between 0-6 months. Albers and Grieve (2007) acknowledged that this is a common problem for using instruments intended to be used with a population in which developmental scores tend to be highly variable. Reservations have also been expressed about the application of Bayley scores for classification of young infants with developmental delays, due to the steep item gradients in the lower end of age levels, which may result in children being viewed as more or less delayed than they truly are (Nellis and Gridley, 1994). Thus, it would seem there are particular difficulties associated with measuring the mental age of very young infants, and in particular those who may have developmental delay.

As discussed, the socio-emotional scale of the BSID-III (Bayley, 2006) is measured through parental report. Rauh, Schellhas, Goeggerle & Muller (1996) recommended that parental report is the most appropriate method to use when wishing to match the

developmental level of infants of a very young age. Rauh et al (1996) discussed how parental-reports are highly valid, and “are able to provide more differentiated information on emotionally and socially sensitive behaviours in the child than professionally administered developmental tests” (pp 152). Interestingly, there are similarities between the BSID-III measures of the socio-emotional scale and the IBQ-R (Gartstein & Rothbart, 2003).

The IBQ-R is the most commonly used questionnaire to measure the temperament of young infants (Gartstein & Rothbart, 2003), and scores infant behaviour on 3 overarching factors: Extroversion/Surgency (with 6 subscales – activity, smiling and laughter, high intensity pleasure, approach, vocal reactivity, perceptual sensitivity), Negative Affectivity (with 4 subscales - distress to limitations, falling reactivity, fear, sadness) and Regulatory Capacity/Orienting (with 4 subscales – cuddliness/affiliation, duration of orienting, low intensity pleasure, soothability). In total, the IBQ-R consists of 191 questions that contribute to a score for each scale.

Similarly to the BSID-III, the IBQ-R is a parent report instrument that contains items regarding commonly occurring infant behaviours. Parents are asked to rate how often that particular behaviour may have occurred over the previous 1-2 weeks, within a given context. Parents are asked to use a 7 point Likert Scale to report to what extent a statement is true or untrue about their infant. Whereas the BSID-III asks one question that relates to infant emotionality, the IBQ-R includes approximately 100. These are asked alongside, and in conjunction with questions that relate to feeding, mobility, social interaction, emotion regulation and attention to the environment. Thus, if parental report is considered the most accurate way to measure and match developmental level at a very young age (as argued by Rauh et al, 1996), then arguably the thoroughness of the IBQ-R could mean it is a very useful tool. Alongside using the IBQ-R to provide information specifically relating to the temperament of the infants in the study, the IBQ-R could also serve as a control for

developmental level. If infants in the two groups score comparably, then (using the justification of the Bayley Scale methodology and the recommendations by Rauh et al, 1996) the infants from the two groups could arguably be considered as developmentally matched.

Whilst measuring the mental age of very young infants has particular challenges, one study has attempted to refine the BSID-II for use with very young infants with Down syndrome, to control for social experience. Moore, Oates, Goodwin and Hobson (2000) discussed how the function and structure of the brain are not independent of experience and active interaction with the world. Moore et al (2000) recognised the difficulty with using the BSID-II to measure the MA of infants with Down syndrome stating that “all the tasks of the Bayley scales..... involve a social interaction between tester and infant, confounding social with cognitive competence” (pp45). Moore et al (2000) extracted particular parts of the BSID-II to make the assessment more cognitively ‘pure’, in order to more accurately measure cognitive performance relatively independent of social, motor and language capacities. The researchers were able to then better match, by cognitive ability, cohorts of typically developing infants to infants with Down syndrome. Using this method, Moore et al (2008) matched a group of 6-month-old infants with Down syndrome to a 4-month-old typically developing sample to measure if infants with Down syndrome performed differently when in a still-face paradigm compared to typically developing infants.

The still-face paradigm (Tronick, Als, Adamson, Wise & Brazelton, 1978) is a common procedure used to assess how infants behave when a perturbation in interaction (mother ceases interacting and takes a neutral, unresponsive stance) is introduced. How the infant behaves is thought to indicate the extent to which they are able to regulate attention and affect in social interactions, and whether they have developed a level of social expectation (Tronick, 2003). Moore et al (2008) examined the emotional and attentional behaviour of 6-month-old infants with DS using this paradigm and compared this to a 4-

month-old typically developing sample, matched by MA (using their revised version of the Bayley scale). Maternal behaviour of the two groups was also compared. Key findings were that infants with and without DS behaved similarly during the procedure, however the infants with DS were found to be less fussy than the typically developing sample and also had differences in looking behaviour. Moore et al (2000) also found mothers from the two groups behaved differently, with mothers of infants with DS demonstrating more 'assertive warmth.' These findings are valuable, considering the lack of research relating to the early socioemotional development of infants with DS, and identifying differences in infant and maternal behaviour at this very young age could have lasting developmental implications (Karmiloff-Smith, 1998). It should be noted however, that the still-face procedure is designed to assess aspects of social interaction, and participants in Moore et al (2008) were not matched on social experience, but on a cognitively 'pure' basis. Thus, it is possible that findings relating to the emotional behaviour of infants with DS in the still-face paradigm were influenced by the fact that the DS sample had had more social experience than the typically developing sample. Maternal behaviour may also have been influenced by the duration of time they had had a relationship with their infant. Moore et al (2008) recommended further study with chronological age-comparable control infants.

Further work is required to discover if, and to what extent, Down syndrome may affect socioemotional functioning in early infancy. For this reason, and for the previous reasons discussed, infants in the thesis are matched by chronological age.

Participants

As the same participants participated in each of the three studies, participant data are included here, and can be referred back to throughout the thesis as required. Mothers (N=22) of 4-month-old (M=18.5 weeks, range = 17 to 20 wks) infants with DS (n=10) and of TD

infants (n=12) participated. Advertisement of the study via the Portsmouth Registry Office, who included a recruitment letter with every newly registered birth, led to the recruitment of the majority of mothers of TD infants. Further advertisement of the study was carried out at a local Baby and Toddler Show, which enabled the recruitment of the remainder. All participants were from the South of England. Mothers of infants with DS were recruited with the assistance of Professor Sue Buckley, Director of Research at The Down Syndrome Education International, Portsmouth. Staff approached each mother with an age-appropriate infant and informed them of the research. In the 10 months of recruitment, all except one mother agreed. Infants would have been excluded if they had any serious health complications. To my knowledge, no infant had any serious health issues. There is a possibility that infants from both groups were not representative of the wider population, and this is discussed further in chapter 5. With respect to the Down syndrome population however, it is understood that the mothers who contact the Down Syndrome Education International represent a cross-section of the population (Buckley, 2011).

The distribution across variables for TD and DS groups is shown in Table 1.1, alongside averages, standard deviations and significance results where appropriate. Two infants with DS were born at 36 wks gestation. It was decided that as these infants at the time of participation were both chronologically aged at the top of the range at 20 weeks, no correction was made, although this is relevant to note. There was no statistical difference in age between the two groups, $t(20) = 0.97, p = 0.34$. All mothers participating were married. There was a trend (close to significance) towards mothers of DS infants being older than mothers of TD infants. Thirteen mothers had university education, and no relationship was found regarding group and level of education. From this sample of 22 infants, 15 were firstborn and 13 were breastfed. No significant group by sociodemographic variable relationship was found. Thus, infants from both groups were comparable on these measures.

Table 1.1 Sociodemographic Information for TD (n=12) and DS (n=10) groups

		Group		
		TD	DS	*
		M (SD)	M (SD)	
Infant age (in wks)		18.4 (1.17)	18.9 (1.23)	t (20) = 0.97, p=0.34 ns
Maternal age (in yrs)		31.0 (3.84)	34.6 (4.48)	trend: DS > TD t (20) = 2.02, p = 0.056
Mothers with uni. ed		6	7	χ^2 (1) = 0.27, p = 0.61 ns
Infant as firstborn		9	6	χ^2 (1) = 0.08, p = 0.77 ns
Feeding	Breast/Mixed	8	5	χ^2 (1) = 0.13, p = 0.72 ns

Notes. A trend < 0.1. Chi square tests included Yates correction due to small sample with 2 groups, and expected cell frequencies less than 5.

Methodological design and statistical decisions

As part of the research design, I conducted power analyses to calculate whether the studies planned would have sufficient power to identify statistically significant effects. This was particularly appropriate as I was working with small samples. Calculating and reporting on the power of a study is an approach recommended by Cohen (1992). Conducting studies with small samples runs the risk of making type II errors; that is reporting that there is no significant effect. In this case, if the sample size was increased, then a significant effect would be found. However, increasing the sample size too much increases the chance of identifying a Type I error; that is finding a statistically significant effect when the difference is not one of relevance. Bakeman and McArthur (1998) discussed that to increase power with small samples, a repeated measures design is recommended. A repeated measure increases the number of scores, and power can be calculated by number of scores, and not just by the

number of participants. In the design of the triadic study, I will be examining two independent groups (TD and DS infants) each completing two conditions (person-person-person and person-person-object). Thus the fact that there was a repeated measures element to the planned study meant that a small sample size does not imply insufficient power.

Bakeman and McArthur (1998) developed a Windows 95 computer programme, BW-Power, specifically designed to measure the power of mixed between-within subject designs as the authors recognised how little advice was provided in the literature of how to conduct power analyses with mixed, repeated measures designs.

Using the BW –Power programme, I calculated the number of participants I would need to detect significance at an alpha level of 0.05 and small to moderate effect sizes, with between-within variables. Ideally, the effect size that one requires to detect is informed by the reported effect sizes in previous studies of the same or similar subject (Cohen, 1990). The difficulty of doing this is acknowledged (Bakeman & McArthur, 1998) due to a lack of research replication and the reporting of effect sizes in the literature (Bakeman, 2005). The researcher is required to make an inference (based on their knowledge of the subject of study) of what may constitute an effect size of value. In reality, most use the guidelines set out by Cohen (1988). The effect size statistic used in the studies will be partial eta squared. For the most part, it is acknowledged that partial eta squared is comparable to using eta squared and is an acceptable statistic for using in designs of this sort (Bakeman, 2005). The guidelines set out by Cohen (1988), supported by Bakeman (2005), are to interpret an effect size of .02 as small, .13 as medium and .26 as large.

The power analysis for the triadic study is shown in Table 1.2. The calculation shows, that with 22 participants, the design of the study would have sufficient power (around 80 to 90 % is generally the aim; Cohen, 1988; 1990; Bakeman, 2005) to detect small to medium effects (ranging from .08 for group, to .05 for all other levels) and significance with

the Alpha level set at $p < 0.05$ in relation to group, condition and, as an example, rate of looks to A/to B. There was sufficient power to detect small to medium effects when examining these variables in interaction. Thus, the aim was to recruit a minimum of 22 participants.

Table 1.2 BW-Power calculation for a 2 X 2 (with two levels) design

Number of cases = 22	Alpha = .05		
Source	Df	Effect	Power
Group	1	.08	.802
Error, between	20	.20	
Condition	1	.05	.817
Condition x Group	1	.05	.817
Error, within	20	.15	
Gaze to A /to B	1	.05	.817
Gaze x Group	1	.05	.817
Error, within	20	.15	
Gaze to A/ to B x condition	1	.05	.817
Gaze to A / to B x condition x group	1	.05	.817
Error, within	20	.12	

Another potential risk of making Type I errors (finding a significant effect when there is not one) occurs when conducting multiple comparisons of the same data set (Field, 2009). That is, through running a multitude of tests on a set of data there is a possibility that a significant finding will be stumbled on purely by chance. In the research proposed, it is possible that there may be a substantial number of measures used. For example, in the triadic study, in one piece of infant interaction the gaze behaviour of infants would be measured, and analysed by group and by condition. There would be a second analysis of the same piece of infant interaction in relation to body movements, and another, separately again, for facial expressiveness. This example demonstrates how, for the triadic study, the same piece of

original data (the footage of infant interaction) may be arguably separately, but extensively, analysed.

There is a debate in the literature regarding how best to control for Type I errors in this instance, but in fact, it should be noted that the planned research is not likely to be testing the same data multiple times, *per se*. All the data that is collected from an infant interaction could be interpreted as one set of data, however, another way to interpret this is that these are separate data sets. Facial expression data is separate to limb movements data, which is separate to gaze data, etc. It is acknowledged however, that the controversy lies in multiple comparisons of the two groups. That is, that extensive testing of various factors of the behaviour of infants with and without DS may identify differences in behaviour purely by chance (Type-I error). In order to reduce the possibility of making Type-I errors, there is a method of adjustment used that greatly increases the alpha level for multiple comparisons. Thus, where a p value <0.05 would first be used, subsequent tests on the same data would have a much more conservative p -value. This method of statistical adjustment is known as the Bonferroni method (Cohen, 1990), and is most commonly used when carrying out post-hoc analyses. Some, however, recommend that this is used when running many tests on one data set, as a means of controlling for Type I errors (see Breakwell, 2006). Yet many statisticians and researchers now acknowledge the potential problems with using the Bonferroni adjustment. As Cohen (1990) stated, researchers are unlikely to solve the “multiple test problem with the Bonferroni maneuver” (pp. 1304). The criticism of the Bonferroni adjustment is that it is too conservative, and that when applied with zeal, almost nothing is ever significant (see Cohen, 1990; Wilkinson and the Task Force on Statistical Inference, 1999). Bakeman & Quera (in press) recognised that the more tests used does increase the possibility of identifying significant-by-chance effects; but question how one decides on those found by chance and differentiating from those that are ‘true’. In fact, using

the Bonferroni adjustment would increase the chance of making Type II errors; finding no significant effect when there is one.

In the current research, it was decided not to make Bonferroni adjustments on the data with this reasoning in mind, but rather to follow the advice of others, and to interpret overall patterns of significant effects (Cohen, 1990; Wilkinson and the Task Force on Statistical Inference, 1999; Bakeman & Quera, in press). Saville (1990) supports this approach, suggesting that corrections for multiple comparisons not be performed, but rather data should be reported as is; informing the reader of the decision, who can then informally adjust for multiple comparisons while reviewing the data where they see fit. Thus, for the reasons described, Bonferroni adjustments were not used.

Counterbalancing

I chose not to use a counterbalanced design due to small sample size. For this reason, I decided for all participants to complete the conditions in the same order so as to maximise power. I did however, make methodological decisions that would minimise order effects (namely fatigue and practice), and discuss the implications of not using a counterbalanced design in the final chapter.

It is common and good practice in studies with two or more conditions to have a counterbalanced design in order to control for order effects. In relation to the experimental designs of the dyadic and triadic studies, two conditions are run for each. For the dyadic interaction study, there are two groups completing two conditions: mother-infant and experimenter-infant. For the triadic interaction study, there are also two groups completing two conditions: person-person-person and person-person-object. If I were to counterbalance these conditions I would assign half of each group to complete one condition first, and the other half assigned to complete the second condition first.

A major disadvantage of adopting a counterbalanced design, however is that another between-subjects factor is introduced. To achieve the same power from a counterbalanced design as a non-counterbalanced design, sample size would have to be doubled (for two condition designs) to achieve the same level of power (Mitchell & Jolley, 2009). As discussed, recruiting typically developing infants is challenging, but recruiting infants with Down syndrome is even more so. Evidence of this lies in the relatively small sample sizes that have been used in other similar studies (e.g. Berger & Cunningham, 1981, 1986; Legerstee & Bowman, 1989; Legerstee & Crown, Feldstein, Jasnow, Beebe & Jaffe, 1992; Carvajal & Iglesias, 1997; 2000). Therefore, the decision was taken not to counterbalance conditions due to the difficulty of recruiting a large enough sample that would provide sufficient power.

I took decisions through the experimental design that sought to limit order effects. The variables that were being measured and associated predictions were considered. In the dyadic study, the infant would play peekaboo with the experimenter and also with mother. The prediction was that the infant would perhaps enjoy playing with mother more than with the experimenter, due to the rationale discussed regarding infant preference for maternal versus stranger interactions (Bigelow, 1998). I decided that upon arrival at the session, all infants would first play peekaboo with the experimenter, as this was the condition that the infant may enjoy less. Later on, after the triadic procedure had been completed and after any breaks had been taken, mother and infant played peekaboo. It was considered that infant enjoyment may be lessened with fatigue. Thus, by placing the predicted 'less enjoyable' interaction first, and the 'most enjoyable' interaction second, it would be possible to draw conclusions should it be found that infants prefer playing with mother over experimenter, and there is the potential of considering findings of the sort as conservative. The drawback with this design however is recognised, in that should it be found that infants smiled more with the

experimenter compared to the mother, then it may be that fatigue influenced results. Thus, any significant findings would be taken with caution in this instance. A final justification for placing the mother-infant dyadic, positive play interaction at the end of the session was to enable mother and infant the opportunity to finish the session with the potential of a positive engagement with each other. This is arguably important so as mother (and perhaps infant) feel that the experience of research participation was a positive one.

For the triadic study, the person-person-object condition was always completed first, followed by the person-person-person condition. Again, breaks were factored in if required. It was predicted that infants may behave more socially in the more social, person-person-person condition compared to the less social, person-person-object condition. Placing the conditions in the chosen order therefore, looked to reduce the effect of fatigue confounding findings that may support the prediction. If the prediction was upheld, in that infants behaved more socially in the more social condition, and this was the second rather than first condition, than fatigue would only have served to lessen the strength of this social behaviour, and therefore could be considered conservative.

One more factor justifying experimental order was based in practicalities. With the order set as 1) peekaboo-experimenter, 2) person-person-object (this was always with experimenter), 3) person-person-person (when the mother joined) and finally 4) peekaboo-mother, the smoothest transition was enabled through the experimental procedures. Video cameras needed to be set in position for the dyadic observation, and then moved for the triadic. Seating positions needed adjusting, and the mother was required to join at times, and not at other times. In the order set out, for the first half of the session (whilst experimenter and infant were playing) the mother was able to complete questionnaires relating to her infant's temperament and her optimism. Once all of the experimental procedures were completed, the experimenter and mother then completed the maternal parenting system

preference interview. This final part of data collection was carried out last as mother could comfort or feed her infant as required whilst also conducting the interview.

Progression through studies

The thesis is structured to discuss firstly, infant dyadic interaction and then triadic interaction. I took the decision to structure the thesis in this way as in relation to infant development, dyadic interaction precedes the development of triadic interaction and the literature I discuss in the triadic study builds on that relating to dyadic interaction. This is the most logical progression for the reader. However, it is important to note that I firstly analysed the data relating to the triadic study.

The reason the triadic study was analysed first was that the variables to be studied were, to a degree, predetermined. Aspects of infant gaze, body movements and expressions of emotion were known in advance, in order to address the research questions. From my Masters research, I had developed a coding system to measure aspects of very young infant behaviour. I adapted this system. From developing my own, comprehensive coding system I was able to measure those infant behaviours that Tremblay and Rovira (2007) cited as being socially directed.

Following extensive analysis of infant behaviour in the triadic study, I then developed what would be the focus of the peekaboo study. Through the literature review process, I identified questions relating to previous peekaboo studies with young infants (Rochat et al, 1999; Montague & Walker-Andrews, 2001) that I wished to address. In relation specifically to infants with Down syndrome, I had already investigated gaze behaviour in the triadic study, (which would contribute knowledge to the first debate regarding the attentional patterns of very young infants with DS). The finding that infants with DS were comparable in relation to positive emotionality (through behavioural observations) as the typically

developing sample directed the next topic of study. I chose to focus on identifying whether differences between groups emerged regarding infant positive and negative facial expressions of emotion when in dyadic, peekaboo interaction.

Study 3 was formed to enhance the findings from the first two studies. Measures of infant and maternal characteristics were merged with relevant findings from Studies 1 and 2, in order to examine whether there were interactions between observed infant behaviour and individual and environmental characteristics. In study 3, I also discuss individual differences relating to measures from all three studies.

Key thesis aim

In summary, the core aim of the thesis is to examine the three debates I have identified: 1) that infants with Down syndrome may have particular deficits and perhaps strengths in relation to positive emotionality and other social and emotional skills (see Fidler, 2005); 2) that the attentional patterns of infants with Down syndrome may be different to the typical population in that they may be less able to shift gaze and also that infants with DS may focus more on the social partner in the first year and less on objects when compared to the typical population (e.g. Berger & Cunningham, 1981; Carvajal & Iglesias, 2000); 3) that the environment within which the infant with Down syndrome is raised may somehow be different to the typical population (e.g. Buckhalt, Rutherford & Goldberg, 1978; Moore, Oates, Goodwin & Hobson, 2008). In the following chapters I consider these debates, as well as aim to contribute to knowledge of our understanding of aspects of typical socioemotional development.

Chapter Two: Peekaboo! Face-to-face play and emotionality of 4-month-old infants with Down syndrome and infants with typical development.

Abstract

An ecologically valid peekaboo paradigm was used in the current study to investigate aspects of 4-month-old infant socioemotional skills and to compare the emotionality of infants with Down syndrome (DS, n=10) with typically developing infants (TD, n = 11) during positive play interactions. It was predicted that infants would be more positive emotionally, when in maternal versus stranger interactions. Infants with and without DS were compared on a variety of measures of positive emotion. The form and structure of the naturalistic peekaboo game were analysed and infant smiling was evaluated in order to assess social expectancies. It was found that infants with DS were equally as positive as TD infants during peekaboo play, but less fussy overall than TD infants. It was also found that the peekaboo game consisted of 4 key phases: preparatory, hide, reveal and interplay. DS and TD infants did smile during different aspects of the game, with TD infants smiling in a higher percentage of the preparatory and hide phases than DS infants. The prediction that infants would enjoy the game more when playing with mother versus a stranger was not fully upheld. Infants enjoyed the game equally when playing with mother versus the experimenter, however infant smiling behaviour in relation to phases was influenced by play partner. Also different emphasis was placed on particular phases of the peekaboo game dependent on play partner. The implications of these findings with regard infant emotion and social expectancies are discussed.

Chapter Two: Peekaboo! Face-to-face play and emotionality of 4-month-old infants with Down syndrome and infants with typical development.

An ecologically valid peekaboo paradigm was utilised in the current study to investigate the emotionality of 4-month old infants with Down syndrome and compare this to infants with typical development when in face-to-face positive play with mother versus a stranger. Peekaboo was chosen as it is a commonly played game between mother and infant yet is rather complex, in that it involves aspects of cognition (disappearance-reappearance), social expectation, and a goal of high positive affect. Despite its complexity, mothers begin playing peekaboo with their infant when they are very young, perhaps as young as 3 months (Greenfield, 1972; Fernald & O'Neill, 1993). The game has been used in previous experiments to assess very young infants' abilities regarding social expectancy, however these studies added specific controls (rigid timing) on each phase that may have broken down the natural interaction between infant and play partner (e.g. Rochat, Querido & Striano, 1999; Montague & Walker-Andrews, 2001; Fogel, Hsu, Shapiro, Nelson-Goens & Secrist, 2006). Therefore, the current study examined the naturalistic, rather than experimentally controlled, peekaboo game when played with infants aged 4 months in order to ascertain the temporal and structural form of the game when played with infants at this very young age.

The current study focuses on infant emotion, and specifically the emotionality of infants with Down syndrome. The emotionality of very young infants with Down syndrome is of particular interest as there is an argument to suggest that those with Down syndrome may be at least as positive emotionally than the typical population (e.g. Fidler, 2005; Moore, Oates, Goodwin & Hobson, 2008), and at this young age, may have an increased focus on the social partner (Berger & Cunningham, 1981; Carvajal & Iglesias, 2000; Fidler, 2005). Those with Down syndrome may also develop relative social and emotional strengths, despite

significant delays in cognitive development (Carvajel & Iglesias, 2002; Fidler, 2005). This information can be coupled together when acknowledging the role that positive emotion plays in development. Positive emotion is thought to provide the infant with the motivation to engage with the environment, to broaden experiences and build personal resources (Fredrickson, 2003). At four months of age, infants are immersed within an environment of dyadic face-to-face interaction, a period of 'primary intersubjectivity' where infant and partner mutually share in affect and intention, characterised with mutual reciprocity and dynamic emotional exchange (e.g. Trevarthen, 1979, Tronick, Als & Adamson, 1979). Primary intersubjectivity is seen as a building block in the development of more complex socioemotional communication. An increase in positive emotional interactions at this time could therefore, arguably improve socioemotional outcomes. Identifying how infants with and without Down syndrome interact within a potentially positive emotional situation, namely peekaboo, enabled consideration of this argument, enhancing understanding of the role of positive emotion in development. Furthermore, the current study has a goal of increasing knowledge regarding the socioemotional functioning of very young infants with Down syndrome, which will aid in developing practice, intervention and awareness within the field.

Peekaboo

The hide and reveal game of peekaboo is a familiar game to most, and certainly in societies considered westernised a majority of infants and young children would likely have played the game. In fact, whilst there is insufficient evidence to date to state that it is a cultural universal, it has been concluded to be culturally widespread (Fernald & O'Neill, 1993). What makes peekaboo an interesting paradigm to use to investigate many aspects of early development is that it is commonly played in dyadic interaction from a young age and

in its fullest form, has many different facets. To participate in a full game of peekaboo the infant will have gained abilities to initially engage, have social expectancy, understand the associated vocalisations, may have developed some level of object permanence (the understanding that objects still exist even when they cannot be seen, heard or touched; Piaget, 1954), be able to re-engage and then share in positive, often humorous, emotional exchange with a play partner. Whilst it is not claimed that very young infants are capable of accessing the game to such a complex extent, it is suggested in recent research that very young infants may be accessing the game to some degree. Certainly, mothers and babies begin playing the game together from a very young age (Greenfield, 1972; Fernald & O'Neill, 1993).

The early form of the game may involve mother not completely hiding away; but rather, looming in to her child and saying 'peekaboo,' encouraging smiles and surprise (Fernald & O'Neill, 1993). Bruner and Sherwood (1976) highlighted how infants move from relatively 'passive' participants (with mother instigating the hide and reveal) to more active participants (where the infant hides and reveals) from around the age of 14 months. Bruner and Sherwood (1976) further discussed how peekaboo is not an arbitrary, rule-based game that is 'taught' to the child; rather the mother exploits the "strong, pre-adapted response tendencies in the infant [being] rewarded by the child's responsiveness and pleasure" (pg 282). Thus, playing peekaboo taps into an infant's innate capacity to gain pleasure and arousal from aspects of the game, and arguably the mother also gains through the pleasure of the interaction. Benefits to playing the game include not only a sharing of positive emotion; but also the game structuring and rules are thought to provide a basis for later language acquisition (Bruner & Sherwood, 1976). Peekaboo also contains a disappearance-reappearance aspect to the game and is an ideal opportunity for infants to develop the arguably later emerging concept of object permanence (Piaget, 1954). As mentioned, evidence supports the conclusion that infants are active participants in early interaction (e.g

Trevarthen, 1979; Tronick, 2005). If infants and mothers are playing a version of the game from a very young age, and it is known that very young infants are active participants in interaction then it is reasonable to conclude that infants are contributing to, and learning from, the various social, emotional and cognitive aspects of the peekaboo game.

Dynamic social interaction in early infancy

Early infancy is now recognised as an important time for infants to develop the basics of socioemotional interaction (Reddy, 2008). Historically, infants were considered to be passive recipients of stimulation within a dyadic situation, in that mother and infant behaviour would appear to be in synchrony, not as a result of dynamic communication, but instead due to mother shifting her behaviour to fit with her child's, making the infant appear 'as if' active (Kaye, 1977). This viewpoint has been challenged by many, and it is now recognised that infants are far more active, and contribute far more to an interaction than previously thought.

In contrast to the conclusions by Kaye (1977), naturally occurring dyadic interaction between the very young infant and partner is characterised by dynamic, free-flowing exchange where the infant is not passively receiving stimuli, but is very much an active communicator (e.g. Trevarthen, 1979; Tronick, Als & Adamson, 1979; Nadel & Muir, 2005; Tronick, 2005). From birth, infants demonstrate a preference to human faces (Johnson & Morton, 1991) and for their mother's voice (DeCasper & Fifer, 1980). Newborns are also able to imitate another's actions (e.g., Meltzoff & Moore, 1983; Kugiumutzakis, 1993; Abravanel & DeYong, 1991) with imitation in this context being defined as "a sharing of more or less the same actions, intention, motivation and emotions between two communicating partners (Kugiumutzakis, Kokkinaki, Makrodimitraki & Vitalaki, 2005; p.176)." It is widely accepted that infant social smiling begins around the age of six weeks

(Spitz, 1965; Wolf, 1987), and by 12 weeks, infants have developed the skill to turn-take in exchanges of timed vocalisations ('protoconversation') (Bateson, 1971). Thus, in the early months of life, there is evidence of the beginnings of social and emotional attunement (Stern, 1985).

These early skills are thought to relate to the infant's ability in 'primary intersubjectivity' which, Trevarthen (1979) stated, stems from an innate psychosocial state in which infants are motivated to engage, and be sensitive to the minds of others. Primary intersubjectivity is seen as core to the communicative and social development of the child. By the time infants are 3 months of age, dyadic interaction takes on a particular structure and form. There is a cyclic, variable pattern of communication, with phases including mutual orientation, aspects of engagement and disengagement. Disengagement is an important factor in face-to-face interaction in that it enables infants to assimilate information and regulate emotions (Brazleton, Koslowski & Main, 1974; Trevarthen, 1979; Tronick, Als & Adamson, 1979). Some, but not all phases may be included in an interaction. The waxing and waning of phases and individual and variable temporal pattern make each dyadic communication unique (Tronick, Als & Adamson, 1979). The evidence that infants are active participants in interaction is therefore considered robust. Tronick (1997) argued this point, stating that the mother-infant relationship is not a "unilaterally regulated system"; rather, Tronick (1997) argued, both infants and mothers adjust their own behaviour contingently within a social interaction (p59).

Social expectancy

It is becoming accepted that very young infants are socially contingent, that is, are sensitive to the social responses of others and able to moderate and initiate their own affective behaviour accordingly (e.g. Murray & Trevarthen, 1985, Nadel et al, 1999).

Evidence further supports the conclusion that not only is infant behaviour contingent, but that very young infants have social expectancies within an interaction. Studies have shown that when perturbations to an interaction are introduced, infants detect the disruption to the interaction and become disengaged and/or distressed. Researchers observed 2-month-old infant behaviour in a 'live' versus 'replay' situation. Mothers and infants interacted live via a television screen, or infants were shown the pre-recorded replay version of mother in *an* interaction, but not actually interacting (Murray & Trevarthen 1985; Nadel et al, 1999). The infant observed mother behaving as if she was in an interaction, however she was not actually responding and adjusting her behaviour as the infant expected. The infant became distressed due to mother not behaving contingently, that is, the infant's social expectancies were violated. Further evidence regarding the social expectancy capabilities of very young infants has been demonstrated using the still-face paradigm. By the age of 3 months, infants react negatively when mother ceases contingent interaction and poses a still-face (e.g. Cohn & Tronick, 1987). This is further evidence supporting that very young infants have expectancy regarding social interactions.

Peekaboo play and face-to-face interaction

The peekaboo paradigm has been used by some to further investigate the extent to which infants are sensitive to disruptions in interaction relating to social expectancy. Using a peekaboo paradigm, Parrott & Gleitman (1989) investigated the social expectancy abilities of older infants (aged 6, 7 and 8 month olds, notably older than the 2 and 3 month old infant studies previously discussed) in an occasional 'person-switch' trick experiment to investigate the role of expectations in infants' enjoyment of play. Infants smiled less when an unexpected adult reappeared in the expected adults place, and in a second experiment, infants smiled less when the adult reappeared in a different location. This example supports the conclusion that

infants at this age (6-8 months) have specific expectations, and that conformity to these expectations contribute to levels of enjoyment. As mentioned previously, enjoyment (i.e. positive emotion) has a purpose in that it enables the infant to engage and learn. Peekaboo has a purpose in that it is a rule-based, consistent and structured game, perhaps designed to 'teach' the infant the rhythms and structure of language, of object permanence as well as developing other aspects of social and emotional communication. Peekaboo also has a goal of positive emotional exchange, and the rigidity of the game complements the infant's enjoyment of socially expected interactions. Arguably therefore, mothers (likely instinctively and intuitively) may play the game of peekaboo to optimise their infant's learning capacities, heightening positive emotional interaction which in turn maximises their infant's opportunity to learn important skills.

Other perturbations to the peekaboo game have been introduced by others to examine young infants' expectancies in social interaction, and how infant positive emotion may be impacted when expectancies are violated. Fogel, Hsu, Shapiro, Nelson-Goens and Secrist (2006) investigated the amplitude and duration of 6- and 12-month old infant smiling across typical and perturbed peekaboo games. The perturbed condition involved the mother not revealing her face at the climax. Fogel et al (2006) found that infants of both ages smiled less in the perturbed game, supporting the conclusion that infants as young as 6 months have particular expectations of the game, and enjoy the game more when their expectations are fulfilled. Fogel et al (2006) and Parrott and Gleitman (1989) focused their attention on infants 6 months and older, however, as already discussed, it has been reported that infants as young as 2 months are sensitive to social interactions being unnaturally and unexpectedly manipulated (and therefore have developed some level of social expectancy) (e.g. Murray & Trevarthen, 1985; Nadel et al, 1999). The peekaboo paradigm has only recently been used

with infants younger than 6 months to investigate to what extent these very young infants may have particular expectancies in relation to aspects of social interaction.

Rochat, Querido and Striano (1999) claimed that by 4 months of age, infants are beginning to develop social expectations with regard to the timing and structure of social exchanges, a skill required in the development of protoconversation (Bateson, 1971). Rochat et al (1999) used a peekaboo paradigm as the game has a 'build-up', 'tension, and 'release' pattern; a pattern that they argue is comparable to the temporal and repetitive nature of protoconversation. In their laboratory investigation, Rochat et al (1999) conducted organised and disorganised games of peekaboo with 2-, 4- and 6-month old infants. The organised game consisted of 3 phases: approach ("look, look, look" – the build up), peak ("peekaboo!" - tension) and release ("Yes"). The experimenter used a script and carried out each phase in 3 second frames over a 60 second period. The disorganised game used the same script but in a predetermined random order of both phases and timings. Results suggested that overall, infants smiled more in the organised versus disorganised condition with no effect for age or age-condition interaction. When analysing smiling in relation to just the release phase (the experimenters justified this analysis relevant as it signified the end of the game), 2-month olds engaged in gazing and reciprocal smiling with the experimenter, but showed no differential behaviours across either the organised or disorganised condition. Four- and 6-month olds however, responded with less smiling in the disorganised compared to organised (12% v 18% of time) conditions, and with an increase in gaze, perhaps as an attempt to re-engage. Rochat et al (1999) concluded that by 4 months old, infants recognise others as interactive agents and are beginning to develop social expectations with regard to the timing and structure of social exchanges.

Whilst these findings are interesting, there is a specific question mark raised regarding the focus of analysis. If the peekaboo game is reflective of a prototypic social exchange, with

each of the three phases (build up, peak, release) important to developing protoconversation then arguably, it is also important to analyse socio-communicative behaviour (in this case gaze and smiling behaviour) in not just the release phase, but across all phases. Therefore, whilst findings are interesting, further analysis would have provided a more detailed picture regarding infant affective and attentional behaviours under this experimental situation.

Despite the aforementioned limitation, it would appear from the findings in Rochat et al (1999) that by the age of 4 months, infants have developed some level of social expectancy in relation to the structure and form of the peekaboo game, and thus they conclude, to the form and structure of social exchange. Alongside the limitation already discussed, there are also clear methodological problems with the Rochat et al (1999) study. Specific and stringent controls were added to the peekaboo game. A phase was played for 3 seconds, followed by the next 3 second phase and so on, until 60 seconds of the trial was reached. The same words and actions were repeated each time. Rochat et al (1999) argued that the peekaboo game was reflective of protoconversation, of emerging social exchange between infant and partner. Yet the structured, fixed peekaboo game Rochat et al (1999) utilised could not have been reflective of a dyadic social exchange. Adding controls enabled particular variables to be manipulated; however these specific controls would have broken down dynamic interaction. This argument is justified by the fact that the behaviour of the infant could not have had any bearing on the play partner's behaviour as a result of the fixed pattern of behaviour on the experimenter's part. The timed 3 second phases that were used cannot have allowed for temporal changes in cyclic patterns of engagement and disengagement that typical young infant-other interactions take (Tronick, Als & Adamson, 1979). The experimenter was not responding to the infant behaviour. Therefore, neither infant nor experimenter behaviours were contingent, nor could the infant be engaged in primary intersubjectivity (Trevarthen, 1979). Infant and experimenter could not have been in dynamic interaction, and it was

specifically dynamic interaction (social exchange) that Rochat et al (1999) were aiming to study.

Furthermore, infants' social partner in the study was not the mother, with whom the infant had established a familiarity, but rather was a stranger (the experimenter). By 4 months of age, it is recognised that infants have a preference to interacting with their mother compared to a stranger. Bigelow (1998) investigated contingent behaviours within mother-infant compared to stranger-infant interactions. Even if mother was less contingent than a stranger, (that is less appropriately socially responsive) the infant still showed more responsiveness to the mother. Thus, Bigelow (1998) argued, infants at this age show preference to familiarity, in whichever form it comes. The fact that the experimenter was the social partner rather than the mother in Rochat et al's (1999) research, therefore, would have affected how infants participated in the game, enjoying the game and engaging less than if mother had been a part of the study. Bearing these limitations in mind therefore, it can be concluded from the Rochat et al (1999) study that infants responded differently when 3 seconds each of build-peak-release were placed in random rather than organised order. Conclusions regarding how this may relate to naturally occurring social interaction, should thus be taken with caution.

A further experimental study by Montague & Walker-Andrews (2001) used the peekaboo paradigm to investigate 4-month-old infants' perception of emotional expression, through showing one of four different facial expressions of emotion (anger, fear, sadness and happiness/surprise) upon the presentation phase of the game. For each 10 second trial, the experimenter hid away for 3 seconds (hiding phase), and upon revealing the face, said 'peekaboo' and held an assigned facial expression for 7 seconds (presentation phase). This procedure was then repeated 10 times, with no delay between trials. Infants behaved differently with respect to visual attention and affective responses for different emotions.

This supports the conclusion that at 4-months old, infants are sensitive to differing facial expressions of emotion, and that a standardised game of peekaboo is viable to measure infant affective behaviour. Again, this study can be criticised with regard to the structured approach to playing the game, the impact of stranger versus mother as social partner, and the resulting limitations regarding infant engagement. Conclusions regarding infant expectancies regarding peekaboo structure and social interaction should arguably, not be drawn.

One further study to mention is that carried out by Greenfield (1972), which raises some interesting points. It is only recently that evidence is accruing that is suggestive that infants as young as 4 months may have some level of social expectancy and are sensitive to the timing and structure of the game of peekaboo. Yet, even 40 years ago, peekaboo was used to investigate aspects of infant behaviour. Greenfield (1972) observed 4-month-old infant behaviour in a naturalistic game of peekaboo to see if speech and nonspeech auditory signals structured infant response to the visual peekaboo game. A second purpose of the study was to see whether there was a different pattern of infant response when a human versus an inanimate object disappeared and reappeared. Greenfield (1972) found that speech (and less so nonspeech) sounds, reliably elicited an infant's smile, and when mother was the hiding target, the infant smiled in all conditions. The silent reappearance of an inanimate object however, never elicited the infant's smile. Thus, it would seem from Greenfield (1972), that at 4 months of age, infants smile more during person peekaboo play compared to object peekaboo, and also that speech plays an important role in relation to infant enjoyment of the game. In Greenfield's (1972) study, however, the researcher was studying the behaviour of her own son. Thus, the researcher was, in fact, mother. This is noteworthy when considering Bigelow (1998) assertions regarding infant preference to maternal versus stranger interactions. Infant and mother would likely have had a contingent, dynamic interaction and infant engagement would have been optimised. Whilst scientific evidence at the time did not

recognise that infants at this age participated in the game, a mother (who was also a developmental psychologist) felt that this was an appropriate age to investigate her infant's behaviour during peekaboo. Thus, her judgment is only now supported by more recent evidence. Greenfield (1972) also adopted a naturalistic approach to playing the game. The amount of time spent hiding was not controlled, and Greenfield (1972) justified this by stating that "artificial timing constraints in infant experiments often destroy the phenomenon one wishes to study (p289)." This adds support to the conclusion regarding the limitations of the methodological approaches used in Rochat et al's (1999) and Montague and Walker-Andrews' (2001) research. Taking with this the fact that play partner was mother rather than a stranger; Greenfield's (1972) study could arguably be considered as rather ahead of its time. The findings from Greenfield's study are interesting, yet its scientific value is limited due to the focus on just one participant.

Person permanence

As discussed, mothers and infants begin playing a version of the peekaboo game from a very young age, and given the evidence regarding infant active contribution and expectancies regarding social interaction, it is reasonable to conclude that infants are contributing to, and learning from, the various social, emotional and cognitive aspects of the peekaboo game. As highlighted previously, the peekaboo game provides an ideal opportunity for infants to practice and develop the skills of object permanence (Piaget, 1954), or more specifically, person permanence – a skill replicated in the disappearance-reappearance part of the game. The study by Parrott & Gleitman (1989) manipulated the hide-reveal section of the game, switching who would reappear and where they would reappear in order to measure infant social expectancies. Parrott and Gleitman's (1989) experiment arguably tapped into infant abilities regarding object (or person) permanence. Object permanence (the

understanding that objects still exist even when they cannot be seen, heard or touched) was historically thought to develop at around the age of 10 months (when infants have reached the 'secondary circular reactions' stage; Piaget, 1954). Piaget's staged theory of development has been well documented, yet has received criticism regarding the exclusion of cultural and social influences on the developmental process.

It would appear true to some extent that when following the test procedures of Piaget (1954), infants around the age of 10 months are able to search, locate and reach for a previously hidden object, the test that Piaget concluded was evidence that infants had reached the ability to know that an object continues to exist. Yet arguably, assuming that infants suddenly develop the concept of object permanence, with no building up of the relevant skills throughout the earlier months of development is a little simplistic. In fact, some argue that object permanence develops much earlier, with infants as young as 5 months understanding that objects continue to exist when occluded (Baillargeon, Spelke & Wasserman, 1985), and perhaps even younger (e.g. Bower, 1967). Furthermore, as recognition of the importance of social interaction in early development has grown, it is also argued that the concept of person permanence (understanding a person still exists) is a precursor to object permanence and evidence suggests that again, this skill emerges earlier than the typical interpretation of the Piagetian theories on object permanence (e.g. Bell, 1970). Person permanence is thought to precede object permanence due to infants having a more intense emotional investment in the person versus the object. The infant develops the ability of knowing that a person continues to exist even if out of sight. With this knowledge that mother is a continual and ever existing partner comes the development of attachment, which enables the infant the confidence to explore and interact with the environment that subsequently positively influences all aspects of development (e.g. Ainsworth, Blehar, Waters & Wall, 1978). Interestingly, Piaget himself recognised the important difference between object and person permanence when describing

his daughter playing peekaboo skilfully aged 8 ½ months. Piaget concluded that “The object searched for.... is a person, and persons are obviously the most easily substantiated of all the child’s sensorial images,” (Piaget, 1954; pp 46-47). Playing the game of peekaboo with very young infants therefore, could aid in refining infant ability in relation to person (and object) permanence, and have lasting social, emotional and cognitive benefits for the developing infant.

Positive emotion

It has been discussed how playing peekaboo may have a purpose in building an infant’s knowledge and familiarity with the structure and timing of social exchanges, further aiding social development. Furthermore, it has been discussed how peekaboo taps into the emerging ability for infants to understand the concept of person (and object) permanence, important for socioemotional and cognitive development. It has also been discussed how peekaboo has a goal of mutual positive exchange between mother and infant, and it has been mentioned how positive emotion plays an important role in the developmental process. The function of positive emotion in early development will now be further discussed.

The role of positive emotion has to date, been neglected. The majority of emotion research has focused on understanding the form and function of negative, as opposed to positive, emotion. Seligman and Csikszentmihalyi (2000) explained this stating that negative emotions have received more empirical study than positive emotion due to the tendency of psychological research to focus on psychological ‘problems’ (i.e. depression, psychosis, stress, aggression, etc) and how aspects of negative emotion may be involved within these dysfunctions. In contrast, positive emotions (e.g. love, joy, contentment, interest) are infrequently associated with dysfunctional human behaviour, with the exception of studies relating to mania and addiction. This lack of focus on the function of positive emotions in

human behaviour explains perhaps, why functional definitions of aspects of positive emotion have yet to be clearly made (Fredrickson, 2003). In general, it has been thought that positive emotions have a basic value of facilitating approach behaviour (Davidson, 1993) and promoting continued action (Carver & Scheier, 1990). Relating this to the developmental process, positive emotions enable the infant the motivation to engage, and continue engagement with the environment. Fredrickson (2003) argued that this is a fair, but only partial, picture of the role that positive emotions serve.

General models of emotion have been theorised that argue that emotions are the result of a combination (or not) of physiological responses and psychological appraisals (e.g. Cannon, 1972; James, 1884; Schachter & Singer, 1962) and the evolutionary adaptive purpose of emotion (from ancestors striving to survive life and death situations) is well recognised. Emotion is linked to specific action tendencies (Frijda, 1994, Lazarus, 1991) that enable the person to choose from a narrowed selection of courses of action, dependent on the circumstance. Consider the emotion of fear. The function of fear is relatively clear. We fear something that we perceive as threatening, and therefore need to prepare ourselves either to escape or prepare ourselves to fight. Thus, the evolutionary based 'fight or flight' response is triggered. Strong physiological effects occur, be it prior to, in conjunction with, or after cognitive appraisal of the trigger of fear. Heart rate, breathing and muscle tension increase as the body prepares itself to react. Furthermore, attention is narrowed, drawn in to focus solely on the perceived threat. The physiological and psychological facets of the emotion of fear are striking and easily recognised. However, arguably, general models of emotion have been developed with negative emotions in mind. Positive emotion, Fredrickson (2003) discussed, is shoehorned into fitting these theories as an afterthought, and does not sit so comfortably. Specific action tendencies of positive emotion are vague or incomplete, and as Fredrickson (2003) argued, have been partially or completely omitted from emotion models. Thus,

Fredrickson (1998; 2001) developed a new model that was specific to positive emotion, the broaden-and-build theory.

The broaden-and-build theory of positive emotion is based upon the premise that positive emotions broaden momentary thought-action repertoires (action tendencies) and therefore, build enduring personal resources (Fredrickson, 1998, 2001). As discussed, negative emotions narrow thought-action repertoires in order to promote quick and decisive action at a moment of threat, the ‘fight or flight’ response. In contrast, positive emotions, Fredrickson (2003) proposed, widen our thoughts and ideas; encouraging imagination, creativity and openness that promote engagement with novel and challenging experiences. Joy sparks the urge to play, interest - the urge to explore, and contentment (identified by Fredrickson as a low activation state of positive emotion) sparks the urge to evaluate and savour life that integrates into new views of self and the world. These action tendencies (play, explore, savour, integrate) “broaden habitual modes of thinking or acting” (pp 1369; Fredrickson, 2003). From the broadening of the mindset comes the building of enduring personal social, physical, intellectual and psychological resources; resources that can then be drawn upon throughout life. As Fredrickson (2003) stated, “through experiencing positive emotions, then people transform themselves, becoming more creative, knowledgeable, resilient, socially-integrated and healthy individuals” (pp. 1369).

When relating the broaden-and-build theory specifically to young infant development, the implications of the theory are apparent. The developing child learns in the main, through play and exploration with the environment, and it is specifically positive emotions (joy and interest for example) that spark the infant into playing and exploring. Thus, the infant who is enveloped within a more (rather than less) positive emotional environment will be more open and creative in playing and exploring, building personal resources across all aspects of

development and therefore maximising their developmental potential. Thus, the importance of positive emotions should not be underestimated.

Four- month-old infants with Down syndrome

As discussed, positive emotions are thought to encourage in the developing child the motivation to engage with the environment. Furthermore, positive emotions enable an enhanced, broadened repertoire, spurring creative play and exploration (amongst other behaviours), resulting in a building of enduring personal social, intellectual, physical and psychological resources. It is reasonable to conclude from Fredrickson (2003) that for the infant who experiences more, as opposed to less, positive emotion, the better that infant's developmental potential.

There are contradictions regarding the emotionality of young infants with Down syndrome (DS) that this thesis aims to explore. Some report that young infants with DS are emotionally flat (e.g. Emde & Brown, 1978, Moore, Oates, Goodwin & Hobson, 2008), whilst others report that infants with DS may well be as, if not more positive emotionally than typically developing (TD) infants (e.g. Gunn & Berry, 1985; Ratekin, 1993; Carr, 1995; e.g. Zickler, Morrow & Bull, 1998; Gartstein, Marmion & Swanson, 2006).

It is reported that those with DS have an overriding positive personality stereotype (Fidler, 2005). Those with DS also are thought to develop relative social and emotional strengths (Fidler, 2005); for example, in relation to developing friendships (Kasari, Freeman & Bass, 2003), empathic behaviours (Freeman & Kasari, 2002) and the drawing on inventive and charming social strategies when faced with cognitively challenging tasks (Pitcairn & Wishart, 1994). Adopting the broaden-and-build theory to these two pieces of information (increased positivity and the development of relative social and emotional strengths) it is

viable to ask whether there may be a relationship between positive emotion in early infancy and the development of social and emotional skills.

As discussed, it is known that dyadic face-to-face interaction in early infancy is an important part of the developmental process. It is the time where infant and social partner are sharing in social and emotional exchange, providing perhaps the basis of many, and it could be argued all, aspects of development (for example, turn-taking exchanges of vocalisations aid the subsequent development of language and social communication). If infants with DS are experiencing more positive interactions at this time in development compared to the typical population, then this increased positivity (which broadens experience and builds resources) may enable the developing infant brain to have relative strengthening of socioemotional processes, due to the focus on face-to-face interaction. In contrast, if infants with DS are emotionally flat at this age, therefore expressing (and likely experiencing) less positive emotion, then what might the implications of this be on development?

Differences in functioning in these early months of life could have far reaching impact on a child's developmental outcome. It is important to consider that the child brain is very different to the adult brain. Unlike the adult brain, that has reached maturity and has become relatively static, the child brain (and in particular the very young infant brain) is very much under a process of *development*. For the infant with DS, the impact of the genetic disorder on specific factors of brain functioning may be initially small in relation to some domains and have perhaps no impact on others. However, as the brain develops, relatively minute differences in early aspects of brain functioning will interact together, resulting in further reaching and more diffuse neurological impact (Karmiloff-Smith, 1997). Thus, small differences in the social and emotional functioning of very young infants with DS (i.e. if infants with DS do have more positivity than TD infants at this age) could result in considerable impact on the developmental process. The benefit of studying the behaviour of

very young infants with DS is that it may identify these early small areas of differential behaviours, before this 'snowballing' begins to have substantial effects. Not only may this aid in the development of appropriate early intervention strategies, but furthermore, it could identify the behavioural origins that may be responsible for long-term influence on the developmental process. Thus, the focus of study in the current work is of benefit not only to the field of DS but also to developmental psychology as a whole, building knowledge regarding the role of emotion in development.

Social and emotional development of young infants with Down syndrome

The literature regarding the very early social and emotional development of very young infants with DS is relatively limited. Some studies have compared the early social and emotional skills of infants with DS and the typical population in areas that relate to various aspects of face-to-face interaction. As previously discussed, face-to-face, dyadic interaction in the early months of life is characterised by mutual orientation, socially contingent behaviours from both mother and infant, and emotion sharing (e.g. Murray & Trevarthen, 1985; Nadel et al, 1999). By 4 months of age, TD infants are skilled in primary intersubjectivity (Trevarthen, 1979). Furthermore, dyadic interaction is characterised by cyclic, rhythmical, but unique, patterns of engagement, greeting and disengagement (Tronick, Als & Adamson, 1979) and protoconversation (Bateson, 1971), with infants being active, not passive, participants (Tronick, 1997). Infants as young as 2 to 3 months have also developed some level of expectancy regarding the social content of an interaction (e.g. Murray & Trevarthen, 1985; Cohn & Tronick, 1987; Nadel et al, 1999) and by four months of age have developed a preference to interacting with mother versus a stranger (Bigelow, 1998). Findings specific to these aspects of the early socioemotional functioning of infants with DS raise some interesting points.

Mutual orientation requires the infant to be able to maintain eye gaze with a social partner. Berger and Cunningham (1981) reported that infants with DS 'showed chronological delay in the onset of eye contact' (pp 678). Berger and Cunningham's (1981) well cited longitudinal study evaluated eye gaze behaviour between mother-infant pairs (TD: n=7; DS: n=5). Infants were observed in their home in a face-to-face play situation with mother on a regular basis from the infant age of around 6 weeks to 24 weeks. Infants with DS in their sample reportedly had around a two week delay in the ability to maintain eye contact (6.7wks) in comparison with TD infants (4.1 wks) (obtained by maternal report). However, when Berger and Cunningham (1981) corrected for the fact that infants with Down syndrome had an average gestational age of around 2 weeks less (significant) than TD infants (37.5 compared to 39.3 wks), there was no significant difference between groups. The delay in the ability to maintain gaze may have therefore been due to differences in relation to the maturational development of vision, rather than a particular deficit relating to DS. Furthermore, the small sample should be noted in the study alongside the fact that gaze onset data was based on maternal report rather than behavioural observation. With this in mind it cannot be conclusively reported from Berger and Cunningham (1981) that infants with DS have a delay in the onset of eye contact.

Once eye-to-eye contact is mastered, there is support to suggest some differential patterns of gaze for TD and DS infants. By the age of 4 months, infants with DS reportedly hold eye gaze in dyadic interaction longer than TD infants (Berger & Cunningham, 1981). Carvajel and Iglesias (2000) reported that infants with DS (studying 3 groups aged 3-4-, 6-8- and 10-13- month-old infants with and without DS) had an increased gaze to mother compared to TD infants, however when the object of attention was a toy, there was no difference in looking duration between groups. Berger and Cunningham (1981) argued from their findings that the increased gaze to mother of infants with DS was evidence of an

inability to further develop eye gaze into later functional skills that require voluntary disengagement of eye contact. However, findings from Carvajel and Iglesias (2000) suggest that infants with Down syndrome only show differential patterns of eye gaze when the focus of attention is a toy, rather than a social other. This evidence calls into question Berger and Cunningham's (1981) conclusions that infants with DS have an inability to shift gaze. Rather, combining the findings from Carvajel and Iglesias (2000) and Berger and Cunningham (1981), the more fitting conclusion is that young infants with DS gaze less at an object, and more to a social partner than TD infants. This increased focus to the social partner in face-to-face interaction could further explain how those with DS go on to develop relative socioemotional strengths (Fidler, 2005), due perhaps to increased 'practice' of the basics of socioemotional exchange.

Dyadic interaction is also the time when mothers and infants share in positive emotion, and interactions are characterised with positive emotional exchange, where skills in social smiling are honed. There is an argument that infants with DS have particular deficits compared to the typical population in relation to the onset, frequency and intensity of smiles; however this is by no means conclusive. It has been reported that infants with DS have around a one month delay in the onset of social smiling, and over the first six months of life, smile for a significantly shorter duration and less frequently than TD infants (Berger and Cunningham, 1986). Others remark that infants with DS have a 'dampened' down smile that is less intense than TD infants (e.g. Emde & Brown, 1978). Carvajel & Iglesias (2002) argued however, that these historical studies regarding the smiling behaviour of infants with DS relied more on maternal report, and interpretations or rigid coding of facial expressions from photographs, rather than analysing infant behaviour in active, dyadic interaction.

More recent dyadic interaction studies have revealed that within a still-face paradigm, infants with DS smile for a shorter duration than TD infants in the mobility phase (Carvajel &

Iglesias, 1997), however, infants in their sample ranged in age from around the age of 3-months to 13-months old. There was no significant difference found when comparing the smiling behaviour of the subgroup of very young TD and DS infants (age range: 3.2 to 4.6 months) either throughout the whole, or at any point during the still-face procedure. This finding is supported by Moore, Oates, Goodwin and Hobson (2008) who compared 4-month old TD infants and 6-month old DS infant smiling behaviour (matched on MA) during the still-face procedure, and reported no difference in smiling between the two groups. Moore et al (2008) did, however, find a difference regarding negative emotional behaviour, reporting that infants with DS were less fussy than TD infants during the procedure. The findings by Moore et al (2008) and Carvajel and Iglesias (1997) therefore do not support the conclusion by Berger (1990) that “during the first six months, smiling appears to be the most defective among the DS infants’ major social signalling behaviours” (pp.118), as at 3 and 4 months of age, no difference was observed with regard the smiling behaviour of TD and DS infants. Carvajel & Iglesias (1997) further contradicted Berger (1990) stating that “Down syndrome is a special case of infant disorder, in which smiling is present and similar to that in typical development.” The same authors go on to state “from the age of 6 months, the differences in the development of smiles in typically developing infants and infants with Down syndrome begin to become clearer,” (pp). Drawing on the literature then, it appears that there is a lack of clarity regarding the early smiling behaviour of infants with DS, however, there is support that at least in the early months, infants with DS smile comparably to TD infants in interaction.

Whether, like TD infants, infants with DS have expectancies regarding social interaction and behave contingently or not, has also received some, but little attention in the literature. Four-month old infants with DS are able to share in turn-taking social vocalising similarly to TD infants, although this skill is perhaps a little less coordinated (Jasnow et al,

1988) and over the following months, turn-taking vocalisations may become more disjointed (Berger & Cunningham, 1983). Similarly to TD infants, 3-month-old infants with DS discriminate between objects and people, directing social and emotional behaviour to another social being, a conclusion that is interesting when relating this to the development of person and object permanence. Infants with DS detect perturbations to a social interaction and behave similarly to TD infants throughout the still-face procedure, demonstrating no difference in positive emotion or gaze behaviour when compared to TD infants in the first and final stages; and, again comparably to TD infants, when mother poses a still-face, infants with DS smile less and reduce gaze (Carvajal & Iglesias, 1997; Moore et al, 2008). This supports the conclusion that very young infants with DS may well have social expectancies relating to interaction.

This summary of the research regarding the socioemotional functioning of very young infants with DS suggests that similarly to TD infants of comparable age, 4-month old infants with DS are able to maintain mutual orientation (although may gaze longer at a social partner compared to an object, and compared to TD infants), demonstrate no clear deficits when compared to TD infants regarding social smiling, and according to temperament studies are perhaps more positive than TD infants. Like TD infants of the same age, 4-month old DS infants are sensitive to perturbations in interaction, appear to have some level of social expectancy and also, are sensitive to the timing and structure of social exchange.

If this is the case, then it is reasonable to conclude that infants with DS would behave similarly to TD infants within a naturalistic game of peekaboo, behaving equally or perhaps more positively than TD infants. However, whether mothers from both groups play the game comparably is unclear. It has been reported that mothers of infants with Down syndrome show more 'assertive warmth' (Moore et al, 2008), and are more directive, controlling and take more initiative in play (Buckhalt, Rutherford & Goldberg, 1978) than mothers of TD

infants. Others report no difference in maternal responsiveness (Brooks-Gunn & Lewis, 1984). Differences in maternal behaviour across groups could suggest that contingent behaviours are somehow different in the DS population. Furthermore, it is unclear whether or not, as is the case for TD infants, 4-month old infants with DS have preference over interacting with mother compared to a stranger. If so, this would provide further evidence that infants with DS have social expectancies when in interaction, and as is true for TD infants, are active, capable play partners at this very young age.

Research outline

The current study examined the naturalistic, rather than experimentally controlled, peekaboo game when played with infants aged 4 months in order to ascertain the temporal and structural form of the game when played with infants at this very young age. A peekaboo paradigm was utilised as, at four months of age, infants may well be becoming sensitive to the timing and structure of the game. This is important as it is reflective that infants have developed a level of social expectancy, and by understanding the rules and structure of the game, may be beginning to learn the rules and structure of more complex communication, and also may be learning the concept of person permanence. The majority of peekaboo studies to date with very young infants have by their very nature, affected the phenomenon aimed to study through adding rigid time restraints and inhibiting dynamic interaction. The current study aimed, in contrast, to identify the natural form of the game in order to inform future research in the field, and consider how the early form and structure of the game may be accommodating dynamic interaction. There were no rigid timing restraints, nor control of the content of the interaction.

The study also investigated whether or not mother versus a stranger played the game differently, and whether different play partners related to infant smiling behaviour due to the

claim that by 4 months of age, infants have a preference to maternal over stranger interactions. Alongside the theoretical rationale for this, adding a repeated measures element to small sample studies increases the power of the study.

Smiling behaviour was also measured throughout the game as an index of positive emotion, to investigate how TD infants and infants with DS compare with regard positive emotionality at this age when in dyadic play. The benefit of using a naturalistic peekaboo paradigm was that it has a goal of heightened positive emotion, and under this paradigm, differential patterns of smiling behaviour may become more apparent. The current study is the first to use the peekaboo paradigm to study the social and emotional development of 4-month old infants with DS.

Predictions

The temporal structure and form of the naturalistic game of peekaboo was examined with regard to mother-infant and experimenter-infant dyads. Rochat et al (1999) adopted 3 separate phases of the game: 'approach', 'peak' and 'release', whilst Montague and Walker-Andrews (2001) specified 2 phases: 'hiding' and 'presentation'. It was examined whether or not these phases were evident in the game. In both of these previous pieces of research, phases were time-controlled. It was predicted that in a naturalistic game of peekaboo, these phases would enable a time of engagement and greeting, and would also have a period that would enable the infant the time to disengage, assimilate information and regulate emotions. Furthermore, it was predicted that the duration of phases within the game would fluctuate, due to evidence regarding the cyclic, yet unique patterns of dynamic interaction in infant face-to-face interaction (Tronick, Als & Adamson, 1976). These predictions, whilst seemingly obvious to those experienced in studying the social interactions of young infants, are important to recognise. Rochat et al (1999) described how very young infants have

developed a level of social expectancy, using a peekaboo paradigm to demonstrate this. Yet, the design of the study in Rochat et al (1999) was experimenter led, with the experimenter changing their behaviour every 2 seconds, following a 60 second script. If infants are interactive partners at 4 months of age (as recognised by others such as Trevarthen, 1979; Tronick, 1987; Murray & Trevarthen, 1989; Nadel & Muir, 2005; Reddy, 2009) then the experimenter and infant in Rochat et al (1999) could not have been in an interaction as defined by the aforementioned researchers. The script is primarily dictating experimenter behaviour, not the infant. Thus, the current study will examine the form of the naturalistic game.

In light of conflicting evidence regarding possible differences or similarities in maternal behaviour of infants with and without DS (Buckhalt, Rutherford & Goldberg, 1978; Brooks-Gunn & Lewis, 1984; Moore et al, 2008) it was tentatively predicted that in relation to the timing and structure, mothers would play the game comparably across groups. This prediction was also made due to the fact that there is no clear evidence that infants with DS would participate differently to TD infants with respect to social expectancies within an interaction, nor in relation to the overall timing and structure of social exchange.

The smiling behaviour of infants was examined in order to assess whether infants in both groups enjoyed playing the game in a comparable way, or not. Given the exploratory nature of this work, no directional prediction was made regarding whether infants with Down syndrome would be more or less positive emotionally than typically developing infants during peekaboo play.

Finally, it was predicted that all infants would show increased smiling behaviour in the mother versus experimenter condition, due to the premise that 4-month old TD infants (and there is nothing to suggest anything to the contrary regarding DS infants) behave more positively when interacting with mother compared to a stranger.

Method

Participants

Twenty two 4-month-old infants and their mothers participated. For one of the TD infants, issues with video equipment meant that data could not be collected thus, this participant was excluded from the study. Of the remaining 21 infants, 11 were typically developing (4 male, 7 female) (M18.5 wks, SD 1.13; range 17.5 – 20.5), and 10 infants were diagnosed with Down syndrome (6 male, 4 female) (M18.9; SD 1.23; range 17.0 – 20.5). There were no differences between groups in relation to infant age, maternal age, education or birth order. No infant was known to have any serious health complications. Participants were recruited in and around Portsmouth, a city in the South of England. Recruitment was carried out with the assistance of the Portsmouth Registry Office and at a local baby and toddler show. Infants with DS and mothers were recruited with the assistance of Professor Sue Buckley, Director of Research at The Down Syndrome Educational Trust, Portsmouth. All participants were living in the southern part of England. (Refer to Chapter One for further detail).

Procedure

The study was carried out in the infant laboratory in the Department of Psychology, University of Portsmouth and also for some of those infants with DS, in a similar room, at the Down Syndrome Educational Trust, also situated in Portsmouth. Mothers and infants were asked to come to the lab around the times when the mother felt her infant would be at his or her most alert and content. In the vast majority of cases, this was mid-morning. An outline of the study was verbally provided to mother, and the set up of the room explained. At this point, mothers were given an Informed Consent form to read and sign if in agreement. It was made clear to mothers that if their baby became upset, distressed or needed a break at any

point, then recording stopped and only restarted once infant and mother were happy to continue.

There was an age-appropriate highchair for the infants to sit in and a chair placed opposite the infant (approximately 75cm away) for the play partner. Three video cameras on tripods were set up around the room. Camera 1 was positioned to capture the full interaction (dyad), Camera 2 (infant) captured close up footage of the infant, and Camera 3 was positioned to capture close up footage of the play partner. Mother sat on a sofa behind the infant (out of sight) whilst firstly, play partner and infant played peekaboo. Peekaboo was one of two experimental procedures that infants and mothers participated in at the same visit (See Chapter 3). During this time, mother was asked to complete a selection of questionnaires (and at the end of the whole session, a brief interview with mother was conducted; See Chapter 4). Following completion of the infant-experimenter trials, and subsequent completion of the study described in Chapter 3, mother-infant dyads then played peekaboo, with mother sitting in the chair placed opposite the infant. The experimenter moved out of sight of the infant, but in the same room, whilst mother and infant played.

Experimental order

Peekaboo with stranger (condition 1) always occurred before peekaboo with mother (condition 2). The decision was taken not to counterbalance due to the small sample and the subsequent effect on power (See Chapter 1). Thus, the condition order was set as such so as to allow for a natural flow across experiments (as this was one of two experiments run in the session – see chapter 3). Also, placing mother-infant peekaboo as the second condition looked to counteract any fatigue effect. It was predicted that peekaboo with mother would offer the most positive play experience for the infant in comparison to experimenter play. If infants were fatigued, then the last condition is likely to result in less positive emotional

exchange. If mother-infant peekaboo still offered more positive interactions than experimenter-infant then results, in fact, could be considered as conservative. Furthermore, by finishing the session with mother and infant playing together, the session would be expected to culminate in a comfortable, familiar situation for both mother and infant, enabling the most positive experience for participants. Practice effects were reduced due to separating the conditions so that peekaboo-experimenter was the first condition, and then only after the triadic experimental procedure (in Chapter 3) was carried out, was peekaboo-mother then played.

Condition 1: Peekaboo with stranger (experimenter)

The experimenter placed the infant securely in an age-appropriate highchair and checked with the mother that she was happy that her baby was safely and comfortably positioned. Video recording began. The experimenter sat on a chair directly in front of the infant, with face approximately 75cm away, spoke out loud the start of the trial (for aligning the three video recordings) and initiated a game of peekaboo. It was decided not to use any cloth or prop, as this could become an obstruction to the video recording, serving possibly as a distraction. Rather, hands were used to obscure the face. Key was to keep this game naturalistic and so whilst the game was similar with all babies, it was important for the experimenter to attempt to reach an optimum level of engagement through being responsive and aware of infant behaviour. Once the experimenter felt that the interaction had gone past its peak, that is that the experimenter and the infant had gone past the time of optimum enjoyment, the trial ended. Three trials were attempted if the baby was alert, happy and responsive. Trials were only stopped and not restarted if infant became fussy, or mother felt that her infant could not continue.

Condition 2: Peekaboo with mother

Mother sat directly in front of the infant as in the infant-experimenter condition. Cameras were re-adjusted to capture a close up of mother, infant and the interaction as a whole. Mothers were asked to play peekaboo with their baby, however they felt comfortable, but again without any props for reasons earlier discussed. Mothers were asked to play naturally, without consideration of how the experimenter played, and for how ever long they felt that they, or their baby, were engaged and interested in play. Mother was instructed that if she felt that the interaction had gone past its peak, that is that her and her infant had gone past the time of optimum enjoyment, then she could stop playing the game. The aim was to complete three trials. If mothers felt that there baby needed a break, perhaps for feeding, or for comfort, then the trial stopped. The trial would only restart once mother was happy to continue. Trials were only stopped and not restarted if infant became fussy, or mother felt that her infant could not continue for any reason.

Debriefing

Following the whole data collection session, the experimenter asked the mother if she had any questions and gave a brief overview of some of the reasoning behind the experiments. Mother was reassured that all behaviours are 'typical', that the experimenter was not looking for right or wrong patterns of behaviour, rather it was an exploration of very early skills in social and emotional development. They were given the Debriefing form. Mothers were asked if they would like a DVD copy of the session, and given a Mothercare voucher to reimburse any travelling costs.

Preparation of videotapes for analysis

For each participant, original video recordings from each of the three video cameras were edited into individual trials using Pinnacle editing software. The 2-way video camera recording was edited first, using the start and end points of trials as markers. The onset of the trial was identified as being when the experimenter indicated the start of the trial vocally. The end of the trial was identified by when the experimenter or mother indicated the peekaboo game was over. These edited trials were then exported into MPEG1 files, with relevant titles. The other two camera angles (Play partner and Infant) were then edited to begin and end at the same frame as the 2-way edited trials. Accuracy was achieved through using audio prompts to match frames across the camera recordings. High quality Sony Ericsson headphones enabled an excellent accuracy rate, with most trials risking no error in matching frame to frame. For the rare instances where audio prompts were a little less clear, a generous allowance of up to 2 frames of error is given. These edited trials were then exported as MPEG1 files. Thus, three MPEG1 files for one individual trial were produced, each starting and finishing precisely at the same point.

Observational analysis

The initial step in approaching the analysis of infant-play partner dyadic interaction was to become familiarised with the video footage. This is a necessary step in identifying particular interesting areas of investigation in these naturalistic interactions. A small selection of interactions was observed in detail. Observations were drafted into brief narrative descriptions in order to draw out commonalities and identify particular phenomena. Bakeman & Gottman (1997) support this initial approach to research, stating that the beginning of an investigation can be a search for order, stating further that “it is perfectly legitimate... to

begin the process of systematic observation with the simple goal of description.” An example of a narrative description of one infant-mother trial is provided below:

P5. Trial 1: *Mum gains baby’s attention through calling her name in a soft, high pitched voice, and touches baby’s feet. Baby looks to mum, smiles, baby stops smiling once mum’s face is hidden and then smiles, after a delay, after mum has revealed. Baby begins to make body movements. Mum hides again twice more, baby is relatively still but attentive, with a small smile after the 2nd reveal. When baby doesn’t smile after 3rd reveal, mum covers baby’s face with hands and plays boo. No evidently strong emotional response and mum then tickles her feet. Baby smiles and looks to feet. Mum covers her own face again and baby looks back to mum, very attentive, a little excited. Baby doesn’t smile particularly, but body movements begin to increase. Mum giggles. Baby stops looking at face and looks to mum’s chest area. Mum says baby isn’t paying any attention to her and so trial ends.*

The first draft of the coding system developed was highly detailed (See Appendix A) and adopted an interval sampling approach. It included coding behaviours for play partner such as physical interactions, emotional state, level of arousal, facial expressiveness, vocalisations to name a few. Similarly, regarding infant behaviour, this first draft included coding vocalisations, facial expressions, body movements, gaze, emotion, and levels of arousal. The game of peekaboo itself also was broken down into specific phases and assigned codes. However, it became evident that this coding system was excessively detailed, would be impractical and time-consuming to use and lacked specificity. Bakeman & Gottman (1997) warned that through attempting to look at everything, the observer can become overwhelmed with data and the research could subsequently be compromised.

From conducting the analysis of the triadic study first, it had become apparent that this was a risk. In the triadic study, I analysed a wide range of infant behaviours. Whilst this process was beneficial, in that it was possible to consider a wide variety of infant behaviours and compare the two groups, it had been a challenging method of analysis. There was a vast array of tests carried out, on a vast array of data. Observational analysis of the array of infant behaviour was time-consuming,

Preliminary observation of the footage revealed that the play partners, be they mothers or experimenter, were all highly motivated to engage with the infant when playing the game. With this in mind, it was decided that whilst a detailed analysis of maternal and experimenter behaviours (such as facial expressions, body movements etc) may be of interest in future studies, the current study would focus purely on the structure and timing of the peekaboo game played by mother and experimenter as well as infant behaviour during the game. Furthermore, to address the predictions regarding infant emotionality, it was decided to use 'smiling' as a marker of infant positive emotion, and 'negative facial expressions' as a marker of negative emotion. Another category considered and trialled in the development of the coding system was infant 'anticipatory' behaviour. A working definition for this at the time was 'is the infant demonstrating anticipatory behaviours – e.g. eyebrows raised, physical excitement). Upon trialling with this category however, it became clear that this category was risking ambiguity. A clear definition of what could be classed as 'anticipatory' behaviours in these 4-month-old infants was difficult to develop, and to code reliably. Thus, this category was subsequently dropped from analysis.

Peekaboo structure

Initial observations of the video footage and trialling of the coding system identified four phases of the peekaboo interaction, plus an occasionally occurring ‘attentional request’ phase. This phase was omitted from detailed analysis due to the fact that this was separate and inconsistently occurring in contrast to the more typical four phases of peekaboo. When the attentional request phase did occur, it was often at the very start of the video recording, and preceded infant-play partner interaction. Therefore, whilst it is recognised that data regarding the attentional request phase may well be of interest to future study, this data was not included in subsequent analysis. The four phases identified were: preparatory, hide, reveal and interplay. Codes for peekaboo phases, keys and definitions are shown below in Table 2.1. To qualify as a peekaboo bout, the game had to include a hide and reveal phase, as these are the core elements of any peekaboo game. The remaining phases may or may not occur, and also may or may not occur in order. The coding method selected to record these phases, or events, was timed event sampling. Using this method enabled analysis not only of whether or not an event occurred and how often it may occur, but also enabled collection of durational information. It was possible to identify how long in duration each particular phase lasted, on an individual level, and also overall. The codes developed to categorise the four phases identified (plus the attentional request phase) were designed as such to be mutually exclusive (only one code could be used for one event) and mutually exhaustive (there was one code for every event). Recording the onset of one event would indicate the offset of the previous event recorded.

Table 2.1

Peekaboo phase keys, codes and descriptions

Key	Code	Description
P	Preparatory	Partner begins preparing for the 'hide', perhaps through moving the hands up towards the face, or by saying 'I'm going to hide away'.
H	Hide	When mother or infant face is hidden away
R	Reveal	From when the hide is over, the hands move away from face and includes the time with which partner may say 'peekaboo.' The offset of this phase is marked as when the verbal 'peekaboo' or equivalent ends and the mechanics of moving the hands from the face is complete; when play partner is ready for infant response.
I	Interplay	Face-to-face interaction when partner and infant may share in evaluative or reassuring interactions. Partner may say 'was that funny', 'shall we play again' etc.

Coding procedure

The behavioural analysis software system, Interact (Mangold International), was used for coding. This system enables sequential coding of behaviour and enables the observer to set up coding systems in a way to meet the needs of the individual study. Having prepared Interact files to function using the peekaboo phase coding system described above, each trial was then observed by the experimenter, using the close up video footage of play partner. The onset of each phase was recorded by observing the approximate onset of the event, and then using the frame by frame option to identify the precise frame the behaviour occurred. This had the advantage of being particularly precise, however the disadvantage of being less time efficient than for example, coding from observation of the videos in slow motion. One pass of the trial was made. The onset of each phase was subsequently recorded for each trial, for each infant. The product of this coding was a continuous, timed event data sheet detailing the shifting through different phases of the peekaboo game throughout the trial.

The next phase of coding was for infant emotion during the game, using ‘positive facial expressiveness’ and ‘negative facial expressiveness’ as categories. An event sampling method was adopted for these categories. Codes were not set as being mutually exhaustive and exclusive. Rather, for both positive and negative facial expressiveness respectively, an event was marked as having an onset and offset time. So, the observer marked the specific frame of the onset of a positive facial expression (defined as a smile: the upturn of the corner of the mouth as in Baby FACS; Oster, 2008) and the offset point. Again, this provided data regarding the frequency of the behaviour and also durational information. One pass was made for positive facial expressiveness, using the close up footage of infant. A second pass was made for negative facial expressiveness (grimaces, frowns etc). Using this method, the timing of infant positive and negative facial expression data was mapped on to the peekaboo phases, and enabled analysis of when, how frequently and how long positive and negative facial expressiveness occurred.

Table 2.2
Emotion coding scheme

Key	Code	Description
P	positive facial expressiveness	The onset is marked as when the infant begins smiling – defined as an upturn of the corners of the mouth (as in AU12 – Baby FACS, Oster, 2008). The offset is marked when the corners of the mouth return to a neutral or other position not representative of an AU12.
N	negative facial expressiveness	The onset is marked as when the infant begins frowning, grimacing or other evident negative facial expression. The offset as when none is visible. The infant may vary in intensity of negative expression, perhaps a waxing and waning of negativity, however the offset is only recorded when negativity is not visible.

Reliability

Intra-rater reliability was carried out on 20% of the data and average Cohen's Kappa scores were calculated via Interact. Cohen's Kappa scores for phases were: Preparatory = 78, Hide = 86, Reveal = 76, Interplay = 83; and for Emotion = 0.83. Inter-rater reliability was carried out by a Psychology graduate, who was unaware of the full purpose of the study, and who was trained to use the coding system. Average Cohen's Kappa scores were: Preparatory = 79, Hide = 83, Reveal = 75; Interplay= 79; and for Emotion = 0.80.

Data preparation

Once the coding was completed, the Interact software produced a graphical file for each trial detailing phase durational information with occurrences of emotional behaviour mapped in (a time-line graph). The time-line graphs were then used to record when infant emotional expressiveness occurred in relation to the phases of the peekaboo game. Interact also electronically calculated frequencies, mean durations and total duration of phases and emotional behaviours. These data were collated and input to SPSS.

Data analysis decisions

The alpha level was set at $P < 0.05$, with trends identified as $P < 0.1$. Effect size (partial eta squared) was included where statistical significance or trends were identified. No Bonferroni adjustments were made on the data. The justification to not make Bonferroni adjustments is discussed in Chapter One. The power analyses conducted in Chapter One, demonstrated that in a design such as this (a 2x2 mixed between-within) that a sample size of 22 would yield sufficient power to detect significant effects at $p < 0.05$, and small to moderate

effect sizes. However, whilst 22 participants were originally recruited, the data for one had to be excluded, therefore the reduction of power of the study should be noted.

Results

It was first asked how the groups of infants compared with regard to finishing 3 trials of peekaboo with stranger and 3 trials with mother.

Trial completion

Table 2.3 shows that out of a possible 66 trials, TD infants completed 54 (82%). In contrast, DS infants completed 59 out of a possible 60 trials (98%). Infants were categorised as either completing all trials (yes) or not completing all trials (no) and a chi square test was conducted. Statistical significance was found, $\chi^2 (1, 20) = 6.39, p = 0.01$. Thus, it can be concluded that DS infants were significantly better able to meet the demands of the experiment (i.e. complete all 6 trials) compared to TD infants.

It was decided to analyse data from only the first two trials per condition due to the fact that not all TD infants completed 3 trials per condition. All data collected in T3 were excluded from further analysis. The total number of infants from both groups that completed 2 trials per condition was 9 TD infants (4 male, 5 female) and 10 DS infants (7 male, 3 female). Further analyses considered data only from these 19 participants.

Table 2.3

% of successfully completed peekaboo trials for TD (n=11) and DS (n=10) infants

Condition	Experimenter			Mother		
	<i>Trial 1</i>	<i>Trial 2</i>	<i>Trial 3</i>	<i>Trial 1</i>	<i>Trial 2</i>	<i>Trial 3</i>
Group						
TD	100%	100%	73%	91%	82%	45%
DS	100%	100%	100%	100%	100%	90%

Total trial duration

Table 2.4 depicts the average total duration of Trial 1 and Trial 2 for each group in the mother and experimenter conditions. A mixed ANOVA was performed to see if there was any overall difference relating to total trial duration between groups and conditions. There was no main effect for Condition, $F(1, 17) = 0.36, p = 0.56$. Mother and experimenter trials did not significantly differ in duration (Overall $M = 158.4$). There was also no main effect for Group, $F(1,17) = 3.84, p = 0.07, \eta^2_p = 0.18$; however the p-value supported a non significant trend. The interaction between condition and group was not significant, $F(1,17) = 2.83, p = 0.11, \eta^2_p = 0.14$. For both of the latter analyses however, there was a medium effect size and therefore further analysis of the data was warranted. Univariate analyses revealed that for TD infants, trials with mother were significantly shorter in duration than those with experimenter, $F(1,8) = 7.42, p = 0.03, \eta^2_p = 0.48$, whereas there was no significant difference in trial duration by condition for DS infants (Overall $M = 177.7$), $F(1,9) = 3.89, p = 0.55$. It was also found that trial duration with mother was significantly shorter for TD infants than for DS infants, $F(1,17) = 4.67, p = 0.05, \eta^2_p = 0.22$. Trial duration did not significantly differ

between groups when the play partner was experimenter, $F(1, 17) = 0.21$, $p = 0.65$; (Overall $M = 164.1$, $SD = 41.86$). When TD infants played with the mother, but not the experimenter, the game was played for a shorter duration than DS infants.

Table 2.4

Total trial duration (Trial 1+Trial 2) (in secs) for TD (n=9) and DS (n=10) infants by condition

Condition	Experimenter		Mother	
	M	SD	M	SD
TD	159.4	38.5	120.1	48.0
DS	168.4	46.2	187.1	80.8

As there was a difference in relation to trial duration found, a decision was therefore required as to whether to convert the data to eliminate a possible effect of trial duration influencing results. I considered converting data into the rate that particular behaviours occurred per minute, yet the design of the study was to report on the form of naturalistic games of peekaboo when played with 4-month-old infants with and without Down syndrome, and to examine aspects of infant behaviour within that play. I decided that by not converting the data, the describing of the form of the game, and the behaviour of the infants, would be more meaningful. This decision was supported by the statistical evidence, in that an interaction was identified only as a trend in the first step of analysis.

Phases of peekaboo bouts

To qualify as a peekaboo bout, a hide and reveal phase was required. Hide and reveal phases had perfect correlation in the experimenter, $r(19) = 1.00$, $p < 0.001$; and

mother, $r(19) = 1.00, p < 0.001$, conditions. Analysis of the data regarding the average frequency of occurrence of each of the four phases of peekaboo (preparatory, hide, reveal, interplay) demonstrated that a peekaboo bout includes, in almost all instances, each of the four phases. Average frequencies (with SD) of all phases are shown in Table 2.5. The number of bouts of peekaboo played with mother and experimenter for both TD and DS infants was calculated. Infant-play partner dyads played an average of 9.7 bouts of peekaboo totalled over the two trials. There were no significant main effects for condition, $F(1, 17) = 1.76, p = 0.20$, or group, $F(1,17) = 0.17, p = 0.68$. There was no interaction $F(1, 17) = 2.19, p = 0.16$. As analysis showed no difference in the amount of peekaboo bouts played by play partner with either TD or DS infants (using hide and reveal phase as criteria for a bout), it can also be concluded that there was also no difference in the amount of preparatory and interplay phases played by either mother or experimenter with TD and DS infants. Neither group nor condition influenced the total number of peekaboo bouts played.

Table 2.5
Mean frequency and (SD) of individual phases by Group (TD: n=9; DS: n=10) and Condition

Group	Condition	Preparatory		Hide		Reveal		Interplay	
		M	SD	M	SD	M	SD	M	SD
TD	Experimenter	10.1	(2.09)	10.1	(2.09)	10.1	(2.09)	10.2	(1.99)
	Mother	9.6	(2.96)	9.9	(2.93)	9.9	(2.93)	9.7	(3.04)
DS	Experimenter	7.3	(1.25)	7.3	(1.25)	7.3	(1.25)	7.1	(1.10)
	Mother	11.4	(8.28)	11.4	(8.28)	11.4	(8.28)	11.4	(8.28)

Total duration of phases

There was considerable variability regarding the duration of a phase within a bout of peekaboo. Next, the total duration that phases lasted across the whole of the peekaboo trials was analysed to identify whether one phase received more or less emphasis during the game, and whether this related to group or condition.

Preparatory: A highly significant main effect for condition was found, $F(1,17) = 28.51, p < 0.001, \eta^2_p = 0.63$. The total duration of the preparatory phase was longer with the experimenter ($M = 23.7$ secs, $SD = 9.48$) compared to the mother ($M = 10.8$ secs, $SD = 4.57$) (See Figure 2.1). There was no significant main effect for group; TD ($M = 15.9$ secs) and DS ($M = 18.5$ secs) infants spent equal time in the preparatory phase, $F(1,17) = 1.05, p = 0.32$. There was no interaction, $F(1, 17) = 0.13, p = 0.72$.

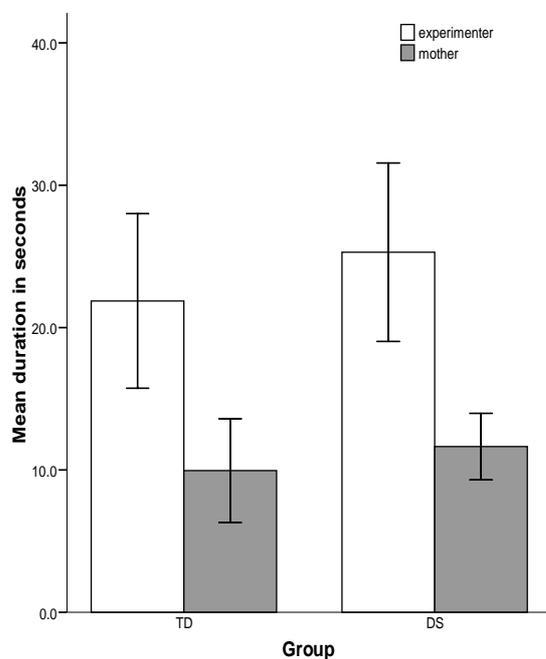


Figure 2.1 Average total duration (in secs) (and SE) of preparatory phase for TD (n=9) and DS (n=10) infants with each play partner

Hide: The time spent in the Hide phase is shown in Figure 2.2. There was no significant main effect for group, $F(1, 17) = 0.22, p = 0.64$. No significant main effect for condition was found, $F(1, 17) = 3.59, p = 0.075, \eta^2_p = 0.17$, and no significant interaction, $F(1, 17) = 3.27, p = 0.088, \eta^2_p = 0.16$, although trends were noted and moderate effect sizes justified further analysis of the data. Univariate analysis revealed a trend (with a large effect size) towards DS infant-mother dyads tending to spend a longer total duration in hide phase ($M = 25.6$ secs, $SD = 12.94$) compared to DS infant-experimenter dyads ($M = 16.0$ secs, $SD = 5.74$), $F(1, 9) = 0.47, p = 0.058, \eta^2_p = 0.34$, whereas TD infant-mother and TD infant-experimenter dyads did not differ in hide phase total duration ($M = 19.2$ secs), $F(1, 8) = 0.01, p = 0.93$.

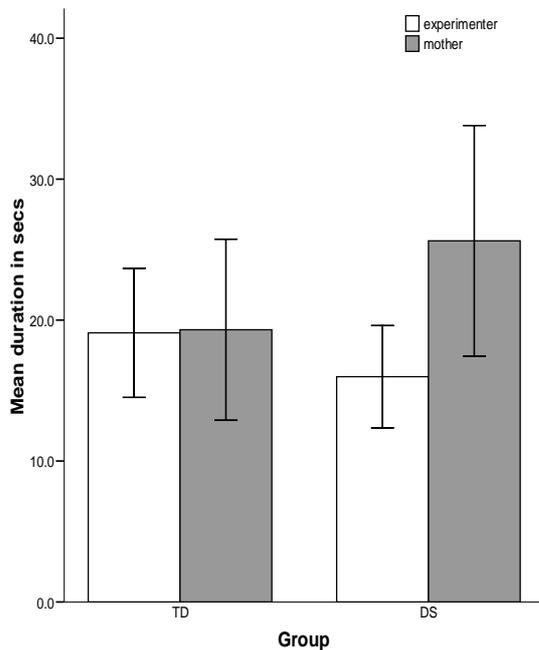


Figure 2.2
Average total duration (with SE) of hide phase for TD (n=9) and DS (n = 10) infants with each play partner

Reveal: Figure 2.3 depicts the time spent in the reveal phase by group and condition. No significant main effects for condition, $F(1, 17) = 0.003, p = 0.96$, or group, $F(1, 17) = 2.03, p = 0.17$, were found. There was no significant interaction, $F(1, 17) = 4.23, p = 0.056, \eta^2_p = 0.20$, however, a trend was noted and the effect size warranted further investigation. Univariate analysis revealed that the experimenter spent a significantly longer duration of time in the reveal phase with TD infants ($M = 23.97, SD = 6.19$) compared to DS infants ($M = 15.09, SD = 2.75$), $F(1, 17) = 16.95, p = 0.001, \eta^2_p = 0.50$; whereas mothers from both groups spent a comparable duration of time in the reveal phase ($M = 19.73, SD = 9.76$), $F(1, 17) = 0.17, p = 0.68$. TD infants also showed a trend (with a large effect size) of spending a longer duration in the reveal phase with the experimenter ($M = 24.0, SD = 6.19$) compared to mother ($M = 18.72, SD = 5.90$), $F(1, 8) = 3.54, p = 0.097, \eta^2_p = 0.31$. In contrast, DS infants did not differ statistically in reveal phase duration with experimenter ($M = 20.6, SD = 12.55$) or mother ($M = 15.1, SD = 2.75$), $F(1, 9) = 1.67, p = 0.23, \eta^2_p = 0.16$; however the moderate effect size should be noted. So, specifically when TD infants and the experimenter played peekaboo, significantly longer was spent in the reveal phase compared to DS infants, and this tended to be longer than with mother.

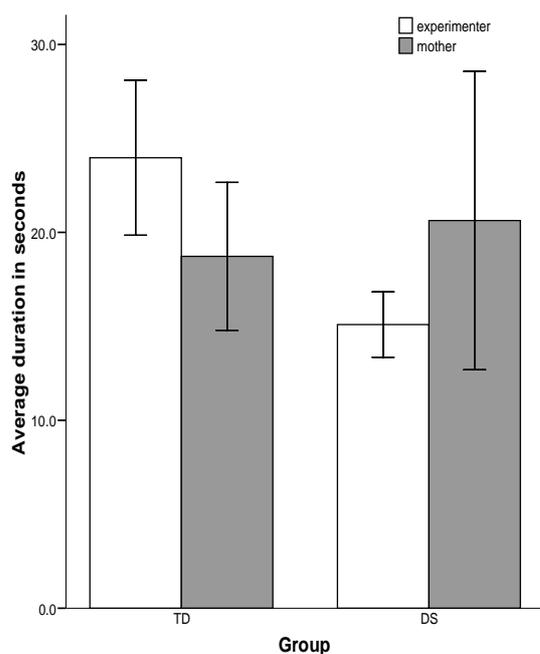


Figure 2.3
Average total duration (in secs) (& SE) of reveal phase for TD (n=9) and DS (n=10) infants with each play partner

Interplay: The amount of time infants and play partners spent in the interplay phase is shown in Figure 2.4. A significant main effect for group was found, $F(1,17) = 6.33, p = 0.02, \eta^2_p = 0.27$. DS infants spent a longer duration in the interplay phase than TD infants. There was a non-significant trend towards a main effect for condition, $F(1,17) = 4.37, p = 0.052, \eta^2_p = 0.20$, and also a non-significant trend towards an interaction, $F(1,17) = 3.56, p = 0.076, \eta^2_p = 0.18$, that justified further analysis. Univariate analysis revealed that TD infants spent a significantly longer duration in the interplay phase with experimenter ($M = 83.9$ secs, $SD = 24.39$) compared to mother ($M = 38.9$ secs, $SD = 17.42$), $F(1,8) = 39.32, p = 0.0002, \eta^2_p = 0.83$, whereas DS infants spent equal duration in this phase with both play partners ($M = 93.6$), $F(1,9) = 0.01, p = 0.913, \eta^2_p = 0.001$. The duration of time TD infants spent in the interplay phase with mother was significantly shorter than DS infants, $F(1,17) = 8.30, p = 0.01, \eta^2_p = 0.33$, but with the experimenter, no such difference across groups was found, F

(1,17) = 0.49, $p = 0.49$. Thus, the interplay phase when TD infants played with mother was specifically shorter in duration than when playing with the experimenter, and also this phase was shorter in duration when compared to the amount of time DS infants spent in the interplay phase.

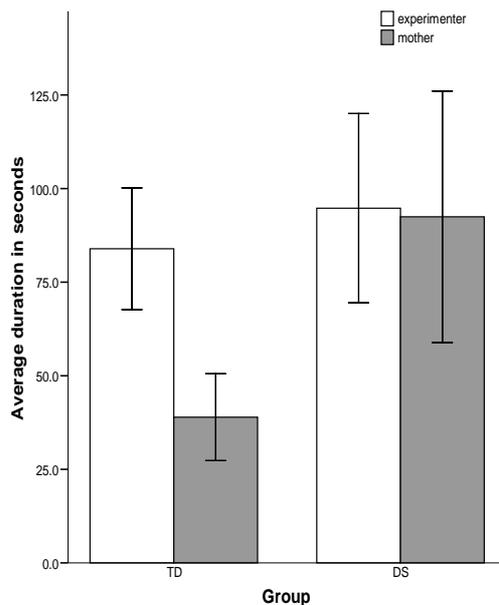


Figure 2.4
Average total duration of interplay phase for TD and DS infants with each play partner

Positive emotion

Infant positive emotion was analysed when playing peekaboo with mother and experimenter to see if positive emotion was influenced by group or by condition. Infant smiles were used as a marker of positive emotion. The duration of smiles were coded from onset to offset. A smile onset was defined as when the corners of the mouth began to move upwards (as in an AU12 – Baby FACS, Oster, 2008). The offset was marked when the smile finished, i.e. when the corners of the mouth returned to a neutral position, or a position that was not representative of an AU12. A period of smiling (onset to offset) was defined as a smile bout.

Infant smiling behaviour during peekaboo play

Infants were categorised as either smiling or not (the criteria being that the infant smiled at least once during the two trials) in each condition, and percentages were calculated. All infants smiled with Experimenter (TD = 100%, DS = 100%) and all but one infant (DS) smiled with Mother (TD = 100%, DS = 90%). Table 2.7 lists the average number of smile bouts, the overall duration of infant smiling throughout the trials and also the average length of each individual bout of smiling. Standard deviations are also provided.

With regard to the analysis of the number of smile bouts infants produced during the peekaboo trials, there were no significant main effects found for condition, $F(1,17) < 0.001$, $p = 0.99$, or group, $F(1,17) = 0.30$, $p = 0.59$. There was also no interaction, $F(1, 17) = 2.21$, $p = 0.16$. Neither play partner nor group influenced the number of smile bouts infants produced. Infants averaged 8.5 bouts of smiling during peekaboo play.

The length of time infants spent smiling during peekaboo play was then analysed. There were no significant main effects for condition, $F(1,17) = 0.10$, $p = 0.76$, or group, $F(1,17) = 0.28$, $p = 0.61$. There was no interaction, $F(1,17) = 1.30$, $p = 0.27$. Infants smiled for an overall average duration of 26.9 secs.

Following analysis regarding the average length of each individual bout of smiling it was found that there were no significant differences relating to group $F(1,17) = 2.11$, $p = 0.17$; or condition, $F(1,17) = 0.49$, $p = 0.49$. There was also no interaction, $F(1,17) = 0.47$, $p = 0.50$. Each individual bout of smiling by infants lasted an average length of 2.76 secs.

Table 2.6

Means (and SDs) relating to smiling behaviour (in secs) of TD (n=9) and DS Infants (n=10) in Experimenter and Mother Conditions

Condition	Group	Number of smile bouts	Overall smile duration (secs)	Mean smile bout duration (secs)
Experimenter	TD	7.1 (6.72)	25.1 (32.06)	2.9 (1.81)
	DS	10.6 (5.42)	27.0 (20.02)	2.4 (1.28)
Mother	TD	9.6 (4.39)	33.8 (23.23)	3.4 (1.16)
	DS	8.2 (5.35)	22.0 (20.88)	2.4 (1.34)

Was infant smiling behaviour influenced by the phases of the peekaboo game?

Smiling data were mapped on to peekaboo phase data to enable the identification of when infant smiling occurred. It was then asked whether smiling behaviour was influenced by the particular phases of the game (preparatory, hide, reveal, interplay). Table 2.7 depicts the number of infants who smiled at least once during each of the phases when played with mother and experimenter. The percentage of each phase that contained smiles was then calculated (e.g. 10 reveals and infant smiles in 5 of them = 50%).

Table 2.7
Percentage of infants who smiled (at least once) in each of the phases of peekaboo

Phase	Condition	TD % (n=9)	DS % (n=10)
Preparatory	Experimenter	45	30
	Mother	100	50
Hide	Experimenter	54	30
	Mother	100	50
Reveal	Experimenter	36	70
	Mother	100	50
Interplay	Experimenter	72	90
	Mother	100	90

Smiling during Preparatory phase. The percentage of preparatory phases that the infants smiled in by group and condition is depicted in Table 2.8 (which also includes data regarding all other phases). TD infants smiled in a significantly higher percent of preparatory phases compared to DS infants, $F(1,17) = 10.12, p = 0.005, \eta^2_p = 0.37$, and infants showed a trend of smiling in the preparatory phase more often with the mother than with the experimenter, $F(1, 17) = 3.75, p = 0.07$. This trend was supported with a moderate effect size, $\eta^2_p = 0.18$. There was no interaction, $F(1,17) = 0.33, p = 0.57$.

Smiling during Hide phase. TD infants smiled in a significantly higher percentage of Hide phases ($M = 31.9$) than DS infants ($M = 15.0$), $F(1, 17) = 5.99, p = 0.03, \eta^2_p = 0.26$. Infants had a trend towards smiling more with mother ($M = 31.1, SD = 30.45$) versus experimenter ($M = 14.9, SD = 20.66$), $F(1,17) = 3.52, p = 0.078, \eta^2_p = 0.17$. There was no interaction, $F(1,17) = 1.32, p = 0.27$.

Smiling during Reveal phase. There were no significant main effects for condition, $F(1, 17) = 3.95, p = 0.063, \eta^2_p = 0.19$, or group, $F(1, 17) = 3.54, p = 0.077, \eta^2_p = 0.17$. There was no interaction, $F(1, 17) = 3.05, p = 0.099, \eta^2_p = 0.15$. Values did support a trend however thus further analysis was justified. Univariate analysis revealed that TD infants smiled in a significantly higher percentage of reveal phases with mother compared to experimenter, $F(1, 8) = 6.30, p = 0.04, \eta^2_p = 0.44$; and significantly more with mother than DS infants, $F(1, 17) = 4.54, p = 0.048, \eta^2_p = 0.21$, but infants smiled comparably when playing with the experimenter, $F(1, 17) = 0.47, p = 0.50$. DS infants did not differ in percentage of smiling during reveal with either mother or experimenter, $F(1, 9) = 0.03, p = 0.86$. Refer to Table 2.8 for averages and standard deviations.

Smiling during Interplay phase. Infants did not significantly differ in the percentage of interplay phases containing smiling with mother or experimenter, $F(1, 17) = 0.48, p = 0.50$, nor was there any significant difference between TD and DS infants overall, $F(1, 17) = 0.41, p = 0.53$. A significant interaction was found, $F(1, 17) = 5.14, p = 0.037, \eta^2_p = 0.23$. Univariate analysis revealed that TD infants had a significantly higher percentage of interplay phases containing smiling compared to DS infants when playing peekaboo with mother, $F(1, 17) = 5.16, p = 0.036$, and there was a trend suggesting that this was more than with experimenter, $F(1, 9) = 4.59, p = 0.065, \eta^2_p = 0.36$. DS infants smiled in a comparable percentage of interplay phases regardless of play partner, $F(1, 9) = 1.21, p = 0.30$. There was no statistical difference between TD and DS infants when playing peekaboo with the experimenter, $F(1, 17) = 1.28, p = 0.24$. (See Table 2.8).

Table 2.8.

The percentage (& SD) of each phase containing infant smiles (TD: n=9, DS n = 10) in experimenter and mother conditions with significance and trends

Phase	Condition	TD M (SD)	DS M (SD)	Sig. t < 0.1, * < .05, ** < 0.01
Preparatory	Experimenter	22.6 (28.58)	6.58 (11.71)	**TD > DS
	Mother	44.9 (27.9)	18.6 (25.16)	t M > E
Hide	Experimenter	18.3 (21.25)	11.7 (20.71)	*TD > DS
	Mother	45.5 (26.26)	18.2 (29.17)	t M > E
Reveal	Experimenter	17.1 (24.43)	16.3 (23.35)	*TD > DS with mother
	Mother	52.1 (34.36)	18.6 (30.64)	* TD: M > E
Interplay	Experimenter	39.8 (36.33)	57.8 (32.92)	* TD > DS with mother
	Mother	71.7 (27.41)	40.8 (31.49)	t TD: M > E

Note: M = mother, E = experimenter

Negative emotion

Table 2.9 depicts the percentage of each group of infants who displayed negative emotion by condition, alongside the average duration of negative emotion by group and by condition. Infants were categorised as either showing negative emotion (through facial expressiveness) (yes) or not, (no) at least once during the trials with mother and experimenter. Just as many TD and DS infants showed negative emotion during the trials, ($\chi^2(1) = 0.04, p = 0.84$). Infants displayed an overall average duration of 3.05 seconds throughout peekaboo play. The average duration did not differ between TD and DS infants, $F(1, 17) = 0.50, p = 0.49$, nor between mother and experimenter conditions, $F(1, 17) = 0.12, p = 0.73$. There was also no interaction, $F(1, 17) = 2.51, p = 0.13$. No further analysis regarding negative facial emotion was carried out due to short durations and non-significant findings.

Table 2.9

Percentage of infants (TD: n= 9; and DS: n=10) who displayed negative facial emotion, and average duration (in secs, & SD) with each play partner

Condition	Experimenter		Mother	
Group	% of infants	Duration (SD)	% of infants	Duration (SD)
TD	44%	5.4 (8.06)	44%	2.2 (4.38)
DS	20%	1.3 (3.62)	40%	3.3 (6.0)

Discussion

The focus of the research reported in this chapter was to examine the temporal and structural form of the peekaboo game when played with TD and DS infants aged 4 months, and consider whether infants enjoyed the game comparably (inferred by measures of infant smiling) when playing with the experimenter versus the mother. Furthermore, infant smiling behaviour was also measured throughout the game as an index of positive emotion, to investigate how TD infants and infants with DS compare with regard positive emotionality at this age when in dyadic play.

In the current study, 4 key phases of the peekaboo game were identified: preparatory, hide, reveal and interplay. It would seem that when the experimenter played peekaboo with 4-month-old TD and DS infants, the interplay phase contributed to a large part of the game, but less so for TD infant-mother dyads. The interplay phase lasted longer than all phases, both within each peekaboo bout, and also over the whole interaction. A key finding was that infants with DS were equally as positive as TD infants during peekaboo play; and equally as

negative during peekaboo play. DS and TD infants did smile at different aspects of the game, with TD infants smiling in a higher percentage of the preparatory and hide phases than DS infants; however there was substantial variance within the samples. The prediction that infants would enjoy the game more when playing with mother versus a stranger was not fully upheld. Infants enjoyed the game equally when playing with mother versus the experimenter, however infant smiling behaviour in relation to phases was influenced by play partner, and also dependent on play partner, different emphasis was placed on particular phases of the peekaboo game. One other interesting finding emerged. It was aimed to complete 3 trials of each condition. Whilst every attempt was made to carry out all trials, this was not possible with some infants as they became fussy. If mother felt that her infant could not continue then the trials were stopped. With regard trial completion, it was found that infants with DS successfully completed more trials than TD infants. Whilst there was no objective measure of fussiness, there was a clear experimental procedure that the experimenter attempted to follow with each infant. Thus, the finding that infants with DS completed more trials than TD infants is indicative, but not conclusive (due to the fact that this aspect was not measured objectively) that infants with DS were less fussy than TD infants.

Emotionality of TD and DS infants in peekaboo play

There was no directional prediction made regarding whether infants with and without DS were more, or less, positive emotionally during peekaboo due to conflicting reports in the literature (e.g. Berger & Cunningham, 1986; Emde & Brown, 1979; Carvajal & Iglesias, 2000; Moore et al, 2008) and due to the exploratory nature of the current study.

Infants with DS were found to be equally as positive as TD infants in peekaboo play, but not more so. Infants smiled on average, for 26.9 seconds during peekaboo play.

No difference was found between groups with regard negative emotionality during the actual peekaboo trials. Infants with Down syndrome, did, however, successfully complete significantly more trials than TD infants. This finding requires interpretation. The experimental procedure required infants to complete 3 trials of peekaboo, firstly playing the game with experimenter, and then with mother. Mothers were instructed that they could end the trials if they felt their infant had become upset or distressed for any reason. Mothers were given the opportunity to restart the trials once they had comforted or fed their baby as required. DS infants completed all 3 trials with both partners in all but one instance (98% completion). TD infants, in contrast, completed 82% of trials. In fact, only 4 of the 9 TD infants managed to complete the final trial with mother. . Despite this however, TD infants and mothers still did not manage to complete as many trials as DS infants.

Due to the lack of completion by TD infants of trial 3, it was decided to analyse only two trials of each condition. Overall, TD infants spent a shorter time playing peekaboo with the mother than with the experimenter, whereas DS infants did not experience any differences in trial length across conditions, playing the game as long with both partners as TD infants played with experimenter. It is understandable that trials with mother and TD infants were shorter than in the other conditions if mothers felt that their infants could not continue playing without becoming distressed.

So, whilst it is true that there was no difference in negative emotion (measured through facial expressiveness) between groups in the first two trials, evidence regarding the successful completion of all 3 trials in each condition is suggestive that overall, throughout the whole experimental procedure, DS infant were less fussy than TD infants. It is recognised

that whilst there was no measure for ‘fussiness’ that would then lead to a measured, objective decision to terminate trials, the pattern of findings is strong. Thus, it is recommended that future investigations include an objective measure that will enable accurate recording of infant behaviour in this instance.

The suggestion in the current study that infants with Down syndrome may be less negative emotionally than the typical population has received support in previous literature. Some report that infants with DS have less negative mood than the typical population (e.g. Gunn & Berry, 1985; Ratekin, 1993; Carr, 1995; Zickler, Morrow & Bull, 1998; Gartstein, Marmion & Swanson, 2006). The current study’s findings also support those from Moore et al (2008) who, as was the case in the current study, also found that infants with DS in their study were less fussy than TD infants. It is noted however, that DS infants in Moore et al (2008) had a chronological age of 6 months, compared to the 4-month-old TD sample. One explanation offered for the finding that infants with DS were less fussy than TD infants, is that DS infants may not have been as engaged as TD infants, and were perhaps more passive, as Emde & Brown (1979) suggested, due to a ‘dampened emotionality.’ Yet findings regarding infant smiling behaviour do not support this conclusion.

Of the 19 infants who participated, 18 smiled when playing peekaboo with mother and experimenter, with the exception of one infant with DS who smiled with experimenter, but not with mother. Infants with and without DS showed no difference in the amount of time spent smiling during the game, nor how many smile bouts were made. There was also no difference between TD and DS infants regarding the average duration of each smiling bout (approx 2 ½ secs). Therefore, in this study, infants with DS smiled just as often as TD infants during the peekaboo game, and furthermore, when infants with DS did smile, the bout lasted a comparable amount of time to TD infants. This evidence does not support the statement that infants with DS have a dampened emotionality, as asserted by Emde and Brown (1979), but

neither does this behavioural evidence relate to temperament studies that report that those with DS have more positive mood (e.g. Gunn & Berry, 1985; Ratekin, 1993; Carr, 1995; Zickler, Morrow & Bull, 1998; Gartstein, Marmion & Swanson, 2006). When these findings are considered alongside levels of successful trial completion, it is possible to draw a conclusion. Infants with DS were just as positively engaged as TD infants during the first two trials, supporting the findings by Carvajal and Iglesias (2000) and Moore et al (2008). TD infants however, could not maintain this and became distressed, and were unable to complete the final trials, whereas DS infants did not become distressed. So whilst it cannot be concluded definitively that DS infants were more positive emotionally than TD infants, it can be concluded that DS infants were less negative. There were differences however, regarding the phases within which TD and DS infants smiled. This will be discussed in further detail in conjunction with phase information.

Did infants show preference to Mother versus Experimenter in play?

It was predicted that infants would show preference, measured by smiling behaviour, to mother as opposed to stranger in play in line with previous research (Bigelow, 1999). Summarising the findings regarding infant smiling behaviour during peekaboo play, it is concluded that whilst there was no overall difference relating to the amount infants enjoyed the game with mother compared to the experimenter, during particular phases TD infants did demonstrate a preference to mother versus the experimenter, however, DS infants did not. Again, this matter will be addressed in more detail during consideration of phase data.

TD infants are thought to prefer maternal versus stranger interactions from around 4 months of age as a result of developing a familiarity with the way in which themselves and their common partner interact. Regardless of whether mothers are interacting 'perfectly' (that is, mother and infant are in a more or less contingent interaction), infants still prefer

interacting with their mother versus a stranger (Bigelow, 1998). The fact that in this study, DS infants did not demonstrate any differential patterns of smiling behaviour regardless of play partner, suggests that they perhaps have not developed a preference to mother's more or less contingent interactions, over interacting with another. However, it is possible that infants with DS did not differentiate between partners during peekaboo play, more as a result of the complex game being played, rather than due to a difference per se between TD and DS infants play partner preference.

There was a methodological issue regarding the analysis of play partner preference that was a consequence of experimental design. Conditions were not counterbalanced. This was due to the fact that there was insufficient power as a consequence of sample size to introduce another variable (i.e. Cond 1a): mother-infant Cond 1b) cond: experimenter-infant). Increasing the sample size to enable counterbalancing was not an option due to the difficulties recruiting very young infants with Down syndrome. Therefore, it was decided that the best option was to place mother-infant peekaboo as the second condition to counteract any effect of fatigue. If infants were fatigued, then the last condition would more likely result in less positive emotional exchange. Thus, if mother-infant peekaboo still offered more positive interactions than experimenter-infant then there could be no call for fatigue accentuating any effect. In fact, interpretation of results could be considered to be erring on the side of conservatism. The disadvantage of this approach however, is that it limits conclusions to be drawn if infants show more positive behaviour with stranger over mother. Results from this study can be interpreted only regarding infants' preference to mother versus stranger in play, and less so, regarding preference to stranger over mother. As previously discussed, there was a high drop out rate regarding trial 3 with mother, in particular with regard to TD infants. It is imprudent to draw any conclusions regarding trial completion in

relation to infant play partner preference. It is most likely that this was a fatigue effect, due to the fact that play with mother was set as the final stage of the experiment.

The naturalistic peekaboo game

It was predicted that in a naturalistic game of peekaboo, phases would include a time of engagement and greeting, and would also have a period that would enable the infant the time to disengage, assimilate information and regulate emotions. Furthermore, it was predicted that the duration of phases within the game would fluctuate, due to evidence regarding the cyclic, yet unique patterns of dynamic face-to-face interaction (Tronick, Als & Adamson, 1976). These predictions, whilst perhaps obvious to those experienced in studying mother-infant interaction, are worthy of consideration. This is due to the fact that other studies have previously used the peekaboo paradigm to make inferences regarding the social capabilities of very young infants (e.g. Rochat et al, 1999; Montague & Walker-Andrews, 2001), but have added specific controls to the game (fixed-time phases) that break down the possibility of dynamic face-to-face interaction. Experimenters in both studies aforementioned used a timed script to move from phase to phase, which cannot have allowed for fluctuations and variability in the duration of phases of peekaboo play. Rochat et al (1999) constructed the peekaboo game into bouts, with each bout divided into 3 phases: approach, peak and release. Each phase lasted 2 seconds and followed a 60 second script for experimenter behaviour. Infant smiling behaviour was then measured that led to conclusions regarding infant social expectancies. Not only was there no possibility of variability in the duration of peekaboo play with infants, but also experimenter behaviour was led by script, and not by infant. From this evidence, it can be deduced that the experimenter and infant were not interacting contingently and therefore, whilst the finding that infants smiled less in an organised game of peekaboo as opposed to a disorganised game is of worth, drawing

conclusions regarding infant social expectancies within social interactions is limited.

Findings from the current study enhance these other peekaboo studies with respect to how best to replicate the game of peekaboo under experimental conditions.

When the game is played between play partner and 4-month-old infants, rather than a 2 phased (Montague & Walker-Andrews, 2001) or 3 phased (Rochat et al, 1999) structure, I identified 4 key phases: 'Preparatory', 'Hide', 'Reveal' and 'Interplay.' These phases consistently occurred in nearly every bout and were repeated in order. The role of these phases in interaction will be shortly discussed. Infants and play partners played an average of 19 bouts over two consecutive trials, with the overall duration of the two trials totalled together averaging from just over 2.5 to just over 3 minutes when infants played with the experimenter, and when DS infants played with their mothers. For TD infants and their mothers, trial duration was significantly shorter, averaging 2 minutes in duration. Mothers were instructed to play the game as often and for how long as they felt, with a goal of reaching maximum enjoyment for both partners. They were also instructed that if they felt that the game had reached and gone past its peak, that they could end the trial. The experimenter also followed these instructions. Thus, mothers and TD infants played bouts over a shorter period of time than experimenter and TD infants did, and also compared to DS infants with both partners, however, they played the 4 key elements of the game an equivalent frequency. This may suggest that there is an upper limit to the amount of bouts that can be played in face-to-face play, before partner and infant's enjoyment is lessened, and that for both groups, this was comparable. DS and TD infants could have a comparable upper limit of positive arousal in play, and that it is this limit, rather than the duration of play, that results in the interaction being broken. It may be that infants with DS are able to tolerate longer social engagement (in this study specifically with mother) before needing to disengage. This finding supports the conclusion from others, that infants with DS have an

increased focus on the social partner at this age compared to TD infants (Berger & Cunningham, 1981; Carvajel & Iglesias, 2000). An alternative explanation is that mothers of infants with Down syndrome may try for longer to engage with their infant. Differences in the behaviour of mothers of 4-month-old infants with Down syndrome have been identified previously, in that they may demonstrate more assertive warmth (Moore et al, 2008) compared to mothers of 6-month-old typically developing infants. Others report no differences in maternal responsivity between CA matched groups (from 3-36 months) (Brooks-Gunn & Lewis, 1984). Aside from peekaboo structure, maternal behaviour was not analysed in the current study. Examining aspects of maternal characteristics, in order to examine the environmental influences on infant development would enhance the findings in the current study.

The role of peekaboo phases

As previously highlighted, in the current study a peekaboo bout was defined as consisting of 4 key phases: preparatory, hide, reveal and interplay. The role of each of these phases is discussed below.

Preparatory phase. The preparatory phase builds the tension to the typical hide-reveal section of the game. It is a time where infants and play partner become engaged, and where the infant is prepared for the hide-reveal event that is about to occur. This phase builds anticipation. In this heightened state of arousal, the infant is arguably open to the anticipatory aspects of the game. The play partner may wriggle her fingers and vocalise with an “ooh, I’m.... going..... to.... hide away....”, or “where’s mummy going?” It may more simply be accompanied with an “oooo”, rising in tone, to build up the anticipation and develop a tight engagement in preparation for the hide phase. The play partner may take on an almost

teasing, but positive and encouraging, tone. These vocalisations may be repeated, again to heighten the anticipation of the next phase. The purpose of this phase therefore, is to reach optimal engagement, but also to communicate to the infant that the next phase is about to occur. The preparatory phase is 'teaching' the infant that there is a pattern to the interaction, that an expected event is about to happen. Thus it helps the infant hone skills in social expectancy.

The preparatory phase was not present at all in the procedure set out by Walker and Montague-Andrews (2001). The structure of the game in their study was a 3-sec followed by a 7-second presentation, then back to a 3-second hide, and so on. Rochat et al (1999) did identify this phase, naming this the 'approach,' using the sole term 'look, look, look,' and fixing this to a 3 second rule. It is unclear whether the vocalisations were carried out with any aim to build tension. Without building tension, heightening anticipation, it is less likely that infants would become as emotionally engaged in the game, and then within a heightened, aroused state be open to anticipate the event that was about to occur. Rochat et al's (1999) approach phase may be more comparable to the Attentional Request phase identified in the current research. The current study did not analyse this section of the peekaboo game due to the fact that it occurred intermittently, and was normally at the beginning of the interaction, where mother or experimenter attempted to form an initial engagement. It is recognised that this phase may be of interest for future investigation, as it also appears to play some role in the peekaboo interaction. Yet, this phase did not occur regularly enough to be considered core to the peekaboo game. It is therefore unclear whether Rochat et al's (1999) approach phase contributed to heightening infant arousal, optimising engagement, and preparing the infant to expect an event was about to occur.

Over the two trials, the experimenter-infant dyads spent longer overall (23.7 secs) in the preparatory phase than mother-infant dyads (10.8 secs), although the number of

preparatory phases played was comparable across groups and conditions. If the preparatory phase is the time where engagement and arousal is optimised, and where infants are being ‘taught’ the rudimentaries of social exchange and social expectancy, then the finding that mothers spent less time in this phase than the experimenter is of interest. Mothers may have spent less time in the preparatory phase, as her and her infant were familiar play partners and needed less time to build up to the hide phase of the game. Infants tended to smile in a higher percentage of preparatory phases with mother as opposed to with the experimenter (although this difference was not significant), despite the fact that the experimenter spent longer than mother in this phase overall. Therefore, mothers were not moving faster through this phase compared to the experimenter regardless of infant behaviour, it would appear perhaps linked in some way to the infant’s increased positive emotion. If, as asserted in other studies (Rochat et al, 1999; Fogel et al, 2006) young infants gain enjoyment from having expectancies met, then the shortened time in this phase with mother-infant dyads could be due to the fact that they have communicated with each other that they are ready to progress to the next phase, with the infant smiling in confirmation of the readiness to move forward. When infants play peekaboo with a stranger however, (the experimenter), the unfamiliarity for both may lead the experimenter to not pick up on the infant’s nuances of communication (unlike mother) and the infant is also less familiar with what to expect from an interaction. Thus, the infant does not enjoy the build up to the hide phase in the same way as when playing this part of the game with mother.

All TD infants smiled at least once during the preparatory phase with mother, compared to half of the DS infants. When playing with the experimenter, 45 % of TD infants smiled during the preparatory phase compared to 30% of DS infants (Table 2.6). Interestingly, mothers of TD and DS infants played the preparatory part of the game comparably in relation to overall duration and the number of bouts, however, infants with DS

smiled in a significantly lower percentage of preparatory phases than TD infants. If smiles are indicative that the infant is ready to move on, and that they are enjoying having expectancies met, then it is possible to conclude that unlike TD infants, DS infants did not gain equal immediate enjoyment from the preparatory aspect of the game. It is possible therefore, that DS infants have not developed as much skill regarding social expectancies as TD infants at 4 months of age. However, it should be noted that some infants with DS did smile during the preparatory phase. Therefore, drawing definitive conclusions regarding the social expectancies or socio-cognitive abilities of all young infants with DS should be taken with caution.

Hide phase. As discussed, the key part of the peekaboo game is the hide-reveal aspect. As was the case in all other peekaboo studies, the hide phase was readily identifiable in the current study. Infants and play partners played the hide phase of the game comparably, both with regard to the number of hiding bouts, and also the overall duration of time spent hiding during the trials. A nonsignificant trend was noted however, in that DS infant-mother dyads did have a tendency (very close to significance) to spend longer in the hide phase overall compared to DS infant-experimenter.

During the hide phase, the play partner hid away, usually hiding her face with her hands. Sometimes, mother would hide her infant's face (although this was infrequent). The play partner may vocalise saying, "where am I," or, "where's mummy gone?" She may peek through her fingers to maintain some level of engagement with the infant or perhaps to be able to interpret the infant's responses and behaviours at this time, in order to inform her how long to stay hidden. The infant may continue to gaze at play partner's face, perhaps still smiling, in anticipation of the dramatic 'reveal', suggesting a level of social expectancy. Alternatively the infant may disengage, or just not smile, feeling unsettled during the game,

uncomfortable that the play partner has disappeared and ceased interaction (in some way similar to a still-face scenario), unaware perhaps that play partner is about to re-engage. How the infant behaves in this phase is likely to affect how the game continues. The hide phase to some degree could arguably enable the infant the opportunity to disengage from the interaction (a necessity within social exchange) however, rather than interpreting it in this light, it is arguably less of an opportunity for infants to disengage, as the goal is to maintain the suspense and expectancy regarding the impending reveal.

In the current study it was found that mothers of infants with DS had a tendency to hide for a longer duration overall than mothers of TD infants, and longer than the experimenter. The non-significant trend was very close to reaching significance. This is perhaps an unexpected finding, given that infants with DS would likely have more difficulty with this, as discussed, socio-cognitive task. It might be assumed that the less developed this skill, the shorter time mother would hide away, only building up the length of time hidden as the infant becomes more able to 'wait' and anticipate the reveal. If this is the case, then the fact that mothers of DS infants tended to spend longer hiding away than mothers of the TD sample, might indicate that infants with DS are more skilled at person permanence than the typical population at this age. When considering previous research, another explanation is offered. Infants with DS are thought to maintain prolonged eye gaze to a social partner (e.g. Berger & Cunningham, 1981; Carvajel & Iglesias, 2000) compared to TD infants at the same age. When mother hides, infants with DS may not disengage, thus enabling mother to hide for longer. Whereas the experimenter-infant relationship has not built this level of mutual understanding, mothers and their infants with DS have, with mothers having confidence in her infant's ability to maintain attention.

Alternatively, mothers of DS infants may be over-emphasising the hide aspect of the game to enable infants with DS better opportunity to 'learn' this skill. Mothers with TD

infants may move through this phase quicker than mothers with DS infants, with the knowledge that the hide 'concept' is mutually understood, and therefore less time is needed to play this part of the game. Analysis of infant smiling behaviour during the hide phase revealed that TD infants smiled in a higher percentage of hide phases compared to DS infants. Similarly to the preparatory phase, in the hide phase all TD infants smiled with mother and 54% smiled with the experimenter, compared to DS infants, where 50% smiled with mother and 30 % with the experimenter (Table 2.7). As discussed in the preparatory phase, smiles could be considered indicative that the infant is enjoying having expectancies met. Infant smiling in the hide phase may also suggest that they are enjoying the heightened anticipation of waiting for the reveal. Whilst mothers of DS infants hid for longer, TD infants and mothers moved on to the next phase, with the reassurance (from infant smiles that they may see through observing the infant between their fingers) that the infant is already anticipating the reveal. As discussed for the preparatory phase, this might be indicative that infants with DS have not developed the expectancy that an event is about to occur, or that they gain less enjoyment from this aspect of the game. The fact that TD infants smiled during the hide phase is perhaps indicative that some level of social expectancy regarding the structure of the game has been developed. Again, some DS infants smiled during the hide phase at some point in the game, and some TD infants did not (with experimenter). Thus, whilst it is worthwhile investigating further whether the social expectancy abilities of 4-month-old infants with Down syndrome are in some way impaired compared to typically developing infants, it is also important to recognise the variability between all infants at this age.

Reveal phase: The number of reveal phases played was comparable across groups and conditions. Specifically when the experimenter and TD infants played, however, longer was spent overall during the reveal phase compared to with mother, and compared to with DS

infants. This finding will be discussed in conjunction with infant smiling behaviour during this phase. The reveal phase is the period of the game where the play partner uncovers the face (or more rarely, the infant's) and says something along the lines of 'peekaboo,' or 'here I am!' The vocalisation and reveal may be sudden, quick and said in a way to make the infant jump in surprise. Or it may take on a more reassuring, musical and comforting tone. It was predicted that the naturalistic game of peekaboo would be reflective of face-to-face interactions in that there would be a period of engagement, greeting and disengagement. The preparatory phase enabled engagement, and to some degree a greeting, however, in this over-exaggerated form of interaction, the reveal phase is the period where the greeting between play partner and infant is accentuated, as the play partner offers herself again back into the interaction.

All TD infants smiled at least once during the reveal phase with mother compared to half of DS infants. When playing with the experimenter, 36% of TD infants smiled during the reveal compared to 70% of DS infants (Table 2.7). TD infants smiled in a significantly higher percentage of reveal phases with mother compared to the experimenter, and also significantly higher than DS infants with mother, although there were no overall group or condition differences. When playing the game specifically with mother therefore, all TD infants enjoyed the reveal phase of the game, smiling when mother revealed the face with a reassuring, or surprising, "boo!" With mother, it can be argued, TD infants enjoyed that expectations were met, and also that there was re-engagement from the period of hiding. With the experimenter however, TD infants smiled less often during the reveal, suggesting that perhaps infants gained less enjoyment from re-engaging and greeting the experimenter. The experimenter spent longer in this phase with TD infants, yet TD infants smiled less. This demonstrates the dynamic aspects of interaction, and how infants and play partner behaviours influence each other. The experimenter, it would appear, prolonged this period of the game,

waiting for an emotional indicator that the infant is ready to move to the next phase. This was not forthcoming as frequently as in other dyads and hence, could be a reason why the reveal phase was longer in this instance.

DS infants smiled in a comparable percentage of reveal phases when playing with the experimenter and the mother (Table 2.7). This is suggestive that infants with DS did not differentiate between mother and experimenter in the same way as TD infants. However, DS infants did smile overall comparably to TD infants during this phase, and this may well be due to having their social expectancies met. Yet, when considering this in light of reduced smiling during the preparatory and hide phases, it is perhaps more prudent, but not conclusive, to suggest that infants with DS gained equal enjoyment from the re-engagement and greeting aspect of the reveal as TD infants, but perhaps not so linked to social expectancies.

Interplay phase: The reveal was followed by the interplay phase. DS infants spent around 1.5 minutes in the interplay phase when playing with mother and experimenter, and TD infant-experimenter dyads around 1.4 minutes. When playing with mother, TD infants spent a significantly reduced amount of time in this phase, averaging 38 seconds of the two trials. Thus, with the exception of TD-mother dyads, the interplay phase was a substantial proportion of the overall interaction. Yet, this phase was not included at all in Rochat et al (1999) and Montague and Walker-Andrews (2001) studies, despite the evidence in the current study that when playing peekaboo with 4-month-olds, it seems to be a particularly important phase of play. What role then might this phase play within the interaction?

As discussed, peekaboo is a game that enables infants to practice the rules and structure of social exchange. Social exchange at this age (defined alternatively as face-to-face interaction) is characterised by cyclic, but unique patterns of engagement, greeting and

disengagement (Tronick, Als & Adamson, 1979). The previous phases capture aspects of engagement and greeting (and to some extent disengagement within the hide phase) however, it is arguably this period of the game that enables the infant the time to disengage, to assimilate information and to regulate emotions; an important facet of social interaction at this age (Brazleton, Koslowski & Main, 1974; Trevarthen, 1979; Tronick, Als & Adamson, 1979). The play partner has just attempted to surprise her baby, maybe make her infant jump. She has certainly disrupted a typical face-to-face exchange by hiding away and revealing. This time may be used to evaluate infant emotion, to reassure or comfort, to share in positive emotion, or to maintain engagement. Infants in this phase, may be enjoying sharing in positive exchange, may look to gain reassurance, or may disengage to regulate his or her emotions. The infant and play partner use this time as an opportunity to indicate the wish for continued engagement. This phase is arguably crucial in order for play partner and infant to regulate the interaction, to reconnect together and to find harmony, a balance against the heightened play. The fact that this phase played such a substantial part in the interaction is evidence that this is a crucial period within a peekaboo interaction. As mentioned above, TD infants and mother pairs spent less time in this phase than any other play-partner infant dyads, although, mothers and infants still spent longer in the interval phase compared to other phases. Therefore, it would seem that mothers and TD infants are able to reaffirm their interaction and find balance in preparation for continued play more rapidly than the other dyads in the study.

Strengths and limitations

The current study has gathered new information regarding aspects of 4-month-old infant behaviour in the game of peekaboo, and in particular with regard how DS infants may participate in the game. The study focused on infant emotionality comparing the behaviour

of TD and DS infants when in positive play. The structure and timing of the peekaboo game was examined, and it was discussed how this might relate to infants' expectancies regarding the timing and structure of social exchange. A particular strength of the investigation was in its design, in that the naturalistic game of peekaboo, rather than experimentally controlled, was examined. Furthermore, it was investigated how familiarity compared to unfamiliarity may influence dyadic interactions, a factor not considered in other related studies (Rochat et al, 1999; Fogel et al, 2006). DS and TD infants were also matched by chronological age. This was arguably crucial in order to examine whether the early socioemotional functioning of young infants with Down syndrome was affected in any way or not. Some limitations merit discussion. The sample size was small, yet comparable to other research studying the early development of very young infants with DS (e.g. Moore et al, 2008), and larger than others (e.g. Berger & Cunningham, 1981). With a smaller sample than the planned minimum of 22, it is possible that the study was lacking sufficient power to detect small statistically significant differences. Thus, whilst the findings are of interest, future studies increasing power would be advantageous. However, some significant differences were found between groups, and thus this is suggestive that with a larger sample, perhaps the effect would be increased.

Furthermore, it would have been ideal conditions were counterbalanced. However, due to the difficulties of recruiting this atypical population, there was insufficient power to do this. The decision not to counterbalance is discussed in greater detail in Chapter One. However, without counterbalancing the order effects of practice and fatigue could have influenced results. The condition that was most likely to be confounded by fatigue was play with mother. There were no statistical differences in relation to infant smiling duration, frequency or length of smile bout when playing with mother compared to experimenter. However, if fatigue had influenced infant smiling behaviour in play with mother, then it is

possible that with counterbalanced design, infants would be found to smile more with mother rather than experimenter. Infant smiling with mother was perhaps only comparable to smiling with experimenter due to the infant being fatigued. TD infants and infants with DS however, completed the procedure in the same order, and so it is possible to compare the behaviour of the two groups, and no difference in smiling duration, frequency or length of bout was identified.

It was discovered through the process of recruitment, that recruiting female infants with DS is more difficult than recruiting males. This was likely due to the higher proportion of male compared to female infants born with DS. It is acknowledged that what has been gained through adopting a naturalistic, versus rigid, experimental approach, does mean that there was less experimental control. However, this was the purpose of the research, adding experimental controls would interfere with the naturalistic behaviours that were the focus of study. Results from the current study emphasise the importance for developmental researchers who have a goal of investigating aspects of behaviour in dyadic interaction, to design research in a way that enables young infants to be interactive participants. Without doing this, the phenomenon aimed to be studied may be compromised.

Future directions

Future research plans have emerged from this investigation. Infant positive emotion was measured by the presence, or not, of a smile. In the current study, no differences were found between DS and TD infants in relation to the duration of time infants spent smiling throughout the peekaboo game, the amount of times infants smiled, nor the duration of each individual smiling bout. However, whilst these findings are valuable, further analysis in relation to the intensity of infant smiling would further address the contradictions in the current literature regarding the possible emotional flatness of very young infants with DS

(Sorce & Emde, 1982; Moore et al, 2008). Whilst outside of the remit of the current study, it is proposed that infant smile intensity is measured using Baby FACS (Oster, 2008), by myself as a trained FACS coder. This would add knowledge to the debate as to whether infants with Down syndrome are emotionally flat (as claimed in Sorce & Emde, 1979) or not (Carvajal & Iglesias, 2000). A difference was found in how mothers and typically developing infants played the game compared to mothers and infants with Down syndrome. Thus, there is a justification to examine aspects of maternal characteristics that may relate to infant socioemotional behaviour. An investigation of aspects of maternal characteristics is therefore reported in Study 3.

Infant vocalisations, both with regard the frequency and emotional content were not analysed here, nor were other facets of infant emotion and communicative behaviour (such as infant gaze, body movements, and other emotional expressions). Analysing these behaviours, in a similar manner to Study 2 (chapter 3) would enable consideration of whether there are other aspects of sociocommunicative behaviour that may, or may not, be different for young infants with Down syndrome when in interaction with another. In relation to play partner behaviour, further analysis would also be beneficial including facial and vocal expressions of emotion and the timing and content of vocalisations. This would add further knowledge regarding the contribution of each in the dyad to the interaction and would address whether mothers of infants with Down syndrome behaved in some way differently to mothers of infants with typical development. Practice effects were controlled for to an extent, but in fact, examining how practicing the game may influence infant emotional behaviour would be of interest. It is possible that infants smiled more following the repetition of the game, or perhaps, smiled less. Analysing whether infant smiling behaviour was influenced by the amount of times the game was played would enable questions to be asked such as whether

infants with Down syndrome enjoyed the game similarly as a result of repetition as typically developing infants.

Replication of the current research is recommended as one study alone is not sufficient in establishing knowledge and understanding. Replicating the study with slightly younger and older infants would provide detail of the developmental process of factors within the study, and also enable consideration of whether any differences in behaviour of TD and DS infants are a result of a developmental delay, or a result of more complex processes or deficit. Whilst this comparative study has great value in highlighting some differences between the emotional behaviour of infants with and without DS, it is unwise to draw definitive conclusions. There is not one developmental pathway for those with DS, just as there is not one developmental pathway for infants with TD (Karmiloff-Smith, 2007). Environmental factors arguably play an important role in early development. To gain a fuller understanding of individual trajectories of emotional development, consideration of these environmental factors alongside behaviour is required. Chapter 4 seeks to address some of these issues.

Conclusion

The game of peekaboo provides a heightened positive environment within which the infant can learn the rules and structure of social exchanges. Unlike experimentally controlled, unnatural constructs of the peekaboo game, it was found that the naturalistic peekaboo game consists of 4 phases, each important if the aim is to replicate the structure of social exchange. A key phase discussed was the interplay phase; the phase where it is argued, partner and infant could disengage for a time, and then re-establish harmony and balance, deciding whether or not to carry on in engagement. It was found that infants with DS were just as positive as TD infants during the game, and less negative emotionally overall, enabling

prolonged interaction with mother, a factor found in other studies (Moore et al, 2008; Carvajel & Iglesias, 2000). This increase in duration that infants with DS spent in face-to-face interaction with mother compared to TD infants could explain why those with DS go on to develop relative social and emotional strengths. TD infants did smile at different points of the game compared to DS infants, and smiled more often with mother versus the experimenter, but only with respect to particular aspects of the game, not overall. The implications regarding social expectancies were highlighted. Other studies have used smiling behaviour as indicative that infants gain enjoyment from having their expectancies met (e.g.; Parrot & Gleitman, 1989; Rochat et al, 1999; Fogel et al, 2006). With this premise, it is concluded that TD infants would appear to have expectancies regarding the timing and structure of social exchange. Whether this is so with regard infants with DS is less clear, however the similarities between TD and DS infants socioemotional functioning at this young age seem to outweigh any differences.

Chapter Three. Social triangular joint attentional abilities of 4-month old typically developing infants and infants with Down syndrome

Abstract

The current study investigated the joint attentional abilities of 4-month old typically developing (TD) infants (n=10) and infants with Down syndrome (DS) (n=10) in two triadic conditions: a) person-person-person (Person) versus b) person-person-object (Object). It was predicted that TD, but not DS, infants (due to possible difficulties relating to attention shifting) would follow gaze in both conditions. It was further predicted that all infants would produce more socially directed behaviours (SDBs) in the Person versus Object condition, as a result of the Person condition being a more social context. It was found that TD infants, but not DS infants, followed gaze comparably to previous research. TD infants produced more SDBs in the more compared to less social triadic situation, but not when sharing gaze between two partners. Infants with DS were equally communicative across both conditions and levels of SDBs were comparable to those produced by TD infants in the more social, Person condition. This makes sense when taking into account that DS infants spent longer looking at the social partner than the object. Findings not only go some way in supporting the premise that very young infants are distinguishing between more social and less social triadic situations, but furthermore, that infants with DS are as socially communicative as TD infants. Infants with DS were less fussy and less vocally negative, successfully meeting the demands of the experiment better than TD infants. Prolonged social interactions and less negative emotion in the early months could offer an explanation as to why those with DS develop relative socioemotional strengths.

Chapter 3: Social triangular joint attentional abilities of 4-month old infants with and without Down syndrome

The developmental of joint attention is considered a crucial social and cognitive developmental milestone, seen as a precursor to language, necessary for social referencing and indicative of the development of theory of mind (e.g. Premack & Woodruff, 1978; Bakeman & Adamson, 1984; Sorce, Emde, Campos & Klinnert, 1985; Waldon & Ogdan, 1988; Tomasello, 1999). Historically it was thought that infants develop the skill of joint attention (JA), sharing with another person focus on an object or event, towards the end of the first year (e.g. Bruner, 1983). Recent studies however, suggest that much younger infants have some skill in triadic interactions, in particular when the situation is that of a triadic person-person-person interaction (a more social, communicative context) compared to a triadic person-person-object interaction (e.g. Tremblay & Rovira, 2007). The current research study investigated aspects of joint attentional skills of 4-month-old infants and compares infants with typical development (TD) and infants with Down syndrome (DS). Previous research predicts that Down syndrome may negatively affect the development of joint attention, yet whether there is evidence of this in early infancy is unclear. A purpose of the current study was to identify whether very young infants with DS perform similarly, or not, to TD infants when in more social, and less social, triadic situations.

Joint attention

For an infant to be able to share with another person that person's focus of attention, (joint attention), particular processes are necessary. Consider an example of a mother spotting a cat in a window. If the infant is looking at mother at the time, she will see her mother's

head turn and the direction of mother's gaze alter. The infant follows mother's gaze direction as there may be something of interest for her to attend. The infant must be motivated, and be able to follow the direction of mother's gaze. Upon seeing the cat, the infant understands that this is the focus of mother's gaze and that mother, as a being with intended actions, is motivated to attend to the cat. Infant and mother then both attend to the cat together, with the knowledge that each is mutually sharing in the other's attention. One or the other may look back to each other and then back to the cat. Importantly, the infant could also be the initial instigator of this triadic interaction, demonstrating her intentions, with the mother subsequently engaging jointly. Once mother and infant are jointly attending, then this gives an opportunity of information sharing from each partner to occur about the object of attention. Mother may name the object, and also talk to her baby excitedly about the cat, or perhaps demonstrate wariness. The infant may giggle, or herself be wary. Once able to jointly attend therefore, infants and social partners are able to share the environment together. This one example depicts just some of the dynamics that may be involved in a joint attentional scenario.

Considering the complexities of this process, it is understandable why developmental psychologists place such emphasis on its importance in relation to social and cognitive development. Bruner (1983) for example, argued that joint attention serves a primary purpose in that it is the precursor to language. When infant and mother are focused together on an object, the infant is likely to hear language from mother regarding the object, or the experience itself, and thus learn that 'things' have terms of reference. Joint attention also provides the basis for social referencing. Infants use the process of social referencing to draw emotional meaning about the world, in particular when in an ambiguous situation. Should a barking dog appear, for example, an infant looks to mother for information in how to feel and act. Mother reacts to the dog, either verbally or through non-verbal communicative means

such as her facial expression or body posture, and may intentionally or unintentionally convey her feelings about the dog to her infant. The infant draws on mother's emotional cues and is then informed, or not, that the situation is a positive (or negative) one and reacts accordingly (Sorce, Emde, Campos & Klinnert, 1985; Waldon & Ogan 1988). Thus, for the developing infant, joint attention enables complex interactions with others about the environment.

There is yet another further important skill that is associated with the development of joint attention. If an infant is able to jointly attend, then this is indicative that the infant has also developed some level of theory of mind (Premack & Woodruff, 1978). Baron-Cohen, Leslie & Frith (1985) defined theory of mind as the ability to "conceive of others' mental states: that is; knowing that other people know, want, feel or believe things" (p38). A knowledge of others' mental states is considered crucial to the development of complex social interaction. Joint attention has been a particular focus for those with an interest in autism. It is widely accepted that for those with autism, the social interactional system is particularly impacted. Baron-Cohen et al (1985) investigated the false-belief abilities (a common test for theory of mind of children with Autism (aged 11), Down Syndrome (aged 10-11) and of typical development (aged 4.5). It was found that the groups of typically developing children and children with Down syndrome 'passed' the test suggesting they were able to impute beliefs to others, however the group of children with Autism did not pass. Baron-Cohen et al (1985) argued that this was evidence that theory of mind was absent in children with Autism. It is important to note however, that there was a minority of children with Autism in this study who did pass the test (4 out of 20), and so it could be presumed, had theory of mind abilities. When relating this to joint attention, if children with autism have theory of mind deficits, then it would follow that they may have difficulty engaging in joint attention. Research supports this to be so (e.g. Mundy, Kasari & Sigman, 1990; Mundy,

1995) supporting the premise that joint attention and theory of mind are intertwined.

Furthermore, findings from Baron-Cohen et al (1985) support that whilst those with Autism may have some differences in joint attentional behaviours, those with DS (whilst some differences in chronological age) pass the Theory of Mind test at the same mental age as children with TD. This suggests that for those with Down syndrome, the joint attentional system could well be functioning similarly to TD infants, albeit perhaps with some developmental delay.

The development of joint attention

Historically, infants have been thought to develop joint attention in developmentally distinct stages. Young babies attend firstly to a social partner in the first 4 months of life, this being the time when face-to-face dyadic interaction is prevalent. Infants then 'progress' to attending to objects which peaks around 5-7 months, culminating in the merging of the two, attending to a social partner about an object towards the end of the first year (Bakeman & Adamson, 1984; Tomasello, 1999). Recent studies however, have challenged that joint attention develops over these developmentally distinct stages. Researchers have found that younger infants may be actively involved in triadic interactions, demonstrating aspects of joint attention within the first six months of life.

One joint attention skill is the ability for infants to follow gaze. Some studies have reported that infants are not able to reliably follow gaze, certainly before the last quarter of their first year, and some report after the age of 1 year. Butterworth and Cochran (1980), reported that whilst infants under a year may turn their gaze in the same direction as an adult's turn of gaze, they will focus on the first object they see rather than the target object, only mastering this in the second year. Corkum and Moore (1998) found that gaze following could occur earlier, reporting that whilst 8-month-old infants could be 'trained' to follow

gaze, gaze following was only reliable in infants over the age of 10 months. Others report however, that gaze following is a skill that develops earlier than these previous findings suggest. Morales et al (2000) for example, conducted a study with 6-month-old infants and their mothers, and found that when mother turned to look at an object to the side of the infant (but within the visual field) infants more often than not followed her gaze. Interestingly, Morales et al (2000) also reported that gaze following at 6 months may be related to early language acquisition, supporting theoretical claims of the link between joint attention and language.

Some argue that infants even younger than 6 months are able to follow gaze. D'Entremont, Hains and Muir (1997) investigated gaze following abilities of 3, 4-5 and 6-month-old infants. Infant and experimenter sat opposite each other and at either side of the experimenter were moving puppets. The experimenter engaged with the infant, and then turned her head and eye gaze 90° to look at one or other puppet. D'Entremont et al (1997) found no significant differences between ages, with infants correctly following gaze in 66% of trials (scoring these as a mean latency to gaze change of up to around 8 seconds). Interestingly, even infants as young as 3 months of age followed gaze to the desired target in just over 60% of trials. Striano and Stahl's (2005) findings also support the conclusion that 3-month-old infants can follow gaze (however, see Striano, 2007). This was only the case however, when the experimenter held her gaze away from the infant and looked towards an object for one minute. Sixty five percent of 3-month-olds followed gaze in this instance (with a mean latency of 15.72 secs). When the experimenter turned her head and eye gaze rapidly between infant and target object (every 3-4 secs for 1 minute), the majority of 3 month olds did not gaze follow. Six- and 9- month-old infants, however, followed gaze similarly across conditions, successfully following gaze in just over 50% of trials. Striano and Stahl (2005) concluded that this may indicate that 3-month-olds needed more time than older infants to

process the adult's behaviour; furthermore, they surmised, that there was a transition at 6 months of age when infants followed gaze in both contexts.

Triadic 'object' and triangular 'person' interactions

In each of these studies that have investigated early triadic interactions (D'Entremont et al, 1997; Striano & Stahl, 2005; Striano et al, 2007), the addition to the dyadic interaction was an object. Yet, Fivaz-Depeursinge, Favez, Lavanchy, de Noni and Frascarolo (2005) argued that triadic interactions were not solely in the form of the 'person-person-object' (triadic). Rather, they argued, that humans, as social beings, engage in 'person-person-person' interactions (which Fivaz-Depeursinge et al, 2005; distinguished as 'triangular') frequently and that these are an important part of our social engagement. Furthermore, they argued that person-person-person interactions in early infancy play a key role in social development. It should be noted that from here on in, the same terms will be used in the current study to distinguish between person-person-person interactions (triadic) and person-person-object (triangular) interactions. Adopting the 'Lausanne trilogue play' paradigm for father-mother-infant triads (where 3- 9 month olds were found to engage in, and differentiate between variations in triadic play; Fivaz-Depeursinge & Corboz-Warnery, 1999), Fivaz-Depeursinge et al (2005) studied 4-month-old infant behaviour under four different interactive contexts. The contexts were variations of engagement, including 1) mother and father both engaging together with infant, 2) with a still-face, and also singularly with 3) mother or 4) father. Fivaz-Depeursinge et al (2005) found that 4-month-old infants demonstrated affect and gaze that were context specific. Infants made more communicative bids in the triangular context when all three partners were engaging compared to when mother or father were solely engaging. Infants also demonstrated a trend towards making more communicative bids when mother or father singularly posed a still-face compared to

when he or she was not active in promoting engagement. McHale, Fivaz-Depeursinge, Dickstein, Robertson and Daley (2008) speculated that the findings of Fivaz-Depeursinge et al (2005), being that infants were more communicative in the triangular situation, was suggestive that these 4-month-old infants were “actively seeking the third party parent for help” and that this was perhaps an ‘early precursor to the much later-emerging capacity for social referencing’ (p449). Whether this is so requires further investigation, however, the multiple research findings (e.g. D’Entremont et al, 1997; Fivaz-Depeursinge & Corboz-Warnery, 1999; Fivaz-Depeursinge et al, 2005; Striano & Stahl 2007; McHale et al, 2008) suggest that young infants be credited with far greater triadic social abilities than historically proposed (e.g. Butterworth & Cochran, 1980; Corkum & Moore, 1998).

The stage-like, linear progression to joint attention from purely dyadic infant-person then infant-object then on to infant-person-object interaction, whilst in the main accurate, seems perhaps a little simplistic. Rather, it would seem that even in early infancy, some levels of joint attentional skills are emerging. If, as previously discussed, joint attention is considered a benchmark that indicates theory of mind, then it can be supposed that very young infants have developed at least some level of theory of mind, in other words even young infants have an underlying awareness of others’ mental states. This interpretation is complimented by the theory of ‘secondary intersubjectivity’ proposed by Trevarthen & Hubley (1978). Trevarthen (1979) argued that infants are born with an innate communicative capability which is embedded in emotion, in that infants’ innate emotional consciousness dynamically interacts with mother’s emotion (‘primary intersubjectivity’). Over the first year, infants move from primary to developing ‘secondary intersubjectivity.’ Secondary intersubjectivity defines the developmental point at which infant awareness of people’s intentions and feelings shift, in that not only are infants able to share in dyadic emotional exchange, they are also now able to share with another person one’s attention, feelings and

intentions towards a third pole of an object, event or action (Trevarthen & Hubley, 1978). Whereas some researchers define the development of joint attention as being demonstrative of an infant's ability to co-ordinate attention, to gesture (such as point) and to have an awareness that the other person has an intention to look at or refer to the same object to which their own attention is directed (e.g. Gustafson, Green, & West, 1979; Tomasello, 1993) the recognition of the developmental shift in emotional awareness of the feelings and intentions of another social being is less emphasised. In contrast, Trevarthen & Hubley (1978) stressed that it is the shift in emotional awareness that then leads the development of joint attention (Fogel & DeKoeper-Laros, 2007). The studies by Fivaz-Depeursinge and Corboz-Warnery, (1999) and Fivaz-Depeursinge et al (2005) compliment Trevarthen & Hubley's (1978) proposition in that it is within triadic interactions with other social beings (promoting enhanced emotional awareness) that infants first develop joint attentional skills.

It would appear that infants as young as 3 and 4 months engage in triadic person-person-object situations, and in triangular person-person-person situations. Tremblay and Rovira (2007) discussed however, that just because infants may be engaging in these three-way exchanges, that this alone is not sufficient indication that young infants are communicating 'about' something, or appreciating that the other person is communicating about something. It may be that young infants' initiatives in triadic play serve to meet only their own mental or emotional state. To address this, Tremblay and Rovira (2007) developed a paradigm that enabled them to investigate 3-month-old infants' joint attentional behaviour in both person-person-person (PPP) and person-person-object (PPO) interactive contexts, alongside considering infant communicative, socially directed behaviours (SDBs). SDBs, they defined, are "those behaviours such as vocalising, smiling, or waving arms, accompanied by, or immediately preceded or followed by looking at one or both adults" (p368). In the triangular PPP condition, two experimenters sat one on either side of the infant

and one experimenter firstly sought engagement with the infant. Once engaged, the adult turned away and looked towards the other person. The two experimenters then engaged in conversation. If the infant made bids that caught the attention of the experimenters then they turned back and re-engaged with the infant. In the triadic PPO condition, an experimenter sat to one side of the infant, and an inanimate object (a stick) was positioned to the other side. The experimenter sought engagement with the infant. Once engaged, she turned her head and looked, instead, to the object. She then had a 'conversation' with the object. Again, if the infant made sufficient bids that caught the attention of the experimenter, then the experimenter re-engaged with the infant. Tremblay and Rovira (2007) predicted that whilst infants would follow gaze in both conditions, infants would detect the unnaturalness of the PPO interaction and produce fewer communicative bids in this condition (measured by SDBs including the adult and the object) than triangular interactions (SDBs including adult and adult) in the PPP condition.

In relation to gaze following, similar findings to others were reported (e.g. D'Entremont et al, 1997; Striano & Stahl, 2005). Three-month olds followed gaze in 66% of trials in the PPP condition, and in 53% of trials in the PPO condition. Tremblay & Rovira (2007) also found that infants gazed more frequently at the adult than the object in the PPO condition, yet their gaze was distributed more evenly between the two experimenters in the PPP condition. With regard to SDB production across the two conditions, infants produced significantly more in the PPP versus PPO condition. Tremblay and Rovira (2007) concluded that 3-month-olds did initiate social triangular coordinated interaction in the PPP condition, but not in the PPO condition, supporting that "the social context with three persons may be particularly facilitative for infant early communication and sharing within the family (p374)." A cautionary note however, is offered, in respect of this conclusion, that whilst their findings are of great interest, Tremblay & Rovira's (2007) prediction was that infants would make

more double SDBs (SDBs that were accompanied, preceded or followed by looks to adult and object or adult and adult) in the PPP versus PPO condition. This prediction was actually not statistically supported, rather it was the *total* amount of combined single and double SDBs that differed across the conditions. Another point of interest is that in a separate experiment of the same paper, Tremblay and Rovira (2007) observed 3-month and 6-month olds in just a person-person-person interaction. 3-month-olds produced around 20 SDBs during the interaction compared to 64 SDBs in the PPP condition of the second experiment. The marked variance in scores raises a question regarding generalisability from the samples, or perhaps there was difference in measures adopted. Even so, when considering the second experiment, the fact that infants were markedly more communicative in the PPP versus the PPO condition, adds further support to previous research that suggests that very young infants do have some innate awareness of other minds. Furthermore, infants are active participants, communicating in naturalistic triangular social situations.

Tremblay and Rovira (2007) used 'strangers' as play partners (experimenters), despite recognising the importance of the family. This was in contrast to Fivaz-Depeursinge et al (2005), who had family members as participants. A common issue raised with regard to experimental research, particularly when studying social interaction, is that the prior relationship between the partners may influence the interaction itself. Strangers interacting will likely have a different interactive experience than friends, for example. Bigelow (1998) highlighted how play partner is an important factor in infancy research. An infant behaves differently when the play partner is mother versus a stranger, engaging less positively. Tremblay and Rovira's (2007) findings therefore, may have been influenced by play partner unfamiliarity, in that infants may have been less socially responsive when the play partner is not mother.

Joint attention and Down syndrome

Relatively little is understood about the affect of Down syndrome in the early months of development. There has been a small amount of studies carried out regarding joint attention and older infants and young children with Down syndrome (DS), and some regarding the social and emotional development of very young infants, yet in each case these are few and far between. Prior to the current investigation, no research has come to light that has investigated triadic interactions of very young infants with DS, and certainly not with regard more social, triangular compared to less social, triadic interactions. Hence, the current study is particularly innovative.

Studying the development of joint attention of young infants with DS has particular theoretical and practical value. DS is known to affect language acquisition, and it has been argued that the development of joint attention is crucial in relation to the development of language. If infants with DS have some difficulties or delay with regard to joint attention, then this might be one factor that aids the understanding of subsequent difficulties in language development. Furthermore, as previously discussed, joint attention is a skill that requires a level of theory of mind. If infants with DS demonstrate differential joint attentional behaviours compared to the typical population then this has implications regarding theory of mind. Finally, the development of joint attention enables complex social and emotional interactions about the environment (i.e. social referencing) and if the development of joint attention is affected by DS then these social and emotional interactions will also arguably be affected. In practical terms, understanding how infants with DS develop socially and emotionally will contribute to the development of appropriate and considered early intervention strategies designed to maximise each child's development.

Some studies have investigated the development of joint attention in relation to those with DS. Kasari, Freeman, Mundy and Sigman (1995) investigated the joint attentional and

social referencing behaviours in young children with and without DS. The chronological age (CA) of young children with DS ranged from 13-42 months, and as a group averaged a mental age (MA) of around 18 months. TD infants' CA averaged 14 months (the range is not stated), with a MA of around 17 months. With regard to joint attention, Kasari et al (1995) found that young children with DS looked between their mother and toy just as frequently as TD infants when matched by MA. However, in a social referencing situation (when a moving robot was included) DS children made fewer looks to an adult than TD infants. Kasari et al (1995) suggested that the joint attention system of children with DS was functional, but that cognitive appraisal abilities were impaired. Conclusions from this study are limited in relation to infant joint attention and social referencing however, as the chronological age of the young children with DS ranged vastly, not only in comparison to the TD infants, but also within the DS sample itself (from just over 1 year, up to 3 ½ years of age). Mental age was calculated through using a measure that tested infants' expressive and receptive language abilities, alongside using the Cattell Infant Intelligence Scale (Cattell, 1940). This latter scale focuses on assessing motor skills such as putting a ball into a cup, or marking paper with a crayon, as well as verbal communication skills. Delays and/or difficulties in motoric and language functioning with regard to DS are common, so it is unsurprising that some of these children with DS were that much older than TD infants. However, matching two children's abilities using measurements of language and motor skill does not necessarily mean that those children are matched in their social and emotional functioning. A 3 ½ year old child has a great deal more social and emotional experience than a 1 ½ year old child. Matching by mental age is a common developmental psychopathological approach, and has considerable merit (see Cohen, 2006). Cohen (2006), however, discussed how CA matching can also be informative, stating "specifically, only by comparing to typically developing children of a similar age can one determine if specific groups are 'spared' in their functioning in a specific

domain” (p.256). Thus, whilst Kasari et al’s (1995) study is informative with regard to joint attention and social referencing (note that these are particular social and emotionally based skills) in young children with and without DS, other approaches may also be informative.

Further work in the field can be considered in the same light. Legerstee and Weintraub (1997) examined the developmental process of attention of infants and young children with and without DS, again making MA adjustments. They reported that like infants with TD, young children with DS progressed from a phase of primarily object or person attention, to attending to people and objects (replicating Bakeman & Adamson, 1984), however progressing slower through these phases than TD infants. Legerstee and Weintraub (1997) also found that infants with DS were more passive participants in play interactions, and produced less coordinated attention than TD infants. Participants in this study were grouped in either low or high MA levels, with a chronological age at the first visit of 17.3 to 22.6 months for infants with DS, compared to TD infants ranging in age from 8.1 to 17.6 months. Whilst CA differences are a little less stark in the Legerstee and Weintraub (1997) study compared to Kasari et al (1995), a similar argument regarding whether MA adjustment is the most appropriate method in relation to joint attention still applies.

As discussed, evidence relating to the development of joint attention with regard to *young* infants with DS is scarce, yet there have been investigations relating to the gaze behaviour of young infants with DS – an important facet of joint attention. It has been reported that the eye gaze behaviour of young infants with DS is impaired when compared to the typical population (Berger & Cunningham, 1981). If this is the case, then those areas of development that have a relationship with gaze may also be developing atypically. Berger and Cunningham’s (1981) well cited longitudinal study evaluated eye gaze behaviour between mother-infant pairs (TD, n=7; DS, n=5). Infants were observed in their home in a face-to-face play situation with mother on a regular basis from the age of around 6 weeks to

24 weeks. Berger and Cunningham (1981) reported that infants with DS ‘showed chronological delay in the onset of eye contact’ (p 678). Infants with DS, in their sample, reportedly had around a two week delay in the ability to maintain eye contact (6.7wks) in comparison with TD infants (4.1 wks) (obtained by maternal report). However, when they corrected for the fact that infants with Down syndrome had an average gestational age of around 2 weeks lower than TD infants (37.5 compared to 39.3 wks), there was no significant difference between groups. With this in mind it cannot be conclusively reported from Berger and Cunningham (1981) that infants with Down syndrome have a delay in the onset of eye contact. Infants with Down syndrome could arguably have been at a slight disadvantage being born a little earlier in the gestational period, and thus at birth, may have had less developed gaze functioning.

Group differences were found however, in relation to the duration of individual gaze bouts (Berger and Cunningham, 1981). TD infants had long durations of gaze towards the end of the second month, with these becoming progressively shorter as the infants got older. In contrast, infants with DS did not demonstrate long durations of gaze until into the fourth month of age. Gaze bout length in subsequent weeks did not then show any decrease, unlike TD infants. Berger and Cunningham (1981) concluded that compared to TD infants, infants with DS not only had delays in the overall quantity of eye contact, but also “that eye contact development appeared to be delayed as much and probably more in its qualitative aspects” (p.684). Furthermore, the findings, it is stated, were evidence that infants with DS may have an inability to further develop eye gaze into later functional skills that require voluntary disengagement of eye contact. One such skill affected, one could surmise, would be joint attention. Berger and Cunningham (1981) argued that infants with Down syndrome gaze longer at a social partner because they cannot shift gaze as well as typically developing infants. In contrast Fidler (2005) argued that those with Down syndrome gaze longer at a

social partner, not because they cannot shift gaze, but that they actually have preference to a social partner over an object. It is aimed in the current work, that through examining the gazing behaviour of infants with Down syndrome in a social triangular versus object triadic situation, this conflict may be addressed. A longitudinal study, carried out by Carvajel and Iglesias (2000) addressed looking behaviour and smiling of 3-4-, 6-8- and 10-13- month-old infants with and without DS. Similarly to Berger and Cunningham (1981), Carvajel and Iglesias (2000) also found differences between the looking behaviour of infants with and without DS. Overall, DS infants spent more time looking at mother than TD infants, yet there was no difference in the amount of time infants spent looking at toys. They also found that when TD and DS infants smiled they increased gaze to mother and decreased gaze to toy. Carvajel and Iglesias (2000) concluded that from the age of 3 months, infants with DS discriminate between objects and people in the same way as TD infants, directing social and emotional behaviour to another social being. This finding is particularly relevant to the current study due to the consideration of infant behaviour in more social versus less social three way situations.

The current study focuses on infant socioemotional communication, one facet of which is positive and negative emotionality, in more or less social triadic interactions. Whether infants with DS have any atypicality in relation to emotion in early development is unclear. As highlighted, alongside gaze behaviour, Carvajel and Iglesias (2000) investigated the smiling behaviour of infants with DS and compared this to the smiling behaviour of a TD sample. No difference in smiling behaviour was found between groups. This finding contrasts reports that those with DS may have less intensity ('dampened emotionality') and more variation in facial expression in comparison to TD infants (Emde & Brown, 1979). Others report that infants with DS have a delay regarding the onset of social smiling compared to the typical population (around a month), and report that the smiling behaviour of infants with DS

differs to the typical population in that it is shorter in duration, being more fleeting, and less intense (Berger & Cunningham, 1986).

There appears no conclusive evidence regarding specific delays or dysfunctions in the early social and emotional functioning of very young infants with DS when compared to TD infants. Whilst some report atypical patterns in particular areas that may affect social and emotional development (e.g. Berger & Cunningham, 1981, Berger & Cunningham, 1986; Emde & Brown, 1978), others conclude that “socioemotional abilities are relatively unimpaired in Down syndrome, despite profound impairments in cognitive development” (p.110, Carvajal & Iglesias, 2002) and that the social and emotional development of infants with DS appears to be organised and adaptive, in a similar manner to TD infants (Cicchetti & Beeghly, 1990).

The unresolved questions regarding the emotionality of TD infants compared to those without DS remains. Moore, Oates, Goodwin and Hobson (2008) conducted a study investigating the behaviours of infants with and without DS, matched by MA (CA: TD 4 mths, DS 6 mths) in a still-face scenario. Their findings showed that similarly to TD infants, infants with DS were also sensitive to this particular perturbation in interaction, however infants with DS were less fussy than TD infants. TD and DS infants were emotionally as positive, however DS infants were less negative than TD infants. Moore et al (2008) concluded that infants with DS showed less intense emotional reactivity, supporting the conclusions by Emde & Brown (1978) that the emotionality of infants with DS was somewhat ‘dampened’ compared to the typical population. The difference in emotionality between the two groups in Moore et al (2008) may have been related to the infants with DS having less sensitivity to a perturbation in interaction, or perhaps have related to differences between TD and DS maternal behaviour (with DS mothers found to show more ‘assertive warmth’ and ‘directiveness’ than TD infants; Moore et al, 2008).

Reduced negativity and increased positivity for those with DS is a theme that runs through many studies relating to temperament. Studies have shown that infants and young children with DS may well have more positive and/or less negative mood than TD infants and young children (e.g. Zickler, Morrow & Bull, 1998; Ratekin, 1993; Gunn & Berry, 1985), although it should be noted this is not conclusive (e.g. Bridges and Cicchetti, 1982, Ohr & Fagan, 1994). Contradictory findings may be explained by the diversity of measurements used and differences in chronological ages of infants studied.

The findings of these studies of early facets of the temperament of those with DS go some way in supporting the claim that those with Down syndrome have an overriding positive personality stereotype (Fidler, 2005). Individuals with DS are often described for example, as charming, happy, affectionate, lovable, fun and cheerful. Whilst this stereotype (as any) should be considered with caution, these positive behavioural characteristics have some support (Carr, 1995). Fidler (2005) also made an interesting observation, in that those with DS demonstrate relative social and emotional strengths. Those with Down syndrome are considered to display more empathic behaviours than other children with developmental delay (Kasari, Freeman & Bass, 2003), have competence in forming friendships (Freeman & Kasari, 2002), and will find inventive and charming social strategies to avoid completing a challenging task situation (Pitcairn & Wishart, 1992). It would appear, therefore, that those with Down syndrome are capable of developing a complex array of social skills, and furthermore that overall, the developing child with DS may have an increased positive emotional disposition compared to the developing TD child. Could these factors relate? Research regarding the role of positive emotion in development could suggest so.

Recent research is highlighting the benefits of a positive, rather than negative, psychological state to enable approach behaviours (e.g. Davidson, 1994; Frijda, 1994), continued action (Carver & Scheier, 1990), positive engagement and active participation with

the environment (Huppert, Bayliss & Keverne, 2005). Negative emotions serve to narrow the focus and it can therefore be deduced, reduce engagement, limit approach behaviours and result in a withdrawal from active participation with the environment. If fearful of something, for example, it is necessary to put all your focus on to the subject of fear to preserve your safety. In contrast, positive emotions provide the opportunity to broaden experience and build personal resources (Fredrickson, 2003). Rather than narrowing focus (as is the case for negative emotion), positive emotions widen the focus, allowing the freedom and confidence to absorb more information. It would be natural to conclude therefore, that the developing infant who has more positive and/or less negative interactions with the environment will be broadening their experiences and developing more personal resources that relate to those specific interactions. For the 4-month old infant, the core environmental interaction is with a social other. Increased positivity at this time could therefore lead to an ultimate strengthening of socioemotional skills.

Whilst of course, over time, other factors will interact with the overall developmental trajectory for a particular child, differences in functioning in these early months of life could have far reaching impact on developmental outcomes. It is important to consider that the child brain is very different to the adult brain. Unlike the adult brain, that has reached maturity and has become relatively static, the child brain (and in particular the very young infant brain) is very much under a process of *development*. For the infant with DS, the affect of the genetic disorder on specific factors of brain functioning may be initially small in relation to some domains and have perhaps no impact on others. However, as the brain develops, relatively minute differences in early aspects of brain functioning may interact, resulting in further-reaching, and more diffuse neurological impact (Karmiloff-Smith, 1998). The benefit of studying the behaviour of very young infants with DS is that it may identify these early small areas of differential behaviours, before this ‘snowballing’ begins to have

substantial effects. Carefully considered interventions introduced at this very early stage in development could therefore have extensive long-term benefits for the developing child.

To summarise, young infants with DS may, or may not be emotionally flat; may or may not be more emotionally positive and less negative, and may or may not have differential patterns relating to attention shifting when compared to the typically developing population. The purpose of the current study was to identify whether there are differences between how TD and DS infants communicate in a potential triadic situation, and whether there is evidence of any precursors to the development of joint attention (or secondary intersubjectivity).

Research outline

The majority of research regarding very early joint attentional skills has focused on 3-month old infant behaviour (e.g. D'Entremont et al, 1999; Striano & Stahl, 2005; Tremblay & Rovira, 2007). Whilst this is valuable, in that it seems to be at around this age that infants are able to demonstrate some of the skills that are suggestive of joint attentional abilities, it is not so clear how these develop over time. In the current study, infants were observed in both a 'social, person, triangular' and 'object triadic' situation to investigate early joint attentional abilities in relation to social, emotional and communicative development to further knowledge of the developmental process of triadic interactions. Socioemotional behaviour refers to those aspects of behaviour (such as infant vocalisations and expressions of emotion, body movements, and gaze) that correspondent with social gazing. The experimental framework adopted in the current study was based upon that of Tremblay and Rovira (2007) (who investigated three-month-old infant behaviour), adapting the paradigm to investigate the joint attentional abilities of 4-month-old infants, both with and without DS. At around four months of age, infants are known to be in transition, shifting from primarily engaging with another person, towards becoming much more engaged with objects. Thus, investigating

infant joint attentional and socioemotional behaviour at this age where attention is undergoing a transition, could offer valuable information. No age adjustment was made for infants with DS (similarly to Berger & Cunningham, 1981), unlike in other previous studies (e.g. Kasari et al, 1995; Legerstee & Weintraub, 1997, Moore et al, 2008) to control for past social and emotional experience, since there is no sound evidence supporting any social and emotional delay in very young infants with DS, in particular with regard to triadic interaction. For this reason, infants were matched in chronological age.

As in Tremblay and Rovira's (2007) study, infants were observed in a person-person-person situation (in future referred to the 'Person' condition) and a person-person-object situation (referred from now on as the 'Object' condition). In line with the recognition of the importance of the family in relation to triadic interactions (e.g. Bigelow, 1998; Fivaz-Depeursinge et al, 2005; Tremblay and Rovira, 2007) this investigation included mother, as opposed to a second experimenter, as the third play partner. This enabled the re-enactment of a more naturalistic triangular situation compared to when the infant is with two strangers (arguably, the infant is likely to spend most time in a triangular interaction with mother as one of the participants).

The lateralisation of infant body movements was also investigated. Trevarthen (1996) proposed that young infant limb movements are purposeful, communicative and are lateralised as a consequence of hemispheric asymmetry of emotion. According to Trevarthen (1996), young infants make more communicative bids with the right side of the body as a consequence of a left sided hemispheric dominance in approach and positive emotional behaviours (Davidson, 1993). In contrast, left-sided body movements relate to the right sided dominance of withdrawal, self-regulatory and negative emotional behaviours. Tremblay & Rovira (2007) recorded infant body movements in interactions however, did not take into account whether these behaviours were lateralised in relation to the communicative context.

With Trevarthen's (1996) claims in mind, the paradigm used in the current study provides an ideal opportunity to investigate laterality of infant body movements in communicative contexts, an area that has received little attention to date.

Predictions

Specifically, the goals of this study were to investigate whether TD and DS infants demonstrated early joint attentional abilities in both a Person triangular and Object triadic situation, and also showed differences in social, communicative behaviours across the two conditions. It was predicted, in line with Tremblay and Rovira (2007), that TD 4-month-old infants would produce more socially directed behaviours (SDBs) in the Person versus Object condition, and tentatively predicted that this would also be the case for infants with DS, due to the inconclusive evidence regarding any specific deficit or delay in their socioemotional development. If the prediction is upheld, then findings would support that a triadic communicative context was an important factor in the development of joint attention, and also recognise that very young infants are active, social, communicative partners.

It was also predicted that TD infants would be able to successfully follow gaze comparably to other research (e.g. D'Entremont et al, 1999; Striano & Stahl, 2005; Tremblay & Rovira, 2007), but that this would not be the case for infants with DS, who, according to research (Berger & Cunningham, 1981) have an inability to shift gaze. This prediction is made tentatively, however, in light of Fidler's (2005) assertions, who claimed that infants with DS gaze longer at a social partner not because they cannot shift gaze, but because they have a preference to gazing at a social versus non-social agent. To address this conflict, it was further predicted that infants with DS would shift their gaze more in the Person versus Object condition. If this is the case, then this would suggest there is no deficit in attention shifting

per se (as argued by Berger & Cunningham, 1981), but that there is a preference to social engagement (Fidler, 2005).

It was also predicted that all infants (as there is no evidence to suggest infants with DS would communicate differently to TD infants, nor would have differential patterns of emotion lateralisation) would make more right-sided movements than left-sided when in the more social Person condition compared to the Object condition in line with Trevarthen's (1996) hypothesis, relating to the lateralisation of emotion.

Facial and vocal expressions of negative and positive emotion were examined in order to assess whether there were differences in the emotionality of the groups. Given the exploratory nature of this work, no directional prediction was made regarding whether infants with Down syndrome would be more or less positive or negative emotionally than typically developing infants.

Method

Participants

Twenty two participants were recruited to participate in the study. Two of these original participants (both TD infants) were subsequently excluded from the study due to issues with video recording equipment. Therefore, in the current study, 20 4-month old infants and their mothers participated, 10 infants were typically developing (4 male, 6 female; M18.5; SD1.25; range 17.3 – 20.7), and 10 infants were diagnosed with Down syndrome (6 male, 4 female; M18.9; SD 1.23; range 17.0 – 20.1). The TD sample were recruited with the assistance of the Portsmouth Registry Office and also at a local baby and toddler show in Portsmouth, South of England. DS infants and mothers were recruited with the assistance of Professor Sue Buckley, Director of Research at The Down Syndrome

International Educational Trust, Portsmouth. All participants lived in the South of England. For further details regarding participants refer to Chapter One.

Procedure

The study was carried out in the infant laboratory in the Department of Psychology, University of Portsmouth and also for some infants with DS, in a similar room, at the Down Syndrome Educational Trust, also situated in Portsmouth. The timing of the study was set around when mother felt her infant would be at his or her most alert and content. In the vast majority of cases, this was mid-morning. An outline of the study was verbally provided to mother, and the set up of the room explained. At this point, mothers were given an Informed Consent form to read and sign if in agreement. It was made clear to mothers that if their baby became upset, distressed or needed a break at any point, then recording stopped and only restarted once infant and mother were happy to continue.

There was an age-appropriate highchair for the infant to sit in, with chairs available for mother and experimenter to use at various stages of the experiments. Three video cameras on tripods were set up around the room. Camera 1 was positioned to capture the full interaction, Camera 2 captured close up footage of the infant and Camera 3 was positioned to capture close up footage of mother and experimenter. Mother sat on a sofa behind the infant (out of sight) whilst firstly, experimenter and infant played.

Experimental order

The 'Object' condition (infant-experimenter-object) was carried out first, followed by the 'Person' condition (infant- experimenter-mother). It was decided not to counterbalance for order of condition due to the small sample size, in that counterbalancing would produce another variable which would then lessen the power of the study. Placing the 'object'

condition first allowed mother to familiarise herself with the set-up of the room and with the experimenter, and feel comfortable when she joined the interaction. Another reason for placing the 'Object' condition first rather than the 'person' condition, was to counteract any fatigue effect. It was predicted that infants would produce more socially directed behaviours in the 'Person' versus 'Object' condition. If infants became fatigued, then they would more likely engage less in the last versus first condition. Thus, if infants still produced more socially directed behaviours in the Person condition than the Object condition, then there could arguably be no call for fatigue accentuating any effects. In fact, results could be considered as conservative.

The experimenter attempted three trials of each condition in each instance. However, if the infant presented as fatigued and/ or distressed, or if mother felt that their infant was fatigued and/or distressed, then the experiment was stopped. If the infant was beginning to tire after the first trial of the Object condition, the experimenter would attempt to run the Person condition, in order to obtain data for each condition.

Questionnaires

Mother was given three questionnaires to complete whilst experimenter and infant played (See Chapter 4).

Object condition: Once mother and infant were happy to begin with the first condition, the experimenter positioned herself to either the left or right side (counterbalanced across participants) of the infant at a 45° angle, with face approximately 75cm away. An empty chair was placed symmetrically to the other side of the infant to form an equilateral triangle. The three cameras were arranged to best capture the interaction. The experimenter took hold of a brightly coloured, yellow stick with one hand and held it out at arms length to

the side, over the empty chair. The experimenter briefly engaged with the infant, to gain eye contact. Once interacting face-to-face, the experimenter then turned her head 90° and looked towards the stick, and began a ‘conversation’. A script was used as a guideline in order to prompt areas of ‘discussion’ with the stick. This reflected similar topics that mother and experimenter would later discuss. Caution was taken to re-enact real conversational timing, pausing between sentences for an imaginary response. An example follows of the experimenter and stick ‘discussion’:

“Hi Mr Stick, and how are you?”

“Oh, you’re good. Oh, yes, I’m fine.”

“So, what did you do at the weekend? Really? You went to the park? Sounds fun. And what did you get up to at the park?”

“Oh, right, so you enjoyed yourself!”

“What did I do? “Ah, let me think. I went for a walk with my family and dog down the beach. It was beautiful weather down there. The dog loves to go swimming in the sea.”

“Do you go swimming? A-ha, you do.”

“So, what’s your favourite colour? “Oh right, Yellow, well mine is red.”

“Tell me about your family then, Mr Stick. Do you have brothers and sisters?”

“Me? I have two brothers and a sister”

“Thanks for talking with me Mr Stick, Good-bye!”

If the infant began vocalising sufficiently to distract the experimenter’s attention from the ‘discussion’ with the stick, then the experimenter stopped the discussion and re-engaged with the infant. Should no clear bids be made, or the baby appeared disinterested or fatigued, then the trial came to a close. It was aimed to reach three trials of this condition, each trial lasting no longer than 3.5 minutes.

Person condition. The experimenter sat on a chair, triangularly to the infant and mother (all at approximately 45° to each other). The experimenter firstly engaged with the infant similarly to the Object condition, then turned her head and eye gaze 90° to the mother. Mother and experimenter then began a naturalistic conversation between each other. As in the Object condition, should the infant begin vocalising sufficiently to distract the experimenter

and/or mother from the discussion, then the experimenter and mother ceased their discussion and re-engaged with the infant. If this did not happen, or if the infant appeared distressed or fatigued, then the trial ultimately came to a close. It was aimed to reach three trials of this condition, with each trial lasting no longer than 3.5 minutes. The second trial began with mother engaging with infant, then turning to the experimenter. The third trial replicated the first.

Measures

A coding system was developed in order to record and analyse facets of infant behaviour. Infant gaze, facial expression, vocalisations, mouth movements and body movements were measured. These categories were selected due to Tremblay & Rovira's (2007) definition of socially directed behaviours that included aspects of each of these behaviours. Whilst the overall categories were in the main comparable to those used by Tremblay & Rovira (2007), the codes and coding definitions were developed specifically to fit the purpose of the current study, after trialling and adapting the system where necessary. A clear addition in the current study was the coding of each individual limb movement, a feature lacking in Tremblay & Rovira (2007). Consider 'arm waving,' for example (as mentioned in Tremblay & Rovira, 2007). The waving of arms could be interpreted to mean many things including: a large movement including both limbs, a small movement of both arms, or one arm moving rapidly and the other still. Therefore, it was decided to differentiate between size of movement and also the limb that was producing the movement. This would also enable consideration of whether lateralised body movements were evident in infant interaction as proposed by Trevarthen (1996).

Summary descriptions of codes in each category are shown in Table 3.1, which only displays those codes that were utilised within the definition of an SDB. Behaviours were

coded in 1-second intervals – that is for each 1 second timeframe, each participant was given one code for each category. This coding method was selected for a number of reasons. Interval coding has an advantage when collecting a large amount of data (as in the current study), being more time efficient than marking onset times of specific events. Furthermore, it was decided that precise durational information regarding specific aspects of behaviour was not a necessity in this instance (an advantage of event sampling), and exact timing of one behavioural event with another was not a part of analysis. Within each category, codes were mutually exclusive (only one code could be associated with a given event) and exhaustive (a code can be given for every event) (Bakeman & Gottman, 1997), however there were some hierarchical controls added. The addition of hierarchical coding was taken in order to limit a common problem associated with interval coding. This risk with interval coding is that more than one code of behaviour may occur within an interval or near the boundaries of intervals. Should this situation arise during coding, then a systematic approach was then carried out, following hierarchical instructions. This potential problem was also overcome by setting intervals to an extremely short duration (1 second). This method is considered valid as the behaviours measured were, in the main, longer than 1 second in duration (Bakeman & Gottman, 1997).

One further point to note is that behaviours (unless otherwise stated) are to be considered as intervals that contained that behaviour, rather than behavioural frequencies. One interval for example, could in theory contain 3 very rapid medium body movements, yet rather than identifying the beginning and perhaps ending, of each movement (no easy task), the interval coding approach was to assign the interval as being a ‘one medium body movement’ interval. In this way it was possible to statistically analyse the amount of intervals containing a behaviour, rather than the precise frequency of the behaviour. Again, setting a

very short interval duration of 1 second reduced the risk of distorting the behavioural occurrences.

Alongside infant behavioural measures, adult gaze behaviour was measured to identify when the first look away from the infant to the third target occurred. The interval within which this change of gaze occurred was recorded in order to assess whether infant followed gaze within a 7- second timeframe (reflective of the timescale laid out by Tremblay & Rovira, 2007). Codes that were indicative of socially directed behaviours (if accompanied with gaze) are highlighted in bold in table 3.1 (e.g. positive and negative facial expressions, large and medium (but not small) limb movements). Note that the codes shown are only those which were included as SDBs (when accompanied by gaze) and the full mutually exclusive and exhaustive coding system is included in Appendix B.

Table 3.1 Summary description of infant behaviour coding system categories and codes

Category	Codes	Description
Infant gaze	At A At B Elsewhere	At experimenter's face At object (Cond. A) / At mother (Cond B) Anywhere else
Facial expression	Positive Negative Interest Neutral	A definitive smile A definitive negative expression When looking at object or either partner without positive or negative expression Neither positive, negative or interest
Vocalisations	Positive Negative Other	Not negative or other vocalisations Definitive cries or whinges Hiccups, sneezes etc
Mouth movement	Yes/ No	Any movement was recorded as such
Limb movements: Left / Right Upper / Lower	Large Medium Small	A highly energised limb movement An energised limb movement Very little energy involved

Notes. all categories (with the exception of 'vocalisations') had an additional code of 'can't see' to use where applicable. Codes that were counted as SDBs are highlighted in bold

Preparation of videotapes for analysis

For each participant, original video recordings from each of the three video cameras were edited into individual trials using Pinnacle editing software. The 3-way video camera recording was edited first, using the onset and end points of trials as markers. In order to maintain consistency, it was decided that the onset of each participant's trial was identified as being four seconds before the first head turn away by the adult. The end of the trial was marked by the interval in which experimenter or mother first re-engaged with infant. These edited trials were then exported into MPEG1 files, with relevant titles. The other two camera angles (Mother/Experimenter and Infant) were then edited to begin and end at the same frame as the 3-way edited trials. Accuracy was achieved through using audio prompts to match frames across the camera recordings. High quality Sony Ericsson headphones enabled an excellent accuracy rate, with most trials risking no error in matching frame to frame. For the rare instances where audio prompts were a little less clear, a generous allowance of up to 2 frames of error is given. These edited trials were then exported as MPEG1 files. Thus, three MPEG1 files for one individual trial were produced, each starting and finishing at the same point.

Coding procedure

The coding system was inputted into the behavioural analysis software system, Interact (Mangold International). One pass of the whole trial for each single category was made, and so each trial required eight passes (gaze, facial expressiveness, vocalisations, left upper limb, right upper limb, left lower limb, right lower limb).

Reliability:

Intra-rater reliability was carried out on 20 % of the data. Average Cohen's Kappa scores were calculated for each of the coding categories. Gaze = 0.83, Facial Expressions = 0.87; Vocalisations = 0.89; Mouth movements = 0.83; Left Upper = 0.82; Right Upper = 0.79; Left Lower = 0.78; Right Lower = 0.82. Inter-rater reliability was also carried out. The second coder was a Psychology graduate who was blind to the full purpose of the research. Average Kappa scores were Gaze = 0.79, Facial Expressions = 0.84; Vocalisations = 0.84; Mouth movements = 0.77; Left Upper = 0.79; Right Upper = 0.77; Left Lower = 0.77; Right Lower = 0.80.

Summarising raw data for data analysis

Upon completion of the coding procedure, a raw data sheet for each trial, for each participant, was produced. These raw data sheets were exported from Interact into Microsoft Excel. From Excel, frequencies of intervals containing each behaviour code were calculated. The next step was to calculate the frequency of occurrence of those intervals of behaviours that could be considered 'socially directed'. Using the definition by Tremblay and Rovira (2007), socially directed behaviours (SDBs) were specific infant facial, vocal and motor behaviours that co-occurred (that is within a 7 second time frame) with gaze to the adult or object. Tremblay and Rovira's (2007) definition was adopted in the current study in order to have some consistency across studies within the field. Furthermore, Tremblay and Rovira (2007) differentiated between Single SDBs (SDBs that accompanied, preceded or followed gaze to one adult or object), and Double SDBs (SDBs that accompanied, preceded or followed gaze to two adults or adult-object) (See Table 3.2). Using the gaze category, it was first identified when (by interval) infants were gazing at either experimenter (A) or mother/object (B). These intervals, and the seven seconds before and after each interval of

gaze towards A or B were colour coded red. This was the case regardless of whether infant gaze was towards the experimenter (A) or mother/object (B). Where there was an overlapping of these red intervals (but only when this overlapping was due to gazing at A and B – so not A – A, or B-B) then the overlapping intervals were colour-coded green. Intervals coded red were then interpreted as single SDBs, coloured green – double SDBs, and no colour code – no SDBs.

Infant gaze behaviour was also summarised in preparation for further analysis. Gaze behaviour was summarised in order to investigate the proportion of time infants spent looking at a specific target (mother/experimenter/stick), how often they shifted their gaze to that target, the average duration of gaze to a specific target, and how often they shifted their gaze between targets and elsewhere. Furthermore, the number of double looks was calculated in order to analyse the rate that infants look between two targets (within a timed window). It was decided to look at gaze behaviour in detail due to the question marks that have been made regarding the gaze shifting abilities of infants with Down syndrome. Data were collated for each infant and entered into SPSS to enable statistical analysis.

Table 3.2.

Key terms and definitions used in data analysis

Key Term	Definition
Socially Directed Behaviours (SDBs)	Intervals that contain those coded behaviours (See Table 1) that occurred within 7 seconds either side of a look towards the experimenter or object / mother (i.e. The total of Single and Double SDBs)
Single SDBs	Coded behaviours that occurred within 7 seconds either side of a look towards the experimenter OR object/mother
Double SDBs	Coded behaviours that occurred within 7 seconds either side of a look towards the experimenter AND object/mother
Proportion of Looking time	The proportion of the trial time that infants spent looking towards a particular target
Rate of looks	Number of looks made towards A (for example) – recalculated to rpm. Infants eyes look towards Experiementer (for example).
Gaze Shifts	Any shift of gaze that the infant makes either from the experimenter, the object/mother or elsewhere.
Double Looks	A look between experimenter AND object/mother that co-occurs within a 7 second time window
Gaze Bout Duration	The total duration of consecutive intervals that the infant spent looking towards one particular target

Data analysis and statistical decisions

In Chapter One, I conducted a power analysis and identified that for a 2 x 2 mixed between-within design (with two levels) I would require 22 participants to have sufficient power to detect small to moderate effects and significance at $p < 0.05$. Twenty-two participants were originally recruited, however two participants were dropped from final analyses, and thus, the power of the study was lowered. Statistical analyses were carried out on a variety of measures of infant behaviour. Using the rationale discussed in Chapter One, as recommended by others, I decided not to use Bonferroni corrections to account for any potential multiple testing risking Type I errors due to the issues regarding this practice, but rather look at patterns of results, be aware of the potential problems with multiple testing, and inform the

reader of the statistical decisions made in advance (Cohen, 1990; Wilkinson and the Task Force for Inferential Statistics, 1999; Bakeman, 2005). In the subsequent analyses, the alpha level was set at <0.05.

Results

Trial Information

The target for each infant was to complete three trials for each condition. Out of a possible 60 trials, TD infants completed 47, compared to DS infants, who completed 57 (see Table 3.3 for completion rates by condition). Infants were categorised as either completing all trials (yes) or not completing all trials (no). A chi square test was conducted and a statistical significant relationship was found, $\chi^2 (1,19) = 9.90$; $p = 0.002$. DS infants completed more trials than TD infants. Thus, it appears that DS infants met the demands of the experiment more often than TD infants.

Table 3.3
Number of trials completed by condition for both TD and DS infants

Group	Trial 1	Trial 2	Trial 3	Total
TD (n=10)				
Object	10	9	7	26
Person	10	9	2	21
DS (n=10)				
Object	10	9	9	28
Person	10	10	9	29

Note: each group could complete up to a maximum of 30 trials of each condition

Did infants follow gaze?

An infant was categorised as correctly following gaze in a particular trial if they looked towards the target within the 7 second window following the adult head and eye turn (A look was classed as eye gaze to the target). Table 3.4 shows the distribution of correct and incorrect turns for TD and DS infants across conditions.

Table 3.4
TD and DS infants number of correct (and %) and incorrect looks following adult head and eye turn as a function of condition

Group	Look To Object	Look To Person	All trials
TD (n=10)			
# correct (%)	17 (68%)	6 (27%)	23 (49%)
# incorrect	8	16	24
DS (n=10)			
# correct (%)	5 (18%)	2 (7%)	7 (12%)
# incorrect	23	27	50

A highly significant relationship was found between successful gaze following and group: TD infants were more likely to follow gaze than were DS infants, $\chi^2(1) = 15.12$, $p=0.0001$. TD infants correctly followed gaze in 49% of trials overall compared to 12% for DS infants. . Further Chi square tests were performed to see if there was a relationship between condition, group and gaze following. With regard to TD infants, gaze following related to condition type ($\chi^2(1) = 7.77$, $p = 0.005$): TD infants were more likely to follow gaze to the Object than to the Person. DS infants however, were not more likely to follow

gaze to either Person or Object, demonstrating no relationship between condition type and gaze following ($\chi^2 (1) = 1.59, p = 0.21$) (See table 3.4).

Data cleaning

Due to the miss rate of the third trials in both the Object and Person conditions for the TD infants, the third trials were excluded from further statistical analysis. Therefore, subsequent analysis refers to trials 1 and 2 of each condition. As is evident in Table 3.3, of the TD sample, one participant did not complete trial 2 of the Person condition, and also one participant did not complete trial 2 of the Object condition. Also, one DS participant did not complete trial 2 of the Object condition. One key variable measured in the current study was the rate of socially directed infant behaviours (SDBs). With the relatively small sample size in mind, infant total rate of SDBs across T1 and T2 were found to correlate (Object cond. $r = 0.56, p = 0.02$, Person cond. $r = 0.46, p = 0.05$). Therefore, the justifiable decision for dealing with the two infants' missing data was to replicate data from their first to second trials.

Data were analysed in 1-second intervals. Data should be interpreted in terms of the number of intervals that contained a particular behaviour rather than in frequencies (refer to coding procedure in methods section for more detail on this point).

Trial duration

A mixed ANOVA was conducted to see if there were any differences with regard to the length of trials in relation to Condition and Group. A Main effect for Condition was found. Trial length was significantly longer in the Person condition (M 178.6 secs, SD 68.6) than in the Object condition (M 138.2 secs, SD 43.4), $F (1,18) = 12.17, p = 0.003$. There was also a non significant trend towards a Group effect. Trial length for DS infants was longer (M 180.2 secs) than for TD infants (M 136.5 secs, $F (1,18) = 4.27, p = 0.05, \eta^2_p = 0.19$). There was no Interaction effect, $F (1,18) = 1.17, p = 0.29$.

As trial durations differed significantly, all further data were re-calculated into rates per minute (rpm), unless otherwise stated.

Were there differences in the rate of socially directed behaviours (SDBs) produced by infants in the Person versus Object condition?

There were no Main effects of Condition or Group. No significant difference was found regarding the rate of total SDBs produced in the Object condition (M 29.8, SD 13.30), versus the Person condition (M 34.0, SD 10.22), $F(1, 18) = 1.56$, $p = 0.23$. Infants with and without DS also did not differ in the total rate of SDBs produced (DS, M 33.1; TD, M 30.7), $F(1, 18) = 0.37$, $p = 0.55$. Whilst there was no significant interaction, $F(1, 18) = 2.51$, $p = 0.13$, $\eta^2_p = 0.12$), the p value and effect size was such that it was considered justifiable to explore the relationships further. Univariate analysis revealed a non significant trend: TD infants tended to produce a lower rate of SDBs in the Object condition than the Person condition, $F(1, 9) = 3.87$, $p = 0.08$, $\eta^2_p = 0.30$, however, DS infants did not show such a trend in the rate of SDBs produced across conditions $F(1, 9) = 0.06$, $p = 0.81$. No significant differences were found between the rate of SDBs produced in the object condition by TD and DS infants, $F(1, 18) = 1.76$, $p = 0.20$, nor in the person condition, $F(1, 18) = 0.36$, $p = 0.55$. Whilst TD infant SDB rate had a tendency toward being influenced by condition, this was not the case for DS infants, who produced a comparable rate of socially directed behaviours across both conditions, and this rate was also not significantly different to either of the rates of SDBs in each condition by TD infants.

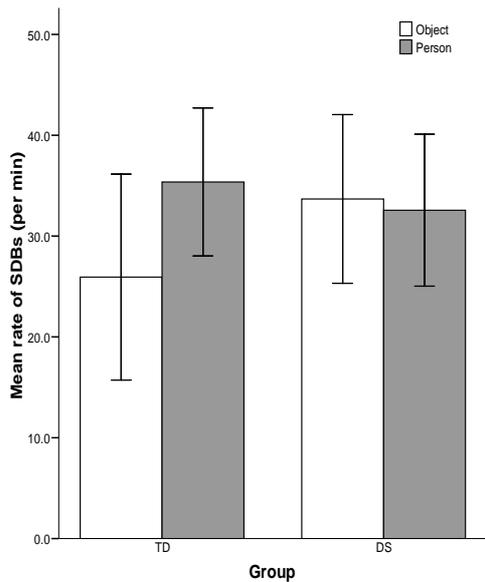


Figure 3.1.

DS (n=10) and TD (n=10) infants average rpm of SDBs (with SE) across conditions

Single and Double SDBs.

The rate of single and double SDBs (for definitions refer back to Table 3.1) produced by TD and DS infants were calculated for both the Person and Object conditions. Table 3.5 depicts the average rate per minute of Single, Double (in the Person condition) and Double (in the Object condition) SDBs.

Single. There was a Main effect of Condition. Infants produced a significantly higher rate of single SDBs in the Person condition (M 24.7, SD 7.94) compared to the Object condition (M 19.0, SD 13.81), $F(1,18) = 4.51$, $p = 0.05$, $\eta_p^2 = 0.20$. There was a non significant trend towards a Main effect of Group, with DS infants tending to produce a higher rate of single SDBs (M 25.2) than TD infants (M 18.5), $F(1,18) = 3.26$, $p = 0.09$, $\eta_p^2 = 0.15$. There was also a significant Condition x Group Interaction, $F(1, 18) = 8.06$, $p = 0.01$,

$\eta^2_p = 0.31$. Univariate analysis revealed that TD infants produced a significantly lower rate of single SDBs in the Object (less social) versus Person (more social) condition, $F(1,9) = 17.38, p = 0.002, \eta^2_p = 0.66$; whereas DS infants did not, $F(1,18) = 0.20, p = 0.67, \eta^2_p = 0.02$. There was no difference between the rate of single SDBs produced by TD and DS infants in the Person condition, $F(1,9) = 0.36, p = 0.55, \eta^2_p = 0.20$. However, in the less social Object condition TD infants produced a significantly lower rate of single SDBs than DS infants, $F(1,18) = 7.14, p = 0.02, \eta^2_p = 0.28$.

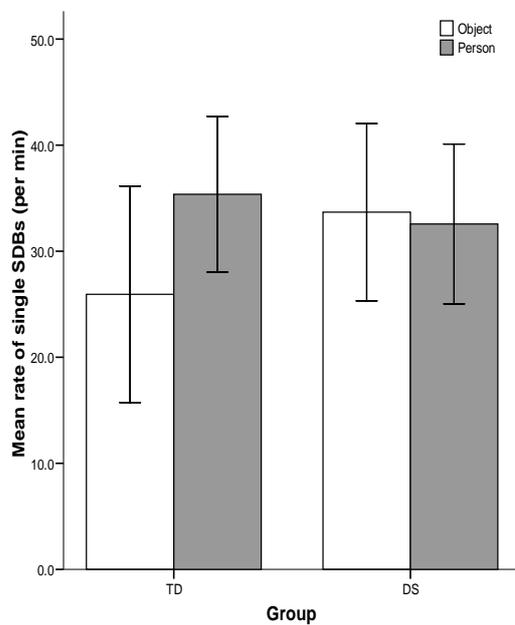


Figure 3.2

TD (n=10) and DS (n=10) infant average rate of single SDBs (& SE) produced in the Object and Person conditions

Double. The average rate of double SDBs was 10.05 per min. There was no Main effect of Condition, $F(1,18) = 0.39$, $p = 0.54$, Group, $F(1,18) = 1.53$, $p = 0.23$, or Condition x Group interaction, $F(1,18) = 0.89$, $p = 0.36$ (See Table 3.5). TD and DS infants produced equivalent rates of double SDBs in both the Person and Object conditions.

Table 3.5.
Means (and SD) of infant single and double SDBs (as rpm) across conditions

SDB category	TD				DS			
	Object		Person		Object		Person	
	M	SD	M	SD	M	SD	M	SD
Single:	11.82	(7.46)	25.16	(8.83)	26.16	(15.25)	24.24	(7.39)
Double: Exp & Mother	-	-	10.21	(9.89)	-	-	7.52	(7.00)
Double: Exp & Object	14.12	(10.95)	-	-	8.32	(9.55)	-	-

How did infants distribute their gaze between the experimenter and the object / mother?

Gazing behaviours were examined in order to assess how infants with DS compared to TD infants with regard gazing behaviours, and also how gaze behaviour may be influenced by condition.

Gazing behaviours towards Experimenter

Proportion of trial time spent looking towards experimenter.

There was no Main effect of Condition, $F(1,18) = 1.60$, $p = 0.22$. A Main effect of Group was found, DS infants spending a significantly higher proportion of time looking at

the experimenter overall ($M = 36.28$) than did TD infants ($M = 17.54$), $F(1,18) = 5.10$, $p = 0.04$, $\eta^2_p = 0.22$. There was also a Group x Condition interaction, $F(1,18) = 7.14$, $p = 0.02$, $\eta^2_p = 0.28$ which is shown in Figure 3.3. Univariate analysis was conducted, and it was found that DS infants spent a significantly longer proportion of time looking at the experimenter during the Object condition than in the Person condition ($F(1,9) = 6.02$, $p = 0.04$, $\eta^2_p = 0.40$). TD infants, however, did not show any significant difference in looking time to experimenter across conditions, $F(1,9) = 1.39$, $p = 0.27$. Furthermore, infants with DS spent a significantly higher proportion of time looking at the experimenter than TD infants in the Object condition, $F(1,18) = 8.37$, $p = 0.01$, $\eta^2_p = 0.32$. This was not the case in the Person condition, where there were no significant differences between the proportion of looking time toward experimenter across the two groups, $F(1,18) = 0.79$, $p = 0.39$.

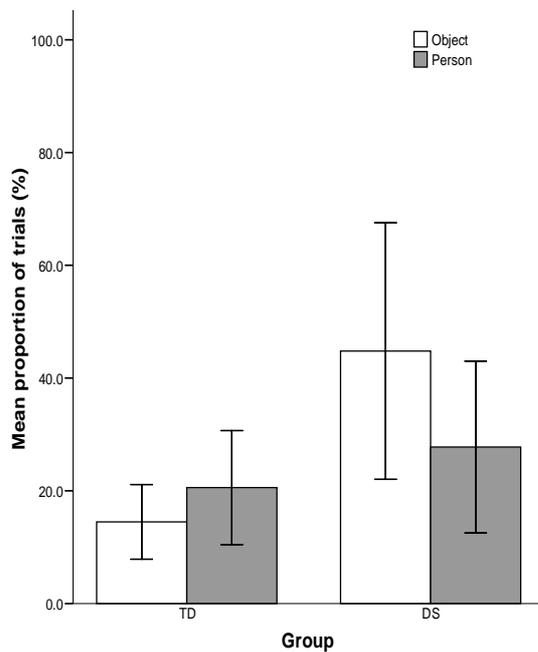


Figure 3.3

TD ($n=10$) and DS ($n=10$) infant mean proportion (& SE) of looking time towards Experimenter

Rate of looks to experimenter.

A main effect of condition was found in that infants had a higher rate of looks towards the experimenter in the Object condition ($M=3.28$, $SD 1.94$), $F(1,18) = 5.92$, $p = 0.03$, $\eta^2_p = 0.25$ as opposed to the Person condition ($M=2.23$, $SD 1.27$) (See Figure 3.4). There was no Main effect of Group ($M= 2.76$), $F(1,18) = 0.39$, $p=0.54$; or a Condition x Group interaction $F(1,18)=0.01$, $p=0.92$. TD and DS infants did not differ in the rate of looks to the experimenter overall or when considered with condition.

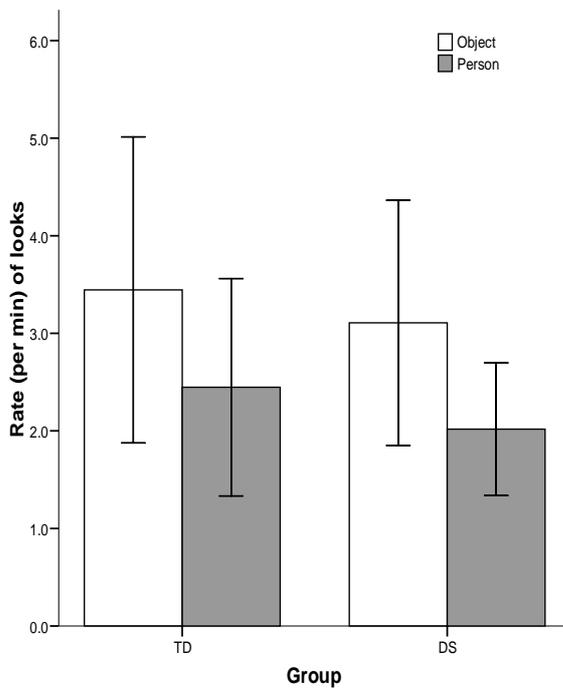


Figure 3.4.

TD ($n=10$) and DS ($n=10$) average (and SE) rate (per min) of looks to experimenter in the Person and Object conditions

Gazing behaviours to B (where B= Cond 1, Object; Cond 2, Mother)

Proportion of looking time to Object/Mother:

Whilst there was no Main effect of Group (M 29.09), $F(1,18) = 1.85$, $p=0.19$; or Condition (M 32.10), $F(1,18) = 0.51$, $p = 0.49$, a significant Group x Condition Interaction was found, $F(1,18) = 8.72$, $p= 0.01$, depicted in Figure 3.5. Univariate analysis revealed that DS infants spent a significantly higher proportion of time looking at Mother versus the Object, $F(1,9) = 6.15$, $p = 0.04$, $\eta^2_p = 0.41$; and that there was a non significant trend supporting that, in contrast, TD infants spent more time looking at the Object versus Mother, $F(1,9) 4.22$, $p = 0.07$, $\eta^2_p = 0.32$. TD infants also spent a significantly longer proportion of time looking at the object compared to DS infants, $F(1,18) = 5.01$, $p = 0.04$, $\eta^2_p = 0.22$. No difference was found between groups with regard to the proportion of looking time towards mother, $F(1,18) = 0.49$, $p = 0.49$.

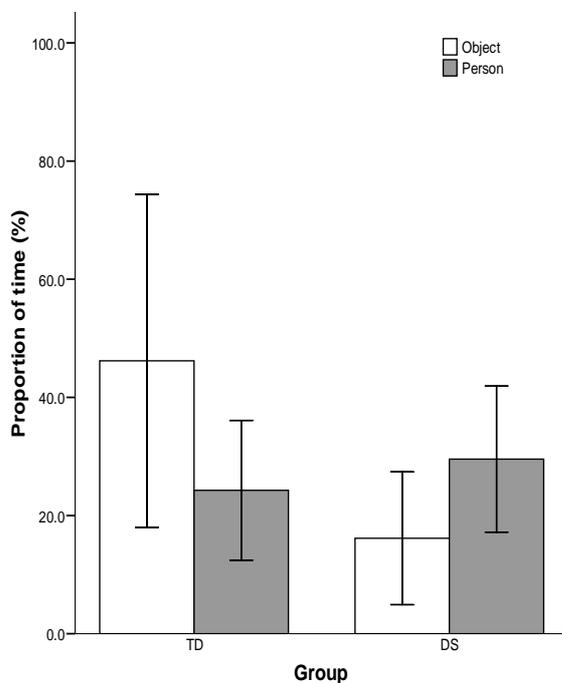


Figure 3.6 TD (n=10) and DS (n=10) infant average proportion of looking time (and SE) towards Object vs. Mother

Rate of Looks to B (Where B = Cond1: Object. Cond 2: Mother)

TD infants produced a significantly higher rate of looks towards B (M 3.63) than DS infants (M 1.88), $F(1,18) = 6.49, p = 0.02, \eta^2_p = 0.27$ (depicted in Figure 3.7). There were no differences between groups across conditions (M 2.76), $F(1,18) = 0.15, p = 0.71$ nor an Interaction, $F(1,18) = 1.59, p = 0.22$.

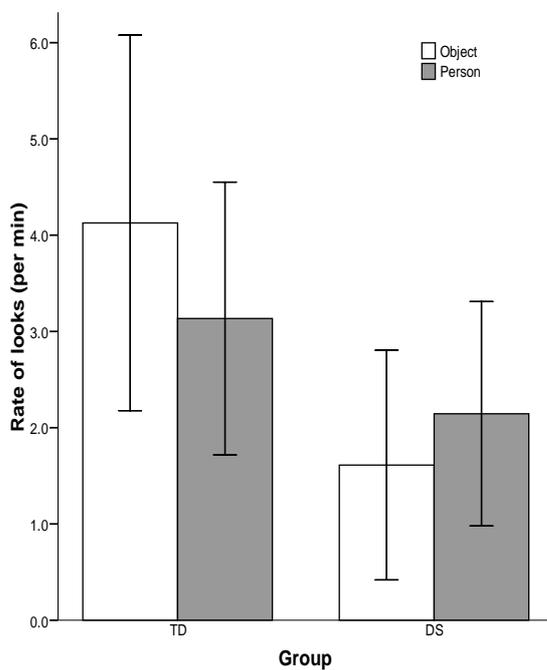


Figure 3.7

TD (n=10) and DS (n=10) infant average (and SE) rate (per min) of looks toward object (Object condition) and mother (Person condition)

Did TD and DS infants differ with regard to gaze bout length and gaze shifting rate?

The length of a gaze bout was defined by the number of continuous intervals that the infant looked at the same target. DS (M 10.9, SD 6.83) and TD infants (M 7.0, SD 4.60) did not significantly differ with regard to overall gaze bout duration, $t(18) = 1.48, p = 0.16$. With

regard to the rate that infants shifted their gaze between the three coded targets (experimenter, object/mother or to elsewhere), infants averaged a rate of 8.63 gaze shifts. There was no Main effect of condition, the rate infants gaze shifted in the Person and Object conditions did not differ, $F(1,18) = 1.70$, $p = 0.21$. There was a non significant trend of a Main effect of Group, with TD infants tending to make a higher mean number of gaze shifts (M 10.3) overall than DS infants (M 7.0), $F(1,18) = 3.28$, $p = 0.09$, $\eta^2_p = 0.15$. There was no Condition x Group Interaction, $F(1,18) = 0.32$, $p = 0.58$. Average rates by group and condition are shown in figure 3. 8.

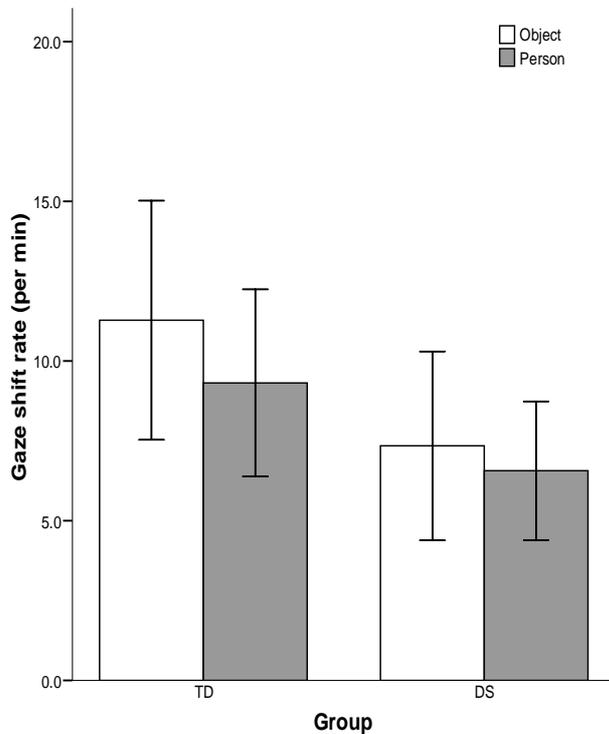


Figure 3.8

TD (n=10) and DS (n=10) infant average (and SE) gaze shifting rate (per min) in the Object and Person conditions

Was there a difference in the number of double looks made by TD and DS infants across conditions?

A double look was defined as a look to both experimenter and mother/object within a 7 second timeframe. Whilst there were no significant Main effects of Group, $F(1,18) = 3.58, p = 0.08, \eta^2_p = 0.17$, or Condition $F(1,18) = 3.55, p = 0.08, \eta^2_p = 0.17$, both statistical values show trends. TD infants tended to produce a higher rate of double looks ($M=2.7$) compared to DS infants ($M 1.5$). There was also a trend towards more double looks being made in the Object condition ($M 2.6, SD 2.33$) compared to the Person condition ($M 1.6, SD 1.63$). There was no Interaction effect, $F(1,18) = 2.47, p = 0.13$.

Summary of Gaze Analyses

DS infants gazed for a longer proportion of time at the experimenter during the less social, Object versus Person condition, and this was longer than TD infants in the Object condition, but comparable to TD infants in the Person condition. There were no differences between groups regarding the rate of looks made towards the experimenter, however overall, more looks were made to the experimenter in the Object versus Person condition. DS infants gazed for a longer proportion of time at mother versus the object, in contrast to TD infants who gazed for a longer proportion of time at the object versus mother. Overall TD infants gazed for a longer proportion of time at, and had a higher rate of looks towards, the object than DS infants. There was no difference in the average length of a gaze bout between TD and DS infants. DS infants did have a tendency (ns) to gaze longer at the experimenter (but not to object/mother or elsewhere) than TD infants. With regard gaze shifting, there were no significant differences (although there was a non significant trend) between the rate that TD and DS infants shifted gaze overall, or in either condition.

Facial expressions and vocalisations of emotion, lateralised body movements and mouth movements

For coding criteria for each of these behaviours refer to the category and coding definitions in Table 3.1 (and for more detail in appendix A). The rate per minute of each coded infant behaviour was calculated across the total trial length. Table 3.6 shows means and standard deviations of each coded behaviour for both TD and DS infants across conditions. Table 3.6 highlights those behavioural differences that were statistically significant or supporting a trend (using mixed ANOVAS). Effect sizes where relevant are included.

Table3.6 TD and DS infant average rates (as rpms) of behaviours across conditions

** = $p \leq 0.01$, * = $p < 0.05$, t = $p < 0.1$, - = ns

	TD (n=10)		DS (n=10)		Condition	Group	Condition X Group				
	Object	Person	Object	Person			Sig.	Part eta sq. (if $p < 0.2$)	Sig.	Part eta sq. (if $p < 0.2$)	Sig.
Total behaviours (as rpms)	M (SD)	M (SD)	M (SD)	M (SD)	Sig.	Part eta sq. (if $p < 0.2$)	Sig.	Part eta sq. (if $p < 0.2$)	Sig.	Part eta sq. (if $p < 0.2$)	Direction
Neg. facial expressions	5.72 (11.63)	6.22 (3.86)	2.20 (3.52)	2.47 (3.26)	-	-	-	0.14	-	-	TD > DS
Pos. Facial expressions	0.68 (0.99)	1.83 (1.90)	1.59 (1.79)	1.58 (1.88)	-	-	-	-	-	-	-
Neg. vocalisations	4.38 (9.80)	8.14 (4.10)	1.12 (1.28)	1.43 (2.80)	-	-	**	0.33	-	-	TD > DS
Pos. vocalisations	0.85 (1.69)	2.71 (2.49)	4.90 (7.52)	2.85 (2.39)	-	-	-	0.11	-	0.12	-
Mouth movement	15.66 (11.46)	27.18 (11.45)	30.82 (10.01)	29.51 (12.03)	-	0.14	*	0.20	*	0.21	TD < DS in particular in Obj Pers > Obj
Left arm	4.56 (4.74)	11.20 (6.26)	4.18 (5.08)	5.20 (7.17)	*	0.20	-	0.13	-	0.12	
Left arm	0.26 (0.81)	0.54 (0.95)	0.15 (0.35)	0.88 (1.61)	-	0.12	-	-	-	-	-
Left leg	7.07 (9.08)	10.76 (7.92)	4.54 (3.58)	6.19 (6.74)	-	-	-	0.12	-	-	-
Left leg	0.09 (0.27)	1.12 (2.98)	0.08 (0.25)	0.24 (0.40)	-	-	-	-	-	-	-
Right arm	4.86 (4.04)	8.99 (7.96)	4.34 (4.94)	4.31 (4.87)	-	-	-	0.10	-	-	-
Right arm	0.04 (0.13)	0.11 (0.29)	0.20 (0.43)	0.69 (1.03)	t	0.14	T	0.15	-	-	Pers > Obj DS > TD
Right leg	5.29 (4.63)	9.37 (8.02)	3.93 (2.55)	7.92 (7.31)	*	0.29	-	-	-	-	Pers > Obj
Right leg	0.00 (0.00)	1.23 (3.57)	1.23 (3.57)	1.34 (3.36)	-	0.13	-	-	-	-	-

Facial expression

With regard to infant total rate of emotional facial expressiveness, statistical analysis revealed that there was no Main effect of Condition, $F(1,18) = 0.22$, $p = 0.65$; or Group, $F(1,18) = 0.20$, $p = 0.18$; nor any Interaction, $F(1,18) = 0.12$, $p = 0.74$. Infants did not differ in their overall total rate of emotional facial expressiveness ($M = 2.79$), nor did rate differ across conditions. Further analysis investigated the rate of positive and negative facial expressions during trials.

Positive facial expressions. There was no Main effect of Condition, $F(1,18) = 1.13$, $p = 0.30$; or Group, $F(1,18) = 0.41$, $p = 0.53$, nor any Interaction, $F(1,18) = 0.16$, $p = 0.41$. The average rate of positive facial expressions was 1.42 per minute.

Negative facial expressions. There was no Main effect of Condition, $F(1,18) = 0.04$, or Group, $F(1,18) = 2.81$, $p = 0.11$, however see effect size in Table 3.6). There was also no Interaction effect, $F(1,18) = 0.004$, $p = 0.95$. The average rate of negative facial expressions was 4.12 per minute.

Vocalisations

Overall, statistical analysis revealed a non significant trend of a Condition X Group Interaction, $F(1,18) = 3.59$, $p = 0.07$, $\eta^2_p = 0.17$. Univariate analysis revealed no statistical differences regarding the rate of vocalisations in the Person vs Object conditions for TD infants, $F(1,18) = 2.99$, $p = 0.12$; nor across conditions for DS infants, $F(1,18) = 0.68$, $p = 0.43$. However, in relation to TD infants, there was a large effect size (0.25). In this sample, 25% of the variance in relation to rate of vocalisations can be accounted for by condition when considering TD infants, who tended to make more vocalisations in the Person ($M =$

10.9) versus Object (M = 5.2) condition. DS infant vocalisations were not influenced by condition (M = 5.2). Further analysis investigated infant rate of positive and negative vocalisations.

Negative vocalisations: A highly significant Main effect of Group was found. TD infants made more negative vocalisations overall (M 6.3) than DS infants (M 1.3), $F(1,18) = 8.99$, $p = 0.008$ (See Table 3.6). There was no Main effect of Condition, $F(1,18) = 1.23$, $p = 0.28$, or any Interaction effect, $F(1,18) = 0.89$, $p = 0.36$.

Positive vocalisations. There was no Main effect of Condition, $F(1,18) = 0.01$, $p = 0.94$; or Group, $F(1,18) = 2.19$, $p = 0.16$. There was also no Interaction effect, $F(1,18) = 2.43$, $p = 0.14$. The average rate of positive vocalisations was 2.8 per min.

Lateralised limb movements

Right-sided

Right upper limb movements: The total mean overall rate of right sided medium and large upper limb movements was 5.9 per min. There was no significant difference across Conditions, $F(1, 18) = 1.75$, $p = 0.20$, between Groups, $F(1,18) = 1.26$, $p = 0.28$, nor any Interaction, $F(1,18) = 1.12$, $p = 0.30$.

When considering medium right upper limb movements separately, there were no significant differences regarding the rate that infants produced (Total M 5.6) either when considered by Condition, $F(1,18) = 1.50$, $p = 0.24$ or Group, $F(1,18) = 1.53$, $p = 0.23$; nor was there any Interaction, $F(1,18) = 1.53$, $p = 0.23$.

With regard large right upper limb movements, there was a non significant trend towards supporting a Group difference, with DS infants tending to produce a higher rate of

large right arm movements (M 0.5) than TD infants (M 0.1), $F(1,18) = 3.26, p = 0.09$. A non significant trend also emerged across conditions with infants tending to produce a higher rate of large arm movements in the Person condition (M 0.40) than in the Object condition (M 0.1), $F(1,18) = 3.03, p = 0.099$. There were no Interactions, $F(1,18) = 1.64, p = 0.22$. (See Table 3.6 for effect sizes).

Right lower limb movements: Infants produced a significantly higher rate of total right leg movements in the Person condition (M = 9.9, SD = 8.39) than the Object condition (M = 8.6, SD = 3.72), $F(1,18) = 8.71, p = 0.009$. There was no Group effect, $F(1,18) = 0.31, p = 0.59$, or Interaction, $F(1,18) = 0.0002, p = 0.99$.

With regard medium leg movements, infants produced a higher rate in the Person (M 8.7, SD 7.51) compared to Object (M 4.6, SD 3.71) condition, $F(1,18) = 7.3, p = 0.02$. There was no Group effect, $F(1,18) = 0.39, p = 0.54$, or Interaction, $F(1,18) = 0.001, p = 0.98$.

There were no significant differences regarding large movements (Total M = 0.8) in terms of Condition, $F(1,18) = 2.59, p = 0.13$; Group, $F(1,18) = 0.01, p = 0.91$; nor any Interaction, $F(1,18) = 0.001, p = 0.98$.

Left-sided

Left upper limb movements: Infants produced a significantly higher rate of total combined medium and large left arm movements in the Person condition (M 8.9) than in the Object condition (M 4.3), $F(1,18) = 5.91, p = 0.03$. No Group effect, $F(1,18) = 1.99, p = 0.18$; nor Interaction was found, $F(1,18) = 2.25, p = 0.15$.

When broken down into medium sized left upper movements, the rate of was significantly higher in the Person condition (M 8.2) than the Object condition (M 4.4), $F(1,18) = 4.52, p =$

0.048. There was no Group effect, $F(1,18) = 2.74$, $p = 0.12$; or any Interaction, $F(1,18) = 2.43$, $p = 0.14$.

With regard large movements (Total M 0.5), there was no effect of Condition, $F(1,18) = 2.48$, $p = 0.13$, Group, $F(1,18) = 0.12$, $p = 0.73$, or Condition X Group Interaction effect, $F(1,18) = 0.50$, $p = 0.49$.

Left lower limb movements: The total mean rate of infant left leg movements was 7.5 per min. There were no effects for Group, $F(1,18) = 2.63$, $p = 0.12$, Condition, $F(1,18) = 1.86$, $p = 0.19$; nor any Interaction, $F(1,18) = 0.37$, $p = 0.55$.

There were also no significant findings when considering the size of movement infants produced with the left leg, be it large (Total M 0.4), (Group: $F(1,18) = 0.74$, $p = 0.41$; Condition: $F(1,18) = 1.90$, $p = 0.19$; Interaction: $F(1,18) = 1.01$, $p = 0.33$) or medium (Total M 7.1 per min) (Group: $F(1,18) = 2.38$, $p = 0.14$; Condition: $F(1,18) = 1.45$, $p = 0.24$; Interaction: $F(1,18) = 0.21$, $p = 0.65$)

Mouth movements

DS infants produced a significantly higher total rate of intervals containing mouth movements (M 30.2) than TD infants (M 21.4), $F(1,18) = 4.64$, $p = 0.045$, $\eta^2_p = 0.21$. There were no significant differences based on Condition, $F(1,18) = 2.93$, $p = 0.10$, however an Interaction was found, $F(1,18) = 4.62$, $p = 0.045$, $\eta^2_p = 0.20$. Univariate analysis revealed that DS infants produced a comparable rate of mouth movements in the Object and Person conditions, $F(1, 9) = 0.11$, $p = 0.75$; whereas TD infants produced significantly less mouth movements in the Object versus Person condition, $F(1,9) = 6.81$, $p = 0.03$, $\eta^2_p = 0.43$ and the rate of mouth movements TD infants made in the Object condition was significantly less than DS infants produced in the Object condition, $F(1,18) = 9.92$, $p = 0.006$, $\eta^2_p = 0.36$. The rate

of mouth movements DS and TD infants produced in the Person condition was comparable, $F(1,18) = 0.20, p = 0.66$.

Discussion

The goal of the current study was to investigate whether typically developing 4-month-old infants and 4-month-olds with Down syndrome demonstrated early joint attentional abilities for the purpose of social triangular communication purposes. The study investigated 4-month-old infant behaviour under two joint attentional settings – a less social ‘Object’ triadic condition (infant- experimenter-object) and a more social ‘Person’ triangular condition (infant-experimenter-mother).

It was predicted that TD infants would follow gaze at a comparable rate reported in other research (e.g. D’Entremont et al, 1999; Striano & Stahl, 2005; Tremblay & Rovira, 2007). This was supported, and furthermore, it was found that TD infants followed gaze more successfully in the Object versus Person condition. TD infants significantly followed gaze more successfully than DS infants. The prediction that infants would produce more socially directed behaviours (SDBs) in the more social Person condition versus the less social, Object condition was not fully supported, however there was a non significant trend, with TD infants having a tendency to produce more SDBs in the Person versus Object condition. Infants produced significantly more single SDBs (but not double SDBs) in the more social Person versus less social Object condition. DS infants produced comparable rates of SDBs in both conditions, and these rates were comparable to the rate produced by TD infants in the Person condition. Whilst this finding does not support the prediction that infants with DS would also differentiate between the less social, Object triadic and more social, Person

condition, analysis of gaze behaviour revealed that in fact, DS infants spent a significantly higher proportion of time looking towards a social partner, be it mother or experimenter (ns trend) rather than the object. Therefore, arguably, infants with DS produced comparable rates of SDBs across conditions not because they didn't differentiate between the conditions, but because they had an increased gaze towards the social partner rather than an object.

With regard the prediction that infants with DS would shift gaze more in the Person versus Object condition, this was not upheld, with infants with DS shifting gaze comparably across conditions. However, analysis of gaze shifting behaviour revealed that infants with DS did not demonstrate an inability to shift gaze, with rates of gaze shifting being comparable to TD infants (although there was a ns trend suggesting that TD infants tended to shift gaze at a slightly higher rate). There were also no significant differences between groups regarding the duration of individual gaze bouts. These findings suggest that infants with DS may not have an inability to shift gaze in contrast to previous reports (Berger & Cunningham, 1981).

There were no significant differences between TD and DS infant lateralised body movements. Overall infants producing a higher rate of medium right leg movements and medium left arm movements in the more social, Person versus less social Object condition. TD infants produced less mouth movements in the Object condition, but not the Person condition, compared to DS infants.

An interesting finding that emerged from the current study was with regard successful trial completion. Not only were trials with DS infants longer in duration than TD infants, but furthermore, DS infants also successfully completed significantly more trials than TD infants. TD infants became fussy and could not continue with the experimental procedure, whereas this was not the case for infants with DS. This finding, alongside the finding that TD infants produced more negative vocalisations than DS infants, supports that infants with DS were less emotionally negative than DS infants, and could maintain

prolonged interaction in these triadic and triangular situations. Thus, whilst the prediction that infants with DS would be more positive emotionally was not upheld, what was found was that infants with DS were less negative. These findings will now be further discussed.

Gaze following

TD infants in the current study followed gaze correctly in approximately 50% of trials. This rate is comparable, if slightly more conservative, than rates reported in other studies regarding very young infant gaze following abilities (e.g. D'Entremont et al, 1999; Striano & Stahl, 2005; Tremblay & Rovira, 2007). Infants with DS successfully followed gaze in approximately 12% of trials. This rate is significantly lower than that of the TD sample, and is markedly lower than findings from other studies regarding typical development as mentioned. Tremblay and Rovira (2007) considered gaze following was successful if the infant followed an adult's gaze and head turn within the following 7 seconds, reporting a rate of approximately 60% across all trials. Other studies reported successful gaze following but used different measures. Striano & Stahl (2005) for example, reported 65% of infants successfully followed gaze, however with a mean latency of 15.72 secs. This demonstrates how interpretation of gaze following data should take account of the possible differences between measures across studies. As the current study had the same sample size, and used the same measures as Tremblay & Rovira (2007) in relation to gaze following, rates can be considered directly comparable. The findings from the current study add to the growing literature supporting that very young infants (TD) are capable of following gaze, and therefore arguably may have some level of awareness of another's mental state (Trevvarthen, 1979; Trevarthen & Hubley, 1978).

Tremblay & Rovira (2007) predicted that infants in their study would follow gaze similarly in both conditions, and their subsequent findings supported this. In the current study

however, TD infants differed in their gaze following behaviour across conditions. There was a relationship between condition type and gaze following ability, in that TD infants successfully followed gaze to the target more often when the target was an object (a brightly coloured, yellow stick) compared to when the target was another person. One explanation for this finding is that the TD infants could peripherally see the stick, and that rather than actively following gaze, their attention was drawn just by the stick being visible to some degree. This may also have been due to fatigue. Infants completed the Object condition prior to the Person condition and if fatigue played a part in whether infants followed gaze or not, then it would be the Person condition that would present as the less successful condition. There is, however, another explanation. Infants may well have had an awareness of the object, certainly as trials were repeated, and were more motivated by the novel object. From around four months of age, infants are going through a transition from primarily focusing on another social partner, to changing focus toward objects. Differences in gaze following across the conditions therefore, could lie in the fact that infant attention is beginning to shift towards objects at this time.

With regard infants with DS, there was no relationship between condition type and gaze following success, suggesting that in contrast to TD infants, infants with DS did not follow gaze, nor have their attention drawn to the third addition to the interaction (be it social partner or object) in the same way. It is possible that infants with DS did not follow gaze due to a lack of motivation and interest in the novel object, or instead preferred to maintain their gaze towards the previously engaged adult, perhaps in an attempt to reengage. Alternatively, this may be indicative of a particular area of delay or deficit for 4-month old infants with DS. This finding goes some way to support Berger and Cunningham (1981) who reported that infants with DS have difficulty shifting gaze, however other findings from the current study contradict this conclusion.

Gaze Shifting and Gaze Distribution

Overall, DS infants spent more time looking towards the experimenter than TD infants, and this was particularly so in the Object condition. Furthermore, DS infants spent more time looking at mother versus the object, whereas in contrast TD infants demonstrated a trend of looking longer at the object versus mother. TD infants, therefore, appear to have shifted attention more towards objects and away from the social partner. This conclusion is supported by the finding that TD infants followed gaze more frequently in the Object versus Person Condition. In contrast, DS infants did not demonstrate this pattern of gaze behaviour, gazing more at the social partner versus the object. This finding adds weight to previous research that reported that DS infants have increased gaze to a social partner (e.g. Berger & Cunningham, 1981; Carvajel & Iglesias, 2000; Fidler, 2005).

If DS infants do look longer at a social partner than TD infants due to difficulties in shifting gaze, then there should be differences between gaze shifting behaviours of the two groups. Findings from the current study supported no statistically significant difference between the rate that TD and DS infants shifted gaze. A non significant trend emerged suggesting that TD infants tended to shift gaze at a slightly higher rate than DS infants however, the lack of significance is important. Whilst there is perhaps a suggestion that TD infants shift gaze more frequently than DS infants within a 3-way interactional environment, DS infants are still able to shift gaze, in fact in this study they did so, on average, every 8-9 seconds (compared to every 6 seconds for TD infants). Furthermore there were no differences regarding the average length of gaze bouts for DS and TD infants. From the findings in the current study, it therefore cannot be concluded that 4-month old infants with DS have a deficit or delay in gaze shifting.

McHale et al (2008) speculated that four-month-olds demonstrated an early precursor to later social referencing in a novel situation (a still-face). Infants in the current study produced a higher rate of looks towards the experimenter in the Object versus Person condition. There was also a trend that when considering double looks (that is a look between both experimenter and object /mother within a 7 second timeframe) infants produced a higher rate in the Object versus Person condition. If McHale et al's (2008) speculations are accurate, then this finding can be interpreted similarly. In the Object condition, infants saw the stick, and looked to the experimenter "actively seeking help" (McHale et al, 2008; p449) in this novel situation, whereas the Person condition was more naturalistic, and reflective of everyday triangular situations. There was no significant difference regarding the rate of double looks produced by DS and TD infants (although a non significant trend was found suggesting TD infants tended to produce more double looks than DS infants).

There is an important question that arises from the current study, one which would merit further investigation. Considering the definition of a double look, and when considering this in conjunction with TD and DS infant gaze shifting rates (DS infants averaged a gaze shift every 8-9 seconds, TD infants every 6 seconds), questions are raised with regard the justification of a 7 second timeframe. If this time frame was slightly extended, or in fact reduced, then results would likely be influenced due to the fact that 7 seconds falls directly between the average rate of gaze shifting for each group. Not only could a minor alteration in this timeframe influence results regarding double looks, but also, the findings regarding one key measurable, namely SDBs (single and double).

Tremblay and Rovira (2007) stated that infant behaviour could only be considered as socially directed if a behaviour occurred within a 7 second timeframe either side of an attentional look. The current study adopted the same definition in order to enable consistency across studies. However, it could be questioned whether there is sufficient justification for

using a 7 second (as opposed for example, a 5 or 10 second) window as a valid definition for whether infant behaviour counts as being socially directed (be it dyadic or triadic), or not. If 4 month old TD infants shift gaze on average every 6 seconds, then a 7 second timeframe could be too short to enable infants to share gaze across two different agents, and at the same time be processing information about the focus of attention. The benefit of this short time frame however, is that it could identify those behaviours which are truly triadic. Despite this, the fact that the 7 second frame was consistent for both TD and infants with DS enabled comparison of the two groups.

Socially Directed Behaviours

As previously stated, the current study (and that of Tremblay & Rovira, 2007) defined socially directed behaviours as those behaviours (positive and negative facial expressions, vocalisations and particular body movements) that occurred within a 7 second timeframe either side of an attentional look. TD infants demonstrated a trend towards producing more SDBs in the more social triangular situation (Person) versus the less social, triadic situation (Object), going some, but not all, of the way in supporting the prediction of the current study and that of Tremblay and Rovira (2007), that early joint attention mechanisms facilitate social communication in a three-way context, and that infants actively seek engagement in a triangular interaction. Infants with DS did not demonstrate any differences in the rate of total SDBs produced across the two conditions, in that they made just as many total SDBs in the Object condition and Person condition, and this rate was comparable to TD infants in the Person condition.

Socially directed behaviours were then broken down to consider to what extent the socially directed behaviours produced by infants could be interpreted as either 'single' or 'double', and whether there were differences regarding the rate of each across conditions.

Tremblay and Rovira (2007) predicted that infants would produce more Double SDBs in the Person versus Object condition. Double SDBs were defined as those socially directed behaviours that occurred within 7 seconds of looks to both experimenter and mother/object, as opposed to Single SDBs that were defined similarly, but within 7 seconds of a look to *either* experimenter *or* mother/object. In contrast to Tremblay and Rovira's (2007) predictions, but in line with their findings, there was no difference in the current study between the rate of double SDBs infants produced across conditions. TD and DS infants did not differ in the rate of double SDBs produced, thus these behaviours can be assumed to be comparable for both groups. These findings support that whilst infants did act more communicatively to one person at a time in the person-person-person situation compared to the person-person-object situation, and so therefore detected some differences, they did not co-ordinate attention *and* communicate to both adults (or adult and object) differently across the conditions. More specifically, TD infants produced fewer single SDBs in the Object compared to Person condition, and the TD infant single SDB rate in the less social, Object condition was significantly less than the rate for infants with DS when in the same situation. In fact, infants with DS did tend to produce more single SDBs than TD infants overall.

It emerged therefore, that it was specifically when the 3 way situation was less, as compared to more social, that differences emerged between groups. Whereas TD infants differentiated behaviour across the two conditions, producing fewer single SDBs when the third addition to the interaction was an object versus a person, infants with DS did not make this distinction and behaved just as socially in both, and this was comparable to TD infants in the social, triangular situation. In contrast to Legerstee and Weintraub (1997) findings, that older children with DS are more passive than TD infants in play (however with the note that CA varied greatly within their DS sample, and when compared to the TD sample) younger infants with DS in this study were not more passive than TD infants in relation to their social

communicative behaviour. This would suggest that if children with DS are more passive in play this may be due to later developing cognitive difficulties or environmental factors, or both, rather than there being any actual deficits in the early functioning socio-emotional communicative system of infants with DS.

Another purpose of the current study was to compare 4-month-old and 3-month-old behaviour in a more social versus less social situation. Arguably, studying early precursors of joint attention specifically in 4-month-olds is important as it is around this age that infants are known to be in transition, shifting from primarily engaging with another person, towards becoming much more engaged with objects. In the current study, 4-month-olds averaged a higher rate of SDBs in both conditions compared to the 3-month-old infants in Tremblay and Rovira's (2007) study. SDB scores had to be converted to rates due to differences in trial durations in the current study, so it is not possible to compare these scores directly with Tremblay & Rovira's (2007), due to the fact that their scores were frequencies rather than rates. However, it would appear from looking at the data, that the 4-month-olds in the present study (both TD and DS infants) produced more SDBs than the 3-month-olds in their two experiments. It should be noted however, that across the two experiments cited within the same paper, frequency of occurrence of SDBs by 3-month-olds differed quite substantially. Two explanations are offered for the finding that 4 month olds produced more SDBs than 3-month-olds. It could be that by 4 months of age, infants' social, emotional and communicative abilities have become more refined than at 3 months of age, having developed physical control and gained skill in socio-communication, therefore increasing the rate of socially directed behaviours. It could also be due to differences in coding systems. Infant body movements may, for example, have been defined differently in Tremblay and Rovira (2007). A similar pattern was found for infant behaviour across the two studies

however, with more SDBs recorded in the Person versus Object condition. This suggests that, overall, the coding systems were comparable, adding validity to the study.

Despite the similarities between the rates of SDBs produced by both DS and TD infants in the Person condition, infants with DS did show some differential behaviours in the Object condition compared to TD infants. Carvajel and Iglesias (2000) concluded that infants with DS discriminate between objects and people in the same way as TD infants, directing social and emotional behaviour to another social being. From consideration of the data regarding SDB production the conclusion could be drawn that infants with DS did not discriminate between the object and person whereas TD infants did. This could suggest that infants with DS did not detect the differences between the triangular person-person-person situation and the triadic person-person-object situation. Analyses of gaze behaviours however, lead to an alternative interpretation.

Gaze distribution and SDB production

With regard to gaze distribution rates, findings are all the more interesting when considered in conjunction with the rate of SDBs infants produced across conditions. DS infants did not differentiate rate of SDBs across the two conditions, producing just as many in the Person versus the Object condition. This is likely linked to the fact that they spent a higher proportion of time looking at the experimenter, and therefore made more communicative bids, be it through body movements, facial expressiveness or with vocalisations. DS infants produced a higher rate of mouth movements than TD infants, with TD infants producing significantly less in the Object condition. It could be argued that DS infants move their mouths repeatedly, and that these movements are perhaps involuntary, however in the Person condition, TD infants produced a very similar rate of mouth movements to DS infants, producing less only in the Object condition. Following the line of

reasoning from other research in relation to findings relating to gaze and SDBs (Tremblay & Rovira, 2007), it can be concluded that these mouth movements were purposeful and socially directed. Perhaps infants with DS continued attending and making social and communicative bids towards another person, perhaps to attempt re-engagement, and just had less interest in the object than TD infants. This may be because they are a little delayed and have not yet reached the transition to object play (as is the suggestion for older infants by Legerstee & Weintraub, 1997), or it may be due to having a higher preference to social engagement than TD infants at this age. In contrast, TD infants (who are likely increasing interest to objects by this age) were motivated more to attend to the stick versus the person, and therefore produced fewer SDBs in this, less social, situation. The fact that infants with DS produced the same amount of SDBs in both conditions as TD infants did in the Person condition, with consideration of gaze behaviours, strengthens the validity of considering particular types of infant body movements, facial expressions and vocalisations as communicative tools in social engagement in infancy. With this in mind, it is concluded that at 4 months of age, DS infants are active communicators in social interactions, as are TD infants.

Vocal and facial expressions of emotion

There were no significant differences regarding the rate of positive or negative facial expressions that infants with and without DS produced, and this was not influenced by condition. With regard to vocalisations, infants produced comparable rates in both the more social, triangular, and less social, triadic situations. However, when considering the emotional valence of infant vocalisations it was found that TD infants produced a significantly higher rate of negative vocalisations than infants with DS, with no difference in the rate of positive vocalisations produced. Coupling this information with the finding regarding trial completion rate, in that infants with DS were significantly more likely to complete all trials whereas TD

infants were not, conclusions regarding the emotional functioning of infants with DS in comparison to TD infants can be drawn. Trials were not run if the infant became fussy. Thus, this is suggestive that TD infants were less able than infants with DS to meet the demands of the experiment, becoming fussy, and needing to stop the experimental procedure. A measure of ‘fussiness’ however, was not taken. Therefore conclusions from this finding are tentative.

It was found that infants with DS were equally as positive as TD infants. they were less negative, producing fewer negative vocalisations and being less fussy overall than TD infants. Furthermore, trial durations for infants with DS were significantly longer than trials with TD infants suggesting that perhaps infants with DS are able to maintain prolonged resilience within triadic and triangular situations.

The finding regarding the positive and negative emotionality of infants with DS adds to previous research that has reported similar findings. DS infants in the current study were equally as positive (also reported by Carvajel & Iglesias, 2000; Moore et al, 2008), but less fussy than TD infants (also reported by Moore et al, 2008). Findings also add weight to studies of temperament that report that infants with DS have less negative mood than TD infants (e.g. Zickler, Morrow & Bull, 1998; Ratekin, 1993; Gunn & Berry, 1985). The finding that infants with DS were equally as emotionally facially expressive as TD infants contrasts the report that infants with DS have less intensity (‘dampened emotionality’) and more variation in facial expression in comparison to TD infants (Sorce & Emde, 1982).

With regard emotion, therefore, it would appear that there is growing support towards the conclusion that very young infants with DS are indeed, less negative than TD infants. As the role of positive emotion is to widen the focus, increase approach behaviours, positive engagement and continued and active participation with the environment then in contrast, negative emotions do the reverse (Carver & Scheier, 1990; Davidson, 1994; Frijda, 1994; Fredrickson, 2003; Huppert, Bayliss & Keverne, 2005). An example of this was evident in

the current study, with TD infants producing more negativity than infants with DS, becoming fussy. This then culminated in shorter and fewer social interactions than infants with DS.

Thus, for the 4-month-old infant with DS, it is possible that an openness to prolonged social interaction and reduced negative emotion could arguably explain how those with DS develop relative social and emotional strengths (as reported by Fidler, 2005), drawing on complex social strategies (from a building up of personal resources; Fredrickson, 2003) when in challenging situations (Pitcairn & Wishart, 1992). It is unclear as to why infants with DS may be less negative and more open to prolonged interactions than TD infants. It may well be the case that this is a result of less intense participation with the environment – a ‘passivity’ (Legerstee & Weintraub, 1997), however, findings from the current study would suggest this is not the case. An alternative explanation is that mothers of infants with DS provide a different environment for their infant compared to mothers of TD infants. Whilst conclusions are by no means concrete, there are suggestions that mothers of infants with DS show more ‘assertive warmth’ and are more ‘directive’ than mothers of TD infants (Moore et al, 2008). An increase in maternal positive emotion (i.e. ‘assertive warmth’), would lead to the mother being more open to increased positive engagement with the environment (her infant in this case), and thus mother and infant are open to more prolonged interactions, and are both then building positive resources. A final explanation offered is that differences between TD and DS infant emotionality in interaction is due to a general developmental delay of infants with DS. Four month old infants with DS were found to be less interested in the object and more interested in the social partner, and less interested in the object than TD infants. As discussed, the lack of interest in the object may be due to DS infants having a delay in moving from dyadic, face-to-face interaction into the transition to object play, which occurs for TD infants at around the age of 4 months. Thus, it would appear that 4-month-old infants with DS have a preference to social interaction rather than object interaction.

Face-to-face interaction is considered a crucial phase of development. It is a time where infants learn the beginnings of social vocalisations (Bateson, 1971), share affect and intention with a social partner (Trevarthen, 1979) and participate in unique, cyclic and rhythmical interactions (Tronick, Als & Adamson, 1979). If infants with DS have a prolonged experience of dyadic, face to face interaction compared to TD infants, then it is understandable why the socioemotional system appears at the least, not negatively affected. This is particularly relevant when taking into account the assertions by Karmiloff-Smith (1998). Whilst differences between the socioemotional functioning of infants with and without DS at 4 months of age could at first, appear relatively small, the impact on the developing brain (due to the snowballing effect that occurs as the brain develops) could become quite profound. Following this reasoning, it is understandable how the socioemotional abilities of those with Down syndrome are at the least, relatively unimpaired in comparison to cognitive abilities (Carvajal & Iglesias, 2002), and why those with Down syndrome may develop relative social and emotional strengths (Fidler, 2005).

Lateralised body movements

Trevarthen (1996) proposed that very young infants produced purposeful, communicative bids and that these were lateralised, influenced by hemispheric asymmetries of emotion systems. Trevarthen (1979) hypothesised that infants made more outward, approach right sided arm movements when in social engagement, whilst the left arm and hand comes into the body self-touching for emotion regulation. The current investigation evaluated infant body movements as SDBs in line with Tremblay & Rovira (2007), and also investigated whether these communicative behaviours presented as lateralised, in consideration of Trevarthen's (1996) hypothesis. With regard to right-sided movements, infants produced a higher rate of medium leg movements in the Person versus Object

condition and there was also a trend towards infants producing a higher rate of large arm movements in the Person versus Object condition. Infants with DS also leant towards producing a higher rate of large right arm movements than TD infants. The fact that these right-sided medium and large movements are more frequent in the Person (more social) versus the Object (less social) condition go some way in supporting Trevarthen's (1996) hypothesis regarding right-sided communicative bids.

Infants also produced a higher rate of left arm movements in total, and specifically more medium left arm movements, in the Person versus Object condition. Whilst it could be considered that this is in contrast to Trevarthen's (1996) predictions, this may not be the case. The current investigation did not code whether the limb was an outward movement, or inward (for example, self-touching). Self-touching is considered an action of self-regulation (Trevarthen, 1996), and therefore it is recommended that future studies examine limb movements in greater detail to identify whether limb movements are self-regulating or outward, approach movements (Trevarthen, 1996). The fact that there were more limb movements in the Person condition versus the Object, and that there were lateralised behaviours, justifies future investigation.

Strengths and limitations

The current study contributes valuable information to the field of Down syndrome research as well as to the wider field of developmental psychology. Whilst the findings are very interesting it is important to recognise the limitations. The samples in this study were small, and therefore generalising findings to the wider population should be taken with caution. However, sample size is reflective of many early infancy studies where such detailed behaviours are considered. In particular, it is comparable to many who have considered social and emotional development of young infants with Down syndrome, and larger than

others (e.g. Berger & Cunningham, 1981); thus power may have been compromised to a degree. Where trends were identified, increasing power may yield statistically different findings. It may be found that with a larger sample, statistical differences in gaze shift rates for example, may be found to be significantly different between groups (a trend was identified with a moderate effect size that infants with TD shifted gaze more frequently than DS infants in the current study). Thus, the study may not have had sufficient power (but with a repeated measures design power was increased) to find small significant effects, risking Type II error. Yet in some instances, significant differences were identified between groups. As discussed in Chapter One in detail, no Bonferroni corrections were used to correct for the potential of multiple tests finding significance purely ‘by chance’ (Type 1 error), justified by others (e.g. Cohen, 1990; Wilkinson and the Task Force for Statistical Inference, 1999; Bakeman, 2005; Bakeman, 2011). It is possible that, for example, the finding that infants with Down syndrome spent longer looking at the Mother over the Object (with a large effect size), and on the converse TD infants spent longer looking at the Object over the Mother (with a large effect size) and longer than DS infants spent looking at the object (with a moderate-large effect size), was a ‘chance’ finding. Only replication and considered interpretation can ultimately look to answer this (Cohen, 1990). However, this finding supported predictions and also findings from previous studies that have suggested that infants with DS have a preference to gaze to social partners over objects. Thus, I would argue that this finding is likely ‘true’. The reader, however, must make their own decisions.

One difficulty of conducting the study was that the experimenter and mother joined together to carry out the experiment, and it was challenging to ensure mother understood her role, as well as relax her enough that she could behave naturally in the experiment. The experimenter and mother had to engage in a natural conversation which could become stilted

at times due to unfamiliarity or perhaps nervousness. However, the disadvantage that this may bring, in that the interaction may not be as natural as one within the infant's home environment, was arguably less when considering the option of introducing two strangers to the infant into the interaction. Another issue was that the 're-engagement' into interaction risked subjectivity in that it was when mother and / or experimenter felt that the infant communicated sufficiently to get attention that signified the re-engagement with the infant and end of the trial. Others have used similarly criteria, however (e.g. Moore et al, 2008). I discuss this further in Chapter Five. Trial duration may have been influenced by inconsistencies in re-engagement, however, given significant differences in trial durations, all data were recalculated to rates per minute which would have reduced the effect of this issue.

Ideally, counterbalancing conditions would have reduced the risk of fatigue influencing results. Counterbalancing was not carried out due to a variety of experimental design reasons. One key finding from the current study that could have been at risk of being attributed to fatigue was in relation to SDB production across conditions. However, it was found that TD infants tended to produce more, not fewer, SDBs in the second, more social Person condition compared to the first, less social Object condition. If fatigue influenced results, then this only served to lessen the potential effect of condition, and findings can be considered conservative. Although it was not viable in the current study, counterbalancing conditions in any future investigation could increase the condition effect. One further point to note is that infants in the current study were not matched precisely by gender due to recruitment factors and the effect on power of potentially adding another between group variable, however, this would be recommended where possible in order to control for any gender effects. The strengths of the current study, however, outweigh its limitations.

This is the first study, to the researcher's knowledge, that investigated how the behaviour of infants with Down syndrome compared to the behaviour of typically developing infants when

in more and less social triadic situations, and the analysis of infant body movements, gaze and emotion under these conditions provides detailed information of how the sociocommunicative behaviour of infants with Down syndrome compares to the typical population.

Future Directions

The current study brings forward areas of interest for future investigation. Infants with DS did not follow gaze as often as TD infants, and it is recommended that future research into the gaze following abilities of very young infants with DS is carried out. This could aid in understanding whether this is actually a particular area of deficit or delay for infants with DS or if it was just specific to those infants who participated in the current study. It is also recommended that further studies should be designed that would enable further investigation of the gaze behaviours of young infants with DS, and in particular, gaze shifting behaviours, due to the finding that infants with DS in the current study did not appear to have any deficit in shifting gaze when compared to TD infants. A question remains regarding whether a 7 second timescale is an appropriate cut off that justifies infant behaviours as being socially directed, or not; or triadic/triangular, or not. Future studies should take this factor into account in their research design, in that slight variation in the timescale could quite dramatically influence findings. Consistency in measures however, is also recommended in order to build comparable knowledge. Further investigation of infant lateralised body movements in interaction is proposed, in light of the findings of the current study, and of benefit would be to identify those movements that are indicative of self-regulating, as opposed to communicative behaviours.

The early joint attentional abilities of infants with DS are further investigated using the paradigm of the present study, but with slightly older infants (5 and/or 6 months of age,

for example) in order to ascertain whether the differences in TD and DS infant behaviour found specifically in the less social, triadic Object condition were due to a more generic developmental delay, in that slightly older infants with DS may well demonstrate similar patterns of behaviour to the object as 4-month-old TD infants. Alternatively if this is not due to a developmental delay, then it is more likely due to a lasting preference for the social partner. Objective measurement of infant positive and negative expressions of emotion would complement this work and contribute to the debates identified relating to the attention, emotion and environmental influences that may relate to the development of infants with DS. Further investigation is required regarding the early emotional functioning of infants with DS, with a focus on matching DS infants with TD infants based chronological age. In this way, conclusions can be drawn regarding infant social and emotional development taking past social and emotional experience into account. As mentioned in Chapter One, the dyadic study is named as Study 1 (and this as Study 2) due to the natural progression for the reader from dyadic, through to triadic interaction, however, the current study was analysed first within the research process, and informed the process of the subsequent investigation. Study 1, was in fact, informed by the findings of the current study where I decided to further examine the emotionality of the two groups, due to the finding that infants with DS were less fussy, and less vocally negative than the TD infants and in consideration of the debates I identified in the literature.

Conclusion

The prediction that TD infants would behave more socially in the more social, triangular situation, compared to the less social, triadic situation was to some degree, but not fully, supported. TD infants did not share gaze with two agents (person-person or person-object) or produce socially directed behaviours to both, any more when in either the Person or

Object condition. It is possible that at this young age, early triadic abilities are yet to develop. However, infants did behave differently in the Person versus Object condition in that in the Person condition, infants produced more socially directed behaviours to one agent at a time than in the Object condition. These findings are suggestive, but not fully conclusive, that 4-month-old infants may behave more socially in a more social, compared to less social, triadic situation.

Infants with DS produced comparable rates of SDBs in both conditions, and these rates were comparable to the rate produced by TD infants in the Person condition. Thus, infants with DS behaved just as socially in both conditions at levels that were comparable to TD infants in the Person condition. This is understandable considering infants with DS had a higher rate of looking time towards a social partner. This was not due to an inability to shift gaze (as reported by Berger & Cunningham, 1981), as there was no significant difference in the rate at which TD infants and infants with DS shifted gaze. It is proposed that it is more likely due to 4-month-old infants with DS having a preference to engage with a social partner, rather than having developed an interest in objects. Infants with DS were equally as active in their social communication as TD infants, and certainly did not present as 'passive' (as reported by Emde & Brown, 1978). In fact, infants with DS were just as positive emotionally and less negative overall than TD infants. Infants with DS were also able to maintain prolonged interaction within a triadic situation. It is argued that these prolonged, and less negative, social interactions that appear characteristic for 4-month-old infants with DS, could offer an explanation as to why infants with DS go on to develop particular social and emotional strengths. Future work is required, however these findings stress the importance of providing young infants with a positive social environment within which to develop.

Chapter 4 . Infant temperament, maternal optimism and parenting system preference of typically developing infants and infants with Down syndrome

Abstract

Maternal optimism, infant temperament and parenting system preference were measured in an investigation of individual differences relating to mothers and their typically developing (TD) and Down syndrome (DS) 4-month-old infants. It was also investigated whether these variables related to infant positive emotion in dyadic play. TD (n=12) and (n=10) infants with DS scored comparably on temperament measures, with the exception of one of the 6 subscales of the Positive Emotionality / Surgency factor, specifically Perceptual Sensitivity. No relationships were found between infant smiling behaviour and infant temperament. Maternal optimism levels were comparable across groups, however when analysing optimism data from mothers who participated in Study 2, there was a tendency for these mothers of infants with DS to score lower than the mothers of TD infants. Maternal optimism did not relate to infant positive emotion, nor overall to infant temperament. However, in the DS sample, it was found that the higher the optimism scores of mothers of DS infants, the higher the score for infant negative affectivity. With regard to parenting system preference, mothers demonstrated variability in their responses, but more often ranked object stimulation (considered a particularly westernised system of preference) as most important over others. The most often ranked least important was Body Contact. The infants of mothers who ranked Face-to-Face Exchange as important did not demonstrate increased smiling behaviour when in dyadic play. These findings are discussed in relation to the mother-infant relationship in the early months. Individual differences are also discussed.

Chapter 4. Infant temperament, maternal optimism and parenting system preference of typically developing infants and infants with Down syndrome

There is a variety of factors that may contribute to individual differences of young typically developing infants and infants with Down syndrome. Some of these were examined in this questionnaire and interview based study. The purpose of the research was to examine whether particular maternal and infant characteristics may play a role in infant early social and emotional development, alongside identifying any characteristics that may differ between groups. Furthermore, informed from findings in Study, it is possible that mother-infant pairs of the two groups behave differently to some extent in interaction. The current study examines whether this may relate to factors relating to mother, and also whether this may relate to infant temperament characteristics.

There are obvious benefits to studying the process of development for infants with Down syndrome for its own merit. It provides greater understanding of the impact of the disability which can then enable more sophisticated interventions. Moreover, Down syndrome is of particular interest to the field of emotion research. As discussed in previous chapters, it has been argued that young infants with Down syndrome may have some differential emotional functioning compared to the typical population. Some highlight deficits (e.g. Emde & Brown, 1978; Moore et al, 2008; Berger & Cunningham, 1986) and others argue that the emotionality of infants with Down syndrome is comparable to the typical population (Carvajel & Iglesias, 2000). Interestingly, others argue that those with Down syndrome are more positive, and/or less negative, emotionally than the typical population (e.g. Rothbart & Hanson, 1983; Radekin, 1993; Zickler et al, 1998; Fidler, 2005; Gartstein et al, 2006) and also that those with Down syndrome develop relative socioemotional strengths

(Fidler, 2005; Pitcairn & Wishart, 1992). Considering what is known about the adaptive benefits of positive emotion in development (Fredrickson, 2002), it is possible that the development of social and emotional strengths could relate to an increase in positive, and decrease in negative, emotion. In the previous chapters of the thesis, aspects of infant behaviour were analysed when infants were in dyadic and potential triadic play in order to further knowledge relating to the socioemotional development of infants with Down syndrome and with typical development. Rather than focusing just on observable behaviour, this chapter focuses on other factors that may influence the developmental process. Cicchetti and Beeghly (1990) stressed the importance of considering individual differences in relation to Down syndrome. There is individuality and variability in the Down syndrome population as in the typical population, due to the interaction of environmental and biological factors determining each infant's particular developmental pathway. Investigating group differences alone builds only a partial picture.

Therefore, in the current study, three variables were examined that may contribute to the overall developmental trajectory of a child (plus a demographic questionnaire the results of which are illustrated in Chapter One). Infant temperament was measured as it is known that individual differences in infant temperament relate to later social and emotional development (Gartstein & Rothbart, 2003). Maternal optimism was also measured. The thesis has focused on the role that positive emotion may play in young infant development and in studies 1 and 2, infant positive emotion was examined. However whether mothers were more, or less, positive emotionally was not investigated. It was decided to measure optimism as optimism is considered the best predictor of life satisfaction, and it is then deduced, a positive emotional state (Peterson, 2006). Maternal caregiving styles were also examined in order to ascertain the priorities that mothers in the South of England place on different aspects of interaction with her young baby. Furthermore, mothers of infants with Down syndrome may

differ from the typical population with regard to the emphasis they place on different caregiving styles, with the consideration that infants with Down syndrome may have different needs compared to typically developing infants. The current study investigates these factors and also examines whether they relate to infant positive behaviour in interactions. I also draw findings from all studies in an examination of individual differences on a variety of factors.

Maternal Optimism

It is known that a positive psychological state enables approach behaviours (e.g. Davidson, 1994; Frijda, 1994), continued action (Carver & Scheier, 1990), positive engagement and active participation with the environment (Huppert, Bayliss & Keverne, 2005). Fredrickson (2003) proposed however, that whilst this is so, positive emotions do more than this. Positive emotions have lasting benefits, in that they broaden momentary thought-action repertoires (action tendencies) and therefore, build enduring personal resources (Fredrickson, 1998, 2001). Negative emotions serve an adaptive function of narrowing the focus to enable immediate automatic action. For example, when encountering a snake, the fear focuses attention to preserve safety. Negative emotions narrow thought-action repertoires in order to promote quick and decisive action at a moment of threat, so ‘fight or flight’. Positive emotions are rare to occur in potentially dangerous or life-threatening situations and so therefore, quick, decisive actions are not necessary. Instead, Fredrickson (2003) proposed, positive emotions widen our thoughts and ideas; encouraging imagination, creativity and openness that promote engagement with novel and challenging experiences. Joy sparks the urge to play, interest - the urge to explore, and contentment sparks the urge to evaluate and savour life that integrates into new views of self and the world. These action tendencies (play, explore, savour, integrate) “broaden habitual modes of thinking or acting”

(pp 1369; Fredrickson, 2003). From the broadening of the mindset comes the building of enduring personal social, physical, intellectual and psychological resources; resources that can then be drawn upon throughout life. As Fredrickson (2003) stated, “through experiencing positive emotions, then people transform themselves, becoming more creative, knowledgeable, resilient, socially-integrated and healthy individuals” (pp. 1369).

Infant positive emotion has been considered in studies 1 and 2, yet maternal positive emotionality has yet to be discussed. It is certainly plausible that mothers who feel and express more positive emotion, may well be more open and active in positive engagement with their infant. This positive environment will undoubtedly play a role in an infant’s developmental pathway. It is possible that when an infant’s own levels of positive emotion could be heightened, and continuing the cycle, the infant then will have a more open and confident approach to the world. This research focuses on one particular aspect of maternal positivity, namely optimism, due to the premise that, optimism is the best predictor of life satisfaction, and life satisfaction relates to a positive emotional state (Peterson, 2006).

Optimism allows one to consider wide expectations in life, with pessimism reducing and narrowing expectations. An optimistic attitude to events in life, Peterson (2006) stated, ultimately affects how you feel and interact. There is evidence that levels of optimism may be influenced by culture and might increase with age (in Americans but not Hong Kong Chinese) (Yu, Fung & Isaacowitz, 2009). Much research has been carried out regarding the benefits of dispositional optimism in relation to physical and psychological well-being. Substantial evidence has been accrued supporting that optimism is a significant predictor of positive health outcomes (for a review see Rasmussen, Scheier & Greenhouse, 2009). Optimists tend to hold more positive expectancies for the future and, if faced with adversity, use more problem-focused coping strategies than pessimists. When problem-focused coping strategies are not possible, optimists use more emotionally adaptive strategies than

pessimists, such as humour, acceptance and positive reframing, to find resolution to the challenge (Scheier, Carver and Bridges, 1994). Peterson and Vaidya (2003) however, offered a cautionary note. There are times that rather than an open, positive optimistic approach to an issue, a narrow-focused negative approach can be more appropriate, and have more efficacy. Optimism in a risky situation (for example, when deciding to walk through a city centre alone at night) could in fact, have rather unpleasant consequences. Peterson and Vaidya (2003) argued that being inappropriately optimistic can underestimate risk. Despite this note of caution, optimism is widely accepted as a beneficial trait.

There has been substantial documentation of the beneficial effects of optimism with regard to coping with life stress and ill health. Interestingly, optimism has been found as the best psychological predictor for fertility success (Lancaster & Boivin, 2005). Yet, it is now also emerging that there is a possible relationship between parental optimism and infant development. Optimism, pessimism and depression measures were taken of mothers, and of their 8-12 year old children (Hasan & Power, 2002). Maternal report regarding parenting practices was also obtained. Whilst this study found no correlation between maternal optimism and child optimism, maternal pessimism was found to correlate with child depressive symptoms. Child optimism was found to negatively correlate with maternal depressive symptoms. Baker, Blacher & Olsson (2005) explored the relationship between parent well-being and behaviour problems of children with intellectual disabilities. It was found that child behaviour problems were related to child scores of depression and also marital adjustment. Maternal optimism was found to moderate these relationships. These studies serve as recognition of the importance of maternal well-being for child developmental outcomes.

Optimists are more able to adjust to important life transitions than pessimists (Aspinwall and Taylor, 1992). The addition of a new baby to a family is without doubt a

stressful time; certainly it can be counted as an important life transition. Following Aspinwall and Taylor's (1992) conclusions, it can be assumed that mothers who have a more optimistic disposition are better equipped to adjust to the arrival of a new baby. The benefits to the early mother-infant relationship are obvious, in particular when considering that new mothers can be at risk of postnatal depression. The literature regarding the impact of maternal depression on the early relationship between mother and infant is extensive (e.g. Field, 1998). A mother who is depressed can be withdrawn: playing infrequently with her baby, vocalising rarely and offering little emotional engagement. She may smile little, and more often have a neutral or sad affect (Weinberg & Tronick, 1998). Maternal depression may also lead to mother being intrusive to the infant, expressing anger, and interfering with their infant's activities. Others diagnosed with depression are able to overcome the disorder with regard their relationship with their infant, and still maintain typical, responsive, positive interactions. Maternal depression is thought to affect infant functioning. From the very early months of life, infants who have been involved in atypical interactions as a result of maternal depression for example, may show more negative and less positive emotion, engage less with mother and with objects, and have more difficulty in regulating their affective and behavioural states. For mothers whose depression does not negatively impact the infant-mother relationship, infant functioning is similar to control infants (Weinberg & Tronick, 1998). Thus, it seems less the diagnosis that affects the mother-infant relationship, and more maternal behaviours. Optimism has been found to offer resistance to the development of depressive symptoms following childbirth (Carver & Gaines, 1987), and therefore can be considered not only a valuable trait for maternal wellbeing, but also for infant social and emotional development.

It is known that having a child with a disability relates to the risk of depressive symptoms in mothers, although it should be noted that whether this translates to actual clinical depression (due to inconsistent measures in the literature) is less clear (Bailey,

Golden, Roberts & Ford, 2007). With regard specifically to mothers of infants with Down syndrome, the birth of her child will be an extremely stressful time. It is undoubtedly an experience that could require complex coping strategies, and likely draws on a variety of emotional resources. An optimist may fare better than a pessimist under these difficult circumstances.

Baker, Blacher and Olsson (2005) emphasised the importance of intervention strategies for parents to increase dispositional optimism, in order to be better psychologically equipped to manage behavioural challenges. Whilst optimism is considered to be relatively stable (Scheier & Carver, 1985) it is possible to enhance this trait. Seligman (2001) devised methods of developing this 'Learned Optimism.' Arguably, new mothers that are considered high risk for developing depression, or are facing a particular stressful time, would benefit on focusing on increasing their levels of optimism. Considering the importance of optimism in general and in particular as a protective factor to the stress of parenting young infants, optimism was measured in the current study.

Infant temperament

Rothbart and Derryberry (1981) defined temperament as constitutional differences in reactivity and self-regulation influenced by heredity, maturation and experience. It is widely accepted that infants have individual differences in temperament. There is little doubt that even very young babies can have variation in, for example, general levels of positive and/or negative mood, of levels of activity, of engagement and of soothability (to name a few). The particular balance of these temperamental characteristics builds from the interaction of an infant's biological and environmental framework yet has behavioural coherence and stability (Goldsmith & Campos, 1990). Individual differences in infant temperament are known to relate to later social and personality development (Gartstein & Rothbart, 2003).

The study of temperament is particularly appealing to those interested in Down syndrome. Behavioural observations and parental reporting of temperament have raised the issue that particular nuances in emotional behaviour and/or temperament may be more, or less, specific to those with Down syndrome when compared to other populations. Four-month old infants with Down syndrome have been reported to have a ‘dampened emotionality’ and more variability in facial expressions of emotion (Emde & Brown, 1979), whilst others note delays in social smiling (Berger & Cunningham, 1986). Moore, Oates, Goodwin and Hobson (2008) report no differences in smiling behaviour between 4-month-old typically developing infants and 6-month-old infants with Down syndrome. Whereas, Carvajal and Iglesias (2000) go further, arguing that before the age of 6 months, the smiling behaviour of infants with Down syndrome is comparable to typically developing infants. After 6 months of age, however, cognitive difficulties may well begin to impact on how infants with Down syndrome utilise more complex emotional processes that are intertwined with cognition. It is possible that differences in the observed emotional behaviour of infants with and without Down syndrome may well relate to underlying temperament characteristics. Infants who are considered to have a more positive temperament may well be more positive in their interactions with another. It is also possible that for those who are considered to have more negative affectivity, interactions would be characterised by more negative emotionality on temperament measures.

Those who have studied infant temperament to date, most frequently adopt a parental report approach. This approach, however, has been criticised in the past for the risk of social desirability influencing responses. Furthermore, it may be that it is parent *perception* of infant temperament that remains stable rather than the infant’s actual behaviour, an important point when considering that it is parent’s perception of the infant that is being measured (Kagan, 1994). It is now widely accepted, however, that parental report is a valuable and valid

approach to measuring infant temperament. Gartstein and Rothbart (1981) stressed the benefit of this method, stating that parents are the best source from which to gain an accurate reflection of an infant's temperament. Parents have the most detailed knowledge of their infant. Furthermore, this information is gathered from interactions with their infant and observing their infant within their natural environment, within a variety of contexts, rather than an artificial laboratory setting, and as such can be considered ecologically valid. This adds further support for the premise that infant temperament may be related to emotional behaviour when in interaction.

The most widely used measure to record infant temperament is the Infant Behaviour Questionnaire (IBQ), developed by Rothbart (1981), more recently revised into the IBQ-R (Gartstein & Rothbart, 2003). The IBQ and subsequently the IBQ-R were devised specifically with the young infant (up to one year) in mind. It is necessary to distinguish temperament measures between older children and infants due to the vast differences in early infant behaviours compared to later development. Furthermore, for young infants, the discrete temperament components map on to the overarching dimensions slightly differently compared to older children and adults. Perceptual Sensitivity (defined as: amount of detection of slight, low intensity stimuli from the external environment), for example, is considered part of the Positive Emotionality/Surgency scale in infancy, but swaps to the Orienting/Regulatory Capacity scale for older children (Gartstein & Rothbart, 2003).

The IBQ-R consists of 14 discrete scales that each contribute to one of the three overarching factors. The Positive Emotionality/Surgency dimension includes 6 scales: approach, vocal reactivity, high intensity pleasure, smiling and laughter, activity level and perceptual sensitivity. The Negative Affectivity dimension includes 4 scales: sadness, distress to limitations, fear and falling reactivity. The Regulatory Capacity/Orienting dimension is also made up of 4 scales: low intensity pleasure, cuddling, soothability and duration of

orienting. Gartstein & Rothbart (2003) emphasised that this revised version enables a more fine grained assessment of temperament, rather than approaching temperament in a more global manner.

Researchers have highlighted some differences in relation to the temperament of infants with and without DS. A recent longitudinal study, using the IBQ-R as a measure, obtained parental report regarding the temperament of 17, 3-12 month old infants with DS and comparing this to a typical sample (Gartstein, Marmion & Swanson, 2006). With regard to the 3 overarching dimensions, infants with DS were reported as having lower levels of Negative Reactivity and higher levels of Orienting and Regulation than typically developing infants. There was no difference between groups regarding the Positive Emotionality/Surgency factor. Considering the fine grained scales, Gartstein et al (2006) reported that infants with DS had lower levels of Distress to Limitations but higher levels of Low Intensity Pleasure, Duration of Orienting, Falling Reactivity and Cuddliness /Affiliation. Thus, infants with DS were less negative than typically developing infants, and also had higher levels relating to all subscales of the Regulatory Capacity/Orienting dimension. Scoring high on the Regulatory Capacity / Orienting scale could be interpreted in a variety of ways. For example, the infant who scores high on this scale may be particularly attentive (duration of orienting) or responsive to parental touch (cuddliness / affiliation and soothability). Another interpretation could be that the infant may be emotionally flat (low intensity pleasure and soothability) The former and latter interpretations could have a bearing on reports from others who have studied the emotionality of infants with Down syndrome (e.g. 'emotional flatness'; Emde & Brown, 1979; 'prolonged social engagement'; Fidler, 2005).

In an earlier comparable longitudinal study, using the IBQ (as opposed to the revised version of the questionnaire) as a measure, Rothbart and Hanson (1983) reported infants with

DS scored lower on the measures Smiling and Laughter, Vocal Activity and Motor Development and higher on Fear and Startle and Duration of Orienting than the typically developing sample. The same study also found no differences between groups with regard to Activity Levels, Distress to Limitations and Soothability. Even taking into account the difference in measures used, there does appear to be some consistency across the two studies with regard to Duration of Orienting levels. This is supported by behavioural observation studies that have found that infants with DS tend to focus longer on a social partner than typically developing infants (Berger and Cunningham, 1981; Carvajal and Iglesias, 2000). The finding from Gartstein et al (2006) reporting that infants with DS were less negative than TD infants is also supported by behavioural observation literature (Moore et al, 2008) where it was found that compared to 4-month-old TD infants, 6-month-old infants with DS were less fussy. There are some contrasting findings here though, in that in the earlier study (Rothbart & Hanson, 1983) found no difference between groups with regard to Distress to Limitations. It is difficult to draw comparisons between the findings in Rothbart and Hanson (1983) and Gartstein et al (2006) due to the fact the measures used were somewhat different.

This is also the case for other studies regarding the temperament of infants with Down syndrome. Bridges and Cicchetti (1982), using the Carey's Infant Temperament Questionnaire (Carey & McDevitt, 1978) measured the temperament of infants ranging in age from 3.5 to 8.5 months and identified that whilst infants with and without DS did not differ with respect to levels of Activity, Intensity, Mood, Adaptability, Distractibility and Rhythmicity, infants with DS were reportedly more frequently found to have higher levels on those scales considered as indicating a more difficult temperament (Threshold to Stimulation, Persistence and Approach). Another study (this time using the Early Infancy Behavioural Questionnaire; Medoff-Cooper, Carey & McDevitt, 1993) found infants with DS (up to the age of 4 months) to have an easier temperament overall; they were also more active, less

intense, more distractible and tended to show more approach behaviours than typically developing infants (Zickler, Morrow & Bull, 1998). Radekin (1993) using a different measure, reported infants with Down syndrome to be more approachable, more soothable, more positive and less intense and persistent. Infants in this case however, were actually around one year of age. Others report (with yet another measure) that by the time infants with DS have become toddlers they are less intense and have more positive mood than typically developing toddlers (Gunn & Berry, 1985). From the collation of these findings, it is not surprising that there are conflicting reports regarding the temperamental characteristics of infants with Down syndrome, however positive characteristics are certainly often quoted as increased in those with Down syndrome.

As Rothbart and Derryberry (1981) stated, temperament is influenced by both biological and environmental factors. Whilst the genetic abnormality that causes Down syndrome may well be an underlying basis for identifying and explaining some developmental outcomes, it is imprudent to ignore the fact that these infants are just as sensitive to environmental influences and other genetic factors, aside from the chromosomal abnormality, as the typical population. Just as in the typical population, those with Down syndrome hold a varied spectrum of temperamental characteristics. If there are commonalities within the group, this could be as much down to similarities in experience, for example an increase in family stress or approach to parenting, rather than due directly to the extra chromosome. As previously highlighted, Cicchetti and Beeghly (1990) recognised that the majority of research relating to young infants with Down syndrome has focused on the comparison of group means, and that to enhance understanding, there is a need to consider individual differences within groups too. There is no evidence to suggest to the contrary that there are fewer individual differences with regard to those with Down syndrome as there are

within the typical population. This point needs consideration with respect to experimental design and subsequent reflection.

One study that took steps toward drawing in temperament measures with behavioural data was that of Ohr and Fagen (1993). Three-month old infants were observed learning to kick a mobile hanging over a crib. Temperament measures were also obtained using the IBQ. Ohr and Fagen (1993) reported that the response rate of infants with DS correlated positively with maternal ratings of activity. This serves as evidence of the validity of maternal reporting of temperament, however, reliance on maternal report alone is rather limited. Overall, Ohr and Fagen (1993) found no differences between the temperament ratings of infants with and without DS at 3 months of age, contradicting findings from others (Ratekin, 1993; Zickler et al, 1998; Rothbart & Hanson, 1983; Gartstein et al, 2006).

The data collected in the current study will add further information to the field, and is novel in its approach in that it not only obtained information regarding the temperament characteristics of 4-month old infants with and without Down syndrome, but also considered findings in relation to infant emotion in dyadic and triadic play.

Maternal caregiving style

Newborns enter the world with a variety of needs that are required to be met if they are to go on to thrive. These needs are basically universal; all infants have a need to be nurtured, comforted, to communicate and to be within an environment that stimulates growth and development. Cross-cultural studies have added valuable evidence to the premise that the ways in which these needs are met are influenced by the cultural environment within which a child is raised, both in relation to the physical demands of the environment and with regard to the specific cultural beliefs and attitudes. Caregivers will intuitively rear their child in the best adaptation to meet the specific environment. Parenting is considered a significant feature

of culture, as cultural practices and values are transmitted from generation to generation (Harkness & Super, 1995). Parents pass down their own cultural history, beliefs and values on to their infant, shaping the child's developmental trajectory. Traditionally, the description of cultures were split dichotomously – individualistic or collectivist, with characteristics of these cultures stressing either the promotion of independence (the former) and interdependence (the latter). Raiff (2010) discussed how the Western world, and in particular the European-American culture was described to have a particularly pronounced independence, individualist orientation. Factors such as autonomy, self-sufficiency, self-fulfilment, self-expression and making choices for oneself were considered the core cultural focus. In contrast, other countries and continents were bracketed as interdependent (and therefore, collectivist) cultures, where values and goals centred around the community, defining oneself in relation to others, conformity and concern's for others' needs. Yet, this dichotomous perspective is limiting. All cultures will focus on all of these values, just to different degrees (Raeff, 2010). With recognition of the important role that parenting plays in imparting a particular culture's beliefs and values, Keller (2007) defined a set of parenting systems that may receive varying focus dependent on the social requisites of the culture within a young infant is raised.

Keller (2007) identified and described five (exhaustive) parenting systems that whilst culturally wide, may receive different focus in early infant interaction, namely: 'primary care', 'body contact', 'body stimulation', 'object stimulation' and 'face-to-face exchange'. Primary Care is characterised by how infants may receive food, shelter and hygiene. In areas of the world, where for example, survival rates are low and poverty may be high, mothers may focus more intently on reducing distress and increasing survival chances through feeding. In cultures where infants are carried mainly on mothers' bodies, where proximal rather than distal care is emphasised, the Body Contact parenting system may take a higher

role than to mothers who transport babies in prams and cars. For infants that live within a physically taxing environment, Body Stimulation could serve to enhance aspects of motor development and body self, or awareness. Object Stimulation is a parenting system that is linked to nurturing cognitive development and promoting independence through exploratory processes, a value that is considered prototypical of Western, European-American parenting. Similarly, the Face-to-Face system particularly promotes the concept of self, the sharing of warmth, social and emotional competence, and the development of language to name a few. Some of these systems may be considered more important than others at different stages of infant development. With this in mind, it is easy to conceive that the environmental requisites of different subcultures may also influence developmental trajectories of infants within that subgroup; more specifically (in light of the focus of the current study) for those infants with Down syndrome.

Down syndrome is characterised by a chromosomal abnormality. Whilst this genetic irregularity is known to affect particular aspects of development, the development of infants with Down syndrome could be as susceptible to environmental influences as for those with typical development. Down syndrome is a disorder that is often diagnosed at birth. Giving birth to a child with a disability undoubtedly results in a difficult, stressful and emotional time for the new mother (and family). In the early months, alongside dealing with the emotional difficulties for themselves that having a child with disability can bring, mothers also have to adapt to meet their newborn's needs, giving care that will best enable their child to manage within their environment. The maternal caregiving environment for infants with and without Down syndrome may therefore carry different focus. Previous research has examined whether maternal behaviour with infants with Down syndrome somehow differs from how mothers may behave with typically developing infants. Mothers of infants with Down syndrome reportedly show more 'assertive warmth' (Moore, Oates, Goodwin and

Hobson, 2008) and with toddlers with DS, are more directive, controlling and take more initiative in play (Buckhalt, Rutherford & Goldberg, 1978) than mothers of typically developing infants and toddlers. Others report no difference in maternal responsivity between groups, and that rather, differences in maternal responsivity are more likely related to infant mental age and the infant's behavioural repertoire rather than the disability per se (Brooks-Gunn & Lewis, 1984).

Considering the content and justification of Keller's (2007) parenting strategy categorisation, it is possible that mothers of infants with Down syndrome may place emphasis on different parenting systems in order to best enable their infant to adapt to their environment, in a way that may be different to mothers of typically developing infants. It is possible for example, that mothers of infants with Down syndrome may place more emphasis on encouraging motor development (Body Stimulation parenting system) with the knowledge that this may otherwise later be delayed. Or, in contrast, with the knowledge that motor development could be delayed, mothers may focus on other care systems, such as Face-to-Face Exchange, that may meet the infant and environmental demands more effectively. Investigating the value that mothers may place on particular parenting systems, and considering these alongside behavioural observations, will enable the generation of further knowledge regarding the influence that environment may play on development.

Observation of maternal behaviour in dyadic interaction can go some way towards addressing how maternal behaviour may interact with how her child learns and develops, but in addition to this, an understanding of a mother's beliefs and attitudes to parenting her newborn is required, alongside an appreciation of the cultural environment within which both live. Maternal caregiving preference data was collected in the current study in order to identify whether mothers of infants with typical development and with Down syndrome placed emphasis on particular aspects of care and interaction over another. It was asked

whether mothers of infants with Down syndrome were similar to mothers of typically developing infants with regard parenting system preference.

Research outline and predictions

The purpose of the current study was to collect data regarding various aspects of young infants' environmental and individual characteristics with an objective to consider these on their own merit, and compare findings across typical and Down syndrome groups. A secondary purpose was to converge findings with behavioural observations of TD and DS infants when in dyadic play (See Chapter 2).

Maternal optimism was investigated and it was considered how it may relate with aspects of early infant development. Maternal optimism was measured using the Life Orientation Test – Revised (LOT-R) (Scheier, Carver & Bridges, 1994). This questionnaire was selected over another widely used test for optimism, the Optimism Test (Seligman, 2002). It was decided that Seligman's Optimism Test was too Americanised for this English sample. Some questions were more geared toward the American population, for example: 'You run for a community office position and you win,' 'Your stocks are at an all time high,' and 'you fall down a lot when skiing.' It was decided that these phrases were not ones which a South of England sample would relate to; for example, there is no snow in the UK for skiing (in contrast to the US), and thus, skiing is an expensive holiday activity that not all may have experienced (it is noted that this may also be the case for a US sample). It was decided instead to use the LOT-R. It had an advantage, due to its brevity, of enabling measurement of this variable, but reducing the load placed on participants. As optimism is considered a relatively stable trait, it was predicted that optimism levels of mothers of infants with and without Down syndrome would not differ. This study explored whether maternal optimism was related to other factors that may contribute to the mother-infant relationship,

such as infant temperament and maternal parenting system preference. In light of research that supports the benefits of positive emotion (e.g. Fredrickson, 2003), it was predicted that maternal optimism would be related to infant positive emotion.

Using the IBQ-R, the temperament of 4-month old infants with and without Down syndrome was investigated via maternal report (Gartstein & Rothbart, 2003). This measure was selected over others as it is widely used, and has most recently received revisions to tie in with advances in temperament research. It was tentatively predicted that infants with Down syndrome would score higher on the more positive temperament scales, lower on the negative temperament scales than TD infants, and higher on the orienting/ regulatory dimension in line with the majority of findings from others (Rothbart & Hanson, 1983; Radekin, 1993; Zickler et al, 1998;; Gartstein et al, 2006) and in line with behavioural observation studies (e.g. Berger & Cunningham, 1981; Carvajel & Iglesias, 2000; Moore et al, 2008). With regard to infant behaviour, it was predicted that scores on dimensions of the Positive Emotionality / Surgency factor would relate to positive emotion of infants in dyadic play.

The importance of particular parenting systems for these participants was assessed using an adaptation of Keller & Demuth's (2006) picture card technique. In accordance with the rationale previously described, data were collected from all mothers regarding the value they placed at the current moment, on each of the five parenting systems: Body Contact, Face-to-Face Exchange, Body Stimulation, Primary Care, Object Stimulation. This will collectively provide new information about the caregiving styles of mothers of 4-month-olds as a group in the South of England, and also regarding mothers of infants with Down syndrome who may place an emphasis on different developmental outcomes for their children than mothers of typically developing infants. For mothers of the typically developing sample, it was predicted that the most important styles would be identified as face-to-face exchange and object stimulation, to tie in with a westernised, independent parenting style. For mothers

of the Down syndrome sample, a similar prediction was tentatively made, in that these mothers will still likely hold westernised parenting beliefs. It may be however, that as a result of their infant's specific needs, more focus would be placed on other styles. It was further predicted that infant positive emotion in play would be greater with those mothers who placed Face-to-Face Exchange as a most important parenting system due to the increased focus.

Method

Participants

Mothers (N=22) of 4-month-old (M=18.5 weeks, range = 17 to 20 wks) infants with DS (n=10) and of TD infants (n=12) participated. As participants were the same as in the previous studies, further participant detail is provided in Chapter One alongside a replication of Table 4.1 (which I include below for ease for the reader). The distribution across variables for TD and DS groups is shown in Table 4.1, alongside averages, standard deviations and significance results where appropriate. Two infants with DS were born at 36 wks gestation. It was decided that as these infants at the time of participation were both chronologically aged at the top of the range at 20 weeks, no correction was made, although this is relevant to note. There was no statistical difference in age between the two groups, $t(20) = 0.97, p = 0.34$. All mothers participating were married. There was a trend (close to significance) towards mothers of DS infants being older than mothers of TD infants. Thirteen mothers had university education, and no relationship was found regarding group and level of education. From this sample of 22 infants, 15 were firstborn and 13 were breastfed. No significant group by sociodemographic variable relationship was found. Thus, infants from both groups were comparable on these measures.

Table 4.1.
Sociodemographic Information for TD and DS groups

		Group		
		TD	DS	*
		M (SD)	M (SD)	
Infant age (in wks)		18.4 (1.17)	18.9 (1.23)	t (20) = 0.97, p=0.34 ns
Maternal age (in yrs)		31.0 (3.84)	34.6 (4.48)	trend: DS > TD t (20) = 2.02, p = 0.056
Mothers with uni. ed		6	7	χ^2 (1) = 0.27, p = 0.61 ns
Infant as firstborn		9	6	χ^2 (1) = 0.08, p = 0.77 ns
Feeding	Breast/Mixed	8	5	χ^2 (1) = 0.13, p = 0.72 ns

Notes. A trend < 0.1. Chi square tests included Yates correction due to small sample with 2 groups, and expected cell frequencies less than 5.

Instruments

Temperament: (IBQ-R) (Gartstein & Rothbart, 2003).

The IBQ-R is a parent report instrument that contains items regarding commonly occurring infant behaviours. Parents are asked to rate how often that particular behaviour may have occurred over the previous 1-2 weeks, within a given context. Parents are asked to use a 7 point Likert Scale to report to what extent a statement is true or untrue about their infant, with the range on the scale starting at ‘never’ and moving through stages to ‘always’. Parents also have an option to select ‘Does not apply.’

To extract data from the IBQ-R, individual scores for each of the 191 questions were entered into an Excel Spreadsheet. Following the scoring system provided with the questionnaire, participants’ average scores for each dimension were calculated. Thus, these dimension scores ranged from 0-7. Scores were then totalled from the relevant dimensions to

obtain an overall score for each of the 3 overarching temperament factors: Positive Emotionality/Surgency (containing 6 dimensions – so a maximum score of 42), Negative Affectivity (containing 4 dimensions – maximum score therefore of 28) and Orienting/Regulatory Capacity (4 dimensions and a maximum score of 28).

Optimism: LOT-R (Scheier, Carver & Bridges, 1994)

The LOT-R is a succinct and widely used questionnaire, designed to measure a person's level of optimism. Mothers were presented with 10 statements, 6 of which were scored and 4 of which served as fillers. Of the 6 scored, 3 were positive statements (eg. 'in uncertain times I usually expect the best') and 3 were negative statements (eg. 'I rarely count on good things happening to me'). Mothers responded to how much these statements may or may not be true using a 5 point Likert scale. The scale ranged from 0 (I disagree a lot) through to 4 (I agree a lot) for the positive statements. The negative statements were reversed scored (where 0= I agree a lot, 4= I disagree a lot). An optimism score was calculated as an average of the non-filler statement scores.

Maternal caregiving style semi-structured interview (Keller & Demuth, 2005)

Five photographs depicting western mothers (German) and young infants in different types of interaction – Body Stimulation, Object Stimulation, Primary Care, Face-to-Face Exchange and Body Contact – were provided kindly by Professor Keller. These photographs were used to assess the value that mothers in this study placed on each through adopting a semi-structured interview approach. It is important to note that this study did not use the full procedure as outlined by Keller & Demuth (2005) in that each parenting system was not subsequently explored with regard further information. This would have required further photographic data and more detailed analysis. Keller & Demuth (2005) investigated parenting

system preference in further detail than was possible within the scope of the current study, qualitatively analysing interviews for ethnographic purposes. Mothers were asked to rank the five parenting system photographs in order, from the one they considered most important to themselves and their infant at the given time, through to the least important.

Sociodemographics

Alongside the data collected regarding maternal optimism, maternal parenting systems and infant temperament, descriptive data were collected regarding the sociodemographics of each infant's family to further accurately reflect environmental factors. Data were collected regarding maternal age, education, marital status, income and levels of infant contact. In addition, whether infants were first in birth order was also recorded. This sociodemographic questionnaire was produced to follow that by Keller & Demuth (2005), who stressed the importance of recognising sociodemographic data when discussing parenting system preference. As these were the same participants as in the previous two studies, a brief summary of results are reported in the current chapter, but refer to Chapter One for full details.

Procedure

The study was carried out in the Infant Laboratory in the Department of Psychology, University of Portsmouth, and for some of the DS sample, in a comparable room at the Down Syndrome Education International Trust, Portsmouth. In all instances the room set up was replicated, and procedures were strictly adhered to. Collection of data for this study was incorporated into the procedure of the dyadic play (Peekaboo), and triadic attention studies (See chapters 2 and 3).

In addition to the procedural information relating to the interaction studies described in Chapters 2 and 3, mothers were also requested to complete a variety of questionnaires and take part in a maternal Parenting System short semi-structured interview as part of the visit. An outline of the requirements of the questionnaires and the interview were verbally provided. Informed Consent was obtained from all mothers.

Questionnaire administration

Mothers were encouraged to complete the questionnaires on the day. Due to the length of the IBQ-R, mothers were instructed to leave this until last so as to be able to complete the shorter questionnaires first. If, due to time restraints, mothers could not finish the questionnaires, then they were informed that they could complete any outstanding questionnaires at home and return them to the experimenter at the University. A stamped addressed envelope was provided for those who needed to do this. Mothers were informed that for all questionnaires there were no right or wrong answers, and were asked to answer as honestly as they could. Completion of these questionnaires was carried out whilst their baby was engaged with the experimenter in other activities, or at the end of the visit when baby may for example, be sleeping. Mothers were given specific instructions regarding the completion of each questionnaire:

Optimism Questionnaire (LOT): “This is a very short questionnaire for you to complete. There are no right or wrong answers, please just indicate to which extent the statement may or may not be true for you personally. If you have any questions please ask.”

Socio-demographic Questionnaire: “Again, this is a very short questionnaire for you to complete. This enables me to identify particular characteristics that relate to your child’s

home environment. If there are any sensitive questions that you do not feel comfortable to answer, then please leave them blank. If you have any questions, please ask.”

IBQ-R (Temperament): “This questionnaire will enable me to gain an understanding of your infant’s temperament, and is a very common questionnaire used for this purpose in research. It is, however, really lengthy. Please take your time with this questionnaire and if you wish to take it home with you to complete and send to me later, then feel free. Also, the IBQ-R is designed for infants up to the age of 1 year. There may well be some questions that are not relevant to your baby at this age. If this is the case, just mark the X for ‘does not apply’. Please ask if you need help or have any queries.”

Maternal caregiving values interview

The maternal caregiving interview was carried out at the end of the session, or when there was a need for the infant to take a break. Mother and experimenter sat on sofas around a coffee table. There was a Dictaphone on the table to record the interview. Following consent by mother, the experimenter turned on the Dictaphone then laid out five photographs depicting different types of mother-infant interaction. The procedure of the interview was explained:

“I will show you five photographs and ask you to select one out of the five that reflects the type of interaction that you feel is *most* important to you and your baby at this point of time. I will then ask you which you select as next important and so on, until we get to the least important. I want to stress that there are no right or wrong answers; it is just to see what is important specifically to *you and your* baby at this moment in time. I will ask you to elaborate on each picture as we go along.”

Each mother was encouraged to describe the picture and to discuss why she chose that picture over another. Once all photographs were discussed, the interview ended and the Dictaphone turned off.

Debriefing

At the end of the whole session, mother was given the opportunity to ask any questions. An overview of the rationale was provided. Mother was reassured that all behaviours are 'typical'; that the experimenter was not looking for right or wrong patterns of behaviour, rather that the whole session had been an exploration of infants' very early skills in social and emotional communication. Mothers were handed the Debriefing form, and were offered a DVD copy of the session, alongside being provided baby care vouchers to reimburse any travelling costs.

Questionnaire return rate

All questionnaires were completed by all participants. This high completion rate was a result of mothers being requested to complete the questionnaires at the time of visit. All mothers completed the Optimism and Sociodemographic questionnaires on the day, with approximately 6 mothers taking only the IBQ-R home to complete. These outstanding questionnaires were all returned by post.

Missing data and decision making

With regard the Sociodemographic Questionnaire, one question that was highlighted as having some inconsistency and some incompleteness was the question regarding monthly family income. Mothers answered this question inconsistently; some gave two alternative answers, and two mothers left this blank. For new mothers, family income can drastically

change at around the time infants are 3-4 months. Mothers who may have been working prior to birth likely lose their full income, and certainly by the time their infant is 4 months of age are likely to receive a significant drop in any maternity pay. It was evident that mothers were unclear as to whether to enter their current family income (whilst possibly on an ever decreasing maternity pay) or their prior income, previous to taking any maternity leave. As a result of the ambiguity of this question (in hindsight) it was decided to act cautiously and drop this question from analysis. It is proposed that for future infant studies wishing to use income as a marker of social status, that this issue is rectified in advance. There were no further issues with regard to missing data.

Results

Temperament measures

Overarching factors and subscales

Table 4.2 lists the group means and standard deviations for each of the three overarching factors and the 14 subscale dimension average scores. A factor score was calculated by totalling the sum of the average scores of the relevant discrete dimensions. Independent t-tests were run with regard to group and each subscale as well as for each of the 3 overarching factors. Test results are also included in Table 4.2. There was no significant difference between DS and TD infants with regard to the Positive Emotionality/Surgency factor. Overall, infants had a mean score of 23.48 ($SD = 4.05$). There was also no significant difference between groups with regard to the Negative Affectivity factor ($M = 13.61$, $SD = 1.66$). This was also the case with regard to the Regulatory Capacity/Orienting factor ($M = 20.06$, $SD = 2.03$). When factors were broken down into each of the 14 dimensions, it was found that DS infants scored significantly higher than TD infants on the perceptual sensitivity scale. There were no other significant differences between the two.

Table 4.2.

Mean factor and subscale scores (with SD) for TD (n=12) and DS (n=10) infants with independent t-test results

Factors & Subscales	Group		*
	TD Mean (SD)	DS Mean (SD)	
Positive emotionality / Surgency	23.32 (3.88)	23.67 (4.45)	0.19, <i>p</i> = 0.85
<i>Activity</i>	3.57 (0.70)	3.79 (1.08)	0.58, <i>p</i> = 0.57
<i>Smiling and Laughter</i>	4.50 (1.17)	4.10 (1.30)	0.76, <i>p</i> = 0.46
<i>High Intensity Pleasure</i>	4.97 (0.65)	4.74 (0.97)	0.65, <i>p</i> = 0.52
<i>Approach</i>	3.80 (0.87)	3.58 (1.22)	0.51, <i>p</i> = 0.62
<i>Vocal Reactivity</i>	4.23 (1.08)	4.04 (1.03)	0.41, <i>p</i> = 0.69
<i>Perceptual Sensitivity</i>	2.26 (0.90)	3.42 (0.70)	3.31, <i>p</i> = 0.003**
Negative Affectivity	13.30 (1.15)	13.98 (2.12)	0.95, <i>p</i> = 0.35
<i>Distress to Limitations</i>	2.88 (0.64)	3.18 (0.72)	1.02, <i>p</i> = 0.32
<i>Falling Reactivity</i>	5.13 (0.71)	5.34 (0.55)	0.77, <i>p</i> = 0.45
<i>Fear</i>	1.89 (0.55)	2.05 (0.81)	0.55, <i>p</i> = 0.59
<i>Sadness</i>	3.40 (0.73)	3.41 (0.89)	0.03, <i>p</i> = 0.98
Regulatory Capacity / Orienting	20.37 (2.34)	19.68 (1.62)	0.78, <i>p</i> = 0.43
<i>Cuddliness/Affiliation</i>	5.84 (0.59)	5.90 (0.46)	0.30, <i>p</i> = 0.78
<i>Duration of Orienting</i>	4.04 (1.19)	3.58 (0.98)	0.97, <i>p</i> = 0.34
<i>Low Intensity Pleasure</i>	5.19 (0.82)	5.25 (0.65)	0.19, <i>p</i> = 0.85
<i>Soothability</i>	5.30 (0.61)	4.95 (0.78)	1.18, <i>p</i> = 0.25

** *p*<0.01

Parenting systems

Mothers rated 5 photographs, each depicting one of 5 parenting systems (as set out by Keller, 2002) from being the most to the least important for themselves and their infant at the given time (where 1 = most important through to 5 = least important).

Table 4.3 contains the number and percentage of the parenting systems mothers rated the most important through to least important. Looking at the distribution in the table, it is evident that there is considerable variability regarding the level of importance with which

mothers viewed the various parenting systems. Markedly, 55% of all mothers ranked the Body contact system as least important from the five. The parenting system more often rated as the most important was Object Stimulation, rated as most important by 27% of mothers, closely followed by Body Stimulation (23%). Face-to-face exchange was rated the most important parenting system by 18% of mothers, and 32% of mothers rated this 2nd. Examining the data by group, face-to-face exchange was rated least important by one mother from the TD sample, and no mothers of DS infants rated this parenting system as least important.

Table 4.3.

Maternal ranking of parenting systems from most to least important for TD (n = 12) & DS (n = 10)

Parenting system	Group	# & % mothers ranked									
		most important (1 st)		2 nd		through to		3 rd		least important (5 th)	
		#	%	#	%	#	%	#	%	#	%
Body contact		3	14	6	27	1	5	0	0	12	55
	TD	1	8	4	33	1	8	0	0	6	50
	DS	2	20	2	20	0	0	0	0	6	60
Body stimulation		5	23	2	9	5	23	8	36	2	9
	TD	3	25	1	8	3	25	5	42	0	0
	DS	2	20	1	10	2	20	3	30	2	20
Face-to-face exchange		4	18	7	32	5	23	5	23	1	5
	TD	3	25	4	33	2	17	2	17	1	8
	DS	1	10	3	30	3	30	3	30	0	0
Object stimulation		6	27	4	18	7	32	3	14	2	9
	TD	3	25	2	17	4	33	1	8	2	17
	DS	3	30	2	20	3	30	2	20	0	0
Primary Care		4	18	3	14	4	18	6	27	5	23
	TD	2	17	1	8	2	17	4	33	3	25
	DS	2	20	2	20	2	20	2	20	2	20

Maternal Optimism

The optimism score was calculated for each mother. Scoring could range from 0-24.

Overall, mothers' average optimism score was 17.45 (SD 4.28). Considering optimism scores by group, there was no significant difference in the overall optimism score for TD (n=12) and DS (n=10) mothers, $t(20) = 1.38, p = 0.18$; (See Figure 4.1 for average group scores).

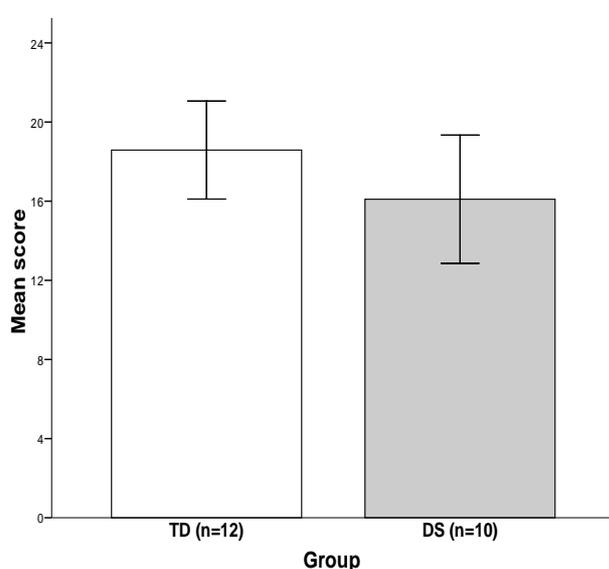


Figure 4.1. Average optimism scores (& SD) for mothers of TD (n=12) and DS infants (n=10)

Maternal Optimism and infant temperament

Maternal optimism did not correlate with any of the 3 dimensions on the temperament scales (Positive emotionality/Surgency $r(22) = -0.06, p = 0.80$; Negative Affectivity, $r(22) = 0.39, p = 0.07$, Regulatory Capacity/Orienting $r(22) = 0.29, p = 0.19$. When this was broken down by group however, a highly significant relationship was found between infants with DS negative affectivity scores and maternal optimism scores ($r(10) = 0.85, p = 0.002$). The higher the optimism scores of mothers of DS infants, the higher the score for infant negative affectivity. This significant result will later be discussed. No other significant relationships

by group were found (DS: Positive Emotionality /Surgency: $r(10) = -0.32, p = 0.36$; Regulatory Capacity/Orienting: $r(10) = 0.24, p = 0.49$. TD: Positive Emotionality/Surgency $r(12) = 0.25, p = 0.43$; Negative Affectivity, $r(12) = -0.14, p = 0.67$; Regulatory Capacity/Orienting: $r(12) = 0.27, p = 0.40$).

Infant smiling and individual variables

Data were imported from study 1, where 9 TD and 10 DS infants were observed in dyadic play with mother and a stranger, and smiling behaviour was recorded. The purpose of the current study was to consider infant smiling alongside data relating to maternal optimism, maternal parenting system preference, infant temperament, and sociodemographic factors. As a marker of smiling behaviour in infants, it was decided to use the measure of overall duration of infant smiling during play. This measure highly correlated with all other smiling behavioural data from peekaboo (smile duration with experimenter: $r(19) = 0.86, p < 0.0001$; smile duration with mother: $r(19) = 0.81, p < 0.0001$; total smile bouts: $r(19) = 0.89, p < 0.0001$ - where total smile bouts with mother: $r(19) = 0.68, p = 0.001$; and total smile bouts with experimenter: $r(19) = 0.66, p = 0.002$).

The overall duration of infant smiling during play was analysed in relation to the variables within the current study. It is important to note that due to the smaller TD sample size in the peekaboo study, the data from the 9 TD infants and 10 DS infants who participated in Study 1 were subsequently analysed.

Infant temperament and smiling in dyadic play

TD infants ($n=9$) and DS infants ($n=10$) in this reduced sample did not differ on dimensions of Positive Emotionality/Surgency ($M = 23.80, SD = 4.23$); $t(17) = 0.68, p = 0.89$; Negative Affectivity ($M = 13.58, SD = 1.78$); $t(17) = 1.04, p = 0.31$; and Regulatory

Capacity/Orienting ($M = 19.97$, $SD = 2.06$); $t(17) = 0.63$, $p = 0.54$; dimensions. With respect to the discrete scales, infants with DS ($M = 3.42$, $SD = 0.70$) still scored significantly higher on the Perceptual Sensitivity, $t(17) = 2.71$, $p = 0.02$; than TD infants ($M = 2.32$, $SD = 1.05$). No other significant differences were found.

With regard infant smiling behaviour and the 3 temperament factors, there were no significant relationships (Extroversion/Surgency $r(22) = -0.17$, $p = 0.48$; Negative Affectivity: $r(22) = -0.23$, $p = 0.35$, Regulatory Capacity/Orienting, $r(22) = -0.02$, $p = 0.93$).

Maternal optimism and infant smiling in dyadic play

Analysing optimism scores in this smaller sample, it was found that mothers of infants with DS had a non significant trend toward lower optimism scores ($M = 16.1$, $SD = 4.53$) than mothers of TD infants ($M = 19.67$, $SD = 2.50$); $t(17) = 2.09$, $p = 0.052$. In the larger sample however, this pattern was not replicated. The p value increased and therefore, with a larger sample, there is less probability that the optimism levels of mothers with and without DS would differ in this way. There were no relationships with regard to the duration of time infants spent smiling during play and maternal optimism scores, $r(19) = 0.06$, $p = 0.81$, nor when this was broken down by group (TD: $r(9) = 0.27$, $p = 0.48$; DS: $r(10) = -0.20$, $p = 0.58$).

Parenting systems and smiling behaviour

It was predicted that for mothers who placed face-to-face exchange as a most important parenting system, infants would behave more positively (measured by smiling behaviour) within a dyadic face-to-face exchange, compared to those who did not. Mothers who rated face-to-face exchange as either 1st or 2nd in importance were grouped ($n = 9$), and compared to mothers who did not ($n = 10$). There were no significant differences found, t

(17) = 0.02, $p = 0.98$. Due to the exploratory nature of this investigation, all other parenting systems were similarly analysed. There were no significant differences in infant smiling behaviour between mothers who rated a particular parenting system as a most important, or not. There were also no differences in infant smiling behaviour between mothers who rated a particular parenting system as a least important one, or not.

Sociodemographics and infant smiling during play

There were no differences in the duration of infant smiling during play between males and female infants, $t(17) = 0.23$, $p = 0.82$; first and non-first born infants, $t(17) = 1.24$, $p = 0.23$, for breast/mixed fed (collapsed) and bottle fed infants, $t(17) = 1.20$, $p = 0.20$; nor between mothers who had university education and those who had not, $t(17) = 0.81$, $p = 0.43$. Maternal age did not relate to infant smiling, $r(17) = 0.26$, $p = 0.29$.

A discussion of individual differences

Specifically focusing on the three debates in the literature that my thesis aims to contribute, as well as my findings from the previous studies, in the current chapter I discuss individual scores for each participant in relation to maternal optimism, infant positive affectivity and smiling behaviour during peekaboo play, as well as gaze following behaviour and trial completion, thus integrating the studies together.

Previous chapters and this chapter so far, have examined various measures of infant behaviour and other factors that may affect the early socioemotional development of infants with and without Down syndrome. Group scores have been compared and statistical inferences made. In this final analysis, individual scores on a selection of variables for each infant and their mother are reported. This is justified, as in Study 2 there was substantial

variance identified in infant scores relating to aspects of infant smiling behaviour and also justified by good practice, in that in examining a small sample it is possible to talk about the individual rather than the group. One key infant behavioural measure is reported from each of the three studies and one maternal measure. In addition, I report whether the infant managed to complete all trials or not, due to the findings relating to trial completion and group. There follows an integration of results and a discussion of some of the key points that arise from considering these individual differences.

In Table 4.4, the total duration each infant smiled during peekaboo play is reported, alongside each infant's score on the Surgency / Positive Affectivity dimension of the IBQ-R. Whether the infant successfully completed all trials is provided, alongside whether the infant was able to follow gaze. Maternal optimism scores are also reported for each mother. Data are only reported for those participants who contributed to data for all of the listed variables (9 TD infant and 10 infants with DS).

Raw scores for the Surgency / Positive Affectivity scale are reported due to the rationale that positive emotionality in infants with DS may somehow be different to the typical population. Scores are summarised as High, Medium or Low. The summaries were calculated from the range of scores for all participants. Scores ranged from 17.3 to 31.5. Scores were considered low if ranging from 17-21, considered medium from 22-26, and scores 27-32 were high. A previous study by Gartstein, Marmion and Swanson (2003) reported average scores on the Surgency / Positive Affectivity scale for infants and young children with DS as 27.3 (SD 3.13), and for typically developing infants and young children as 28.11 (SD 3.24). The average scores reported by Gartstein et al (2003) are higher than those reported in the current study (DS = 23.32, SD 3.88; TD = 23.67, 4.45). Therefore, note

that the levels: High, Medium and Low, relate only to scores of those infants within the current study.

On the Surgency / Positive Affectivity scale, 3 TD infants and 4 with infants with DS were classified as Low scoring, 4 TD and 4 DS infants as Medium, and 2 TD and 2 DS infants scored High. Of the infants who scored highly on the Surgency / Positive affectivity scale, mothers of the 2 TD infants (P3a & P9a)P both scored highly on the Optimism scale, whereas mothers of the 2 DS infants (P2b & P7b) scored low on Optimism. The pattern of Optimism scores across groups shows that only 2 mothers of TD infants did not score highly on this scale; whereas in the DS group, only 3 did score highly. Two mothers of infants with DS had low optimism scores (and these were those mothers who rather their infants as high on the Surgency / Positive Affectivity scale), compared to none in the TD group. To note, in previous analyses a trend was identified within this small sample relating to maternal optimism, with mothers of infants with DS tending to score lower than mothers of typically developing infants. Whilst this pattern of group scores relating to Maternal Optimism is worth noting, given the potential moderating role of optimism for depression (Carver & Gaines, 1987) , what is arguably of most importance in investigating individual scores, is that two mothers who may have low levels of optimism have been identified.

The maternal optimism score for P2b is noticeably low, scoring only 8. This mother may potentially benefit from support to increase dispositional optimism (Baker, Blacher & Olsson, 2005; Seligman, 2002). Interestingly, P2b smiled for a relatively long duration in peekaboo play (84 secs – 4th longest duration in relation to all infants), and successfully completed all trials. Thus, for this particular mother-infant dyad, mother's optimism was low, however it is evident that her infant smiled for a comparatively long duration of the peekaboo play, and was able to maintain interacting long enough to complete all trials. As stated, P2b infant was rated as High on the Surgency / Positive Affectivity scale. P2 b did not follow

gaze (categorised by the infant demonstrating gaze following at least once in both the PPP and PPO conditions), but neither did any of the infants with DS (compared to 4 of the TD infants).

Of the 4 TD infants who scored High on the Surgency / Positive Affectivity scale, 3 (1 TD, 3 DS) completed all trials, however, one TD infant did not (P9a). This same infant, however, did smile for a long duration (100 secs) over all the trials, compared to other infants, and the mother's optimism score was high. Thus, it would seem this infant did enjoy playing the game, but not for a prolonged period.

One TD infant smiled for a markedly long duration (170 secs) in peekaboo play. P7a also completed all trials, was able to follow gaze, mother scored high on the Optimism scale, and the infant score was rated as Medium on the Surgency / Positive Affectivity scale. P7a is arguably the most consistent 'high scorer'. No other infant had as consistently positive scorings across the range of measures. It may be that P7a is particularly high functioning.

In relation to smile duration, 4 infants with DS smile for longer than 1 minute during peekaboo play and 3 TD infants. There are also infants in both groups who smiled for an arguably, short duration during play, with 1 TD infant smiling for under 20 secs of play and, similarly, 3 infants with DS.

Table. 4.4. Scores by participant (TD=9; DS=10) relating to maternal optimism and infant temperament, smiling, gaze behaviour and trial completion.

Individual Participant Scores							
TD infants	Smiling dur. in peekaboo (secs)***	Positive Affectivity (IBQ-R)*		Maternal Optimism (LOT-R)**		Followed gaze?****	Completed all peekaboo trials?*****
1a	38.0	18.1	<i>Low</i>	20	<i>High</i>	Yes	No
2a	71.2	26.2	<i>Med</i>	20	<i>High</i>	No	No
3a	28.8	31.5	<i>High</i>	21	<i>High</i>	No	Yes
4a	25.3	20.1	<i>Low</i>	20	<i>High</i>	No	No
5a	18.2	24.4	<i>Med</i>	14	<i>Med</i>	Yes	Yes
6a	46.5	19.8	<i>Low</i>	18	<i>Med</i>	No	No
7a	170.6	23.7	<i>Med</i>	21	<i>High</i>	Yes	Yes
8a	31.9	24.0	<i>Med</i>	23	<i>High</i>	Yes	Yes
9a	100.0	27.8	<i>High</i>	20	<i>High</i>	No	No
DS infants							
1b	18.2	17.3	<i>Low</i>	16	<i>Med</i>	No	Yes
2b	83.8	30.1	<i>High</i>	8	<i>Low</i>	No	Yes
3b	19.1	22.0	<i>Med</i>	14	<i>Med</i>	No	No
4b	23.9	26.6	<i>Med</i>	24	<i>High</i>	No	Yes
5b	51.3	21.1	<i>Low</i>	20	<i>High</i>	No	Yes
6b	75.6	19.8	<i>Low</i>	14	<i>Med</i>	No	Yes
7b	64.7	30.3	<i>High</i>	13	<i>Low</i>	No	Yes
8b	29.7	24.9	<i>Med</i>	18	<i>Med</i>	No	Yes
9b	18.1	22.5	<i>Med</i>	14	<i>Med</i>	No	Yes
10b	105.7	21.3	<i>Low</i>	20	<i>High</i>	No	Yes

Note: *Surgency/Positive affectivity scores also rated as Low/ Med / High. **Optimism scores also rated as Low / Med / High. ***Smiling duration: total smiling during 2 trials with mother and with experimenter
 ****Gaze following: Yes if infant followed gaze at least once in each of the PPO and PPP conditions *****
 Yes if 3 mother- 3 experimenter- trials of peekaboo completed

Discussion

The purpose of the current study was to collect data regarding various aspects of young infants' environmental and individual characteristics with an objective to consider these on their own merit, and compare findings across typical and Down syndrome groups. A secondary purpose was to converge findings with behavioural observations of TD and DS infants when in dyadic positive play (See Chapter 2).

No significant differences were found between groups with regard infant temperament on any of the 3 overarching factors on the IBQ-R, and therefore predictions that infants with DS would score higher on the more positive temperament scales, lower on the negative temperament scales, and higher on the orienting/ regulatory dimension than TD infants were not upheld. DS infants did, however, score higher on one of the 6 subscales of the Positive Emotionality / Surgency factor, specifically Perceptual Sensitivity. It was further predicted that scores on dimensions of the Positive Emotionality / Surgency factor would relate to positive emotion of infants in dyadic play. No relationships were found with regard smiling behaviour and any of the 3 overarching temperament factors.

The prediction that maternal optimism would be comparable across groups was upheld. When analysing the data from the reduced TD sample and comparing with the DS sample, however, there was a trend towards mothers of DS infants scoring lower optimism levels than mothers of TD infants. In contrast to the prediction of the current study, levels of maternal optimism did not relate to infant positive emotion.

With regard to parenting system preference, the prediction that mothers would rate face-to-face exchange and object stimulation as the most important system of parenting was partly upheld, with object stimulation rated more often by all mothers as the most important. When analysing data by group, more mothers of TD infants rated object stimulation, face-to-

face exchange and body stimulation as the most important systems. Mothers of DS infants rated object stimulation as most important more often than any other system. Over half of all mothers rated body contact as the least important parenting system. Considerable variability in ranking order was observed. There were no significant differences between mothers who rated face-to-face exchange as either most 1st or 2nd most important and those who did not, in relation to infant positive emotion in play.

Temperament of typically developing infants and infants with Down syndrome

It was predicted that infants with DS would score higher on the more positive temperament scales, lower on the negative temperament scales, and higher on the orienting/regulatory dimension than TD infants in line with findings from other temperament studies (Rothbart & Hanson, 1983; Radekin, 1993; Zickler et al, 1998;; Gartstein et al, 2006) and behavioural observation studies (e.g. Berger & Cunningham, 1981; Carvajal & Iglesias, 2000; Moore et al, 2008). It was also predicted that infant smiling behaviour in play would relate to positive temperament characteristics supporting a relationship between temperament and behaviour, and also offering further validity to the IBQ-R. Key findings were: 1) TD and DS infants did not score differently with regard to any of the three overarching factors of the IBQ-R: Positive Emotionality/Surgency, Negative Affectivity or Orienting/Regulatory Capacity. 2) On examining each of the individual dimensions, infants with Down syndrome scored higher than typically developing infants on only one of the 14 individual temperament subscales, the Perceptual Sensitivity scale, but no other differences were found. 3) No relationship was found with regard infant smiling behaviour in play and any of the 3 overarching temperament dimensions.

Within the IBQ-R, Perceptual Sensitivity is considered one of the six subscales contributing to the Positive Emotionality/Surgency factor, whereas this subscale contributes

to the Orienting/Regulatory factor in older children. The current study emphasises the importance of the recent revision of the IBQ. Without this revision then differences in the Perceptual Sensitivity of TD and DS infants would not have been identified. Whilst no other differences were found between groups, the fact that infants with DS scored higher on this scale is interesting as it is inconsistent with findings in a similar study by Gartstein, Marmion & Swanson (2006) who found no difference between groups on this scale. Gathering further data is recommended to address whether this finding would be consistent across the wider population, or if it was specific only to the current sample. Unfortunately, due to the vast array of different temperament measures used across studies in relation to infants with DS, it is not possible to make further direct comparisons to findings from other studies.

It is unclear why infants with DS would score higher on the Perceptual Sensitivity subscale than TD infants, however there are some explanations. Questions that built the Perceptual Sensitivity scale included those that related to infant detection of low intensity stimuli, such as ‘how often did your infant notice fabrics with a scratchy nature (e.g. wool)’ or ‘attend to sights and sounds when outdoors (for example, wind chimes or water sprinklers)?’ It may be that mothers from the DS sample are more aware of their infant’s finer behaviours due, perhaps, to an increased focus on her infant’s development. Alternatively, infants with DS, who are thought to have different patterns of environmental focus (e.g. an increased focus on the social partner as opposed to objects), may focus more on these aspects of the environment compared to TD infants. Another explanation is offered. A part of early intervention strategies with infants with disabilities, in particular for those who may have sensory difficulties, encourage infants to be surrounded with differing textures, sounds, colours etc, in order to stimulate sensory activity. Mothers may be encouraged, for example, to provide sensory stimuli for their infant that may involve using objects such as bells, sensory books that have different surfaces to feel or black and white contrasting patterns.

Interesting materials are encouraged to be used such as sandpaper, bubble wrap and fur, in order to stimulate her infant's senses. Mothers likely watch her infant's behaviour under these circumstances in order to assess response. Hence, the fact that infants with DS scored higher on this subscale compared to the TD sample is perhaps, understandable.

With the exception of the Perceptual Sensitivity subscale, TD and DS infants scored comparably on all other subscales, and with regard the overarching dimensions. Thus, findings from the current study do not support the conclusion that 4-month-old infants with DS have differential temperament characteristics than the typical population, although the small sample size limits generalisability. It is important to emphasise the similarity between infants with DS and the typical population. Despite the tendency for researchers to stress differences and deficits in developmentally at risk groups, it is just as important to recognise sameness. It may be that the IBQ-R is not a sensitive enough measure to pick up on nuances in temperament of very young infants. In order to draw effective conclusions regarding the temperament of very young infants with DS, the collection of further data using the same temperament measure is recommended.

Maternal Optimism

The main findings regarding maternal optimism were: 1) there was no significant difference in the optimism levels of mothers of TD and DS infants (however a non-significant trend emerged that when comparing a reduced TD sample with the DS sample, mothers of infants with DS tended to score lower); 2) higher levels of negative affectivity of infants with Down syndrome related to higher levels of maternal optimism; 3) no relationship was found regarding infant positive emotion during dyadic play and maternal optimism.

Mothers scored an average of 17.5 on the LOT-R (Scheier, Carver & Bridges, 1994). Using the categorisations from Bacher, Blacher & Olsson (2005), mothers overall scored to

the top end of the moderate (scores between 14-18) optimism category. When optimism scores from the smaller sample of the mothers of TD infants were analysed (in order to analyse whether or not optimism related to infant smiling behaviour), mothers of DS infants demonstrated a trend (very close to significance) toward scoring lower than mothers of TD infants. The 9 mothers of TD infants scored in the high optimism level category (18 +), and the 10 mothers of DS infants scored in the moderate category. Due to the fact that as the sample increased, the p value was lowered, this finding is arguably a result of the small sample size.

Yet, this suggestive finding regarding lowered optimism in mothers of very young infants with DS is worth mentioning. It is possible that in fact, having an infant with Down syndrome risks lowering optimism levels, and could, over time risk lowering them more as the extent of an infant's disability begins to emerge as developmental goals may not be reached. It is understandable that when something bad happens to you, at that particular time it is far more difficult to make strong statements regarding how, for example, you expect more good things to happen to you than bad. This would suggest that optimism is a less stable trait, perhaps more transient than Scheier and Carver (1985) would profess. If it is possible that increasing optimism levels can be learned (as proposed by Seligman, 2001) then it stands to reason that this fluidity is a possibility. This calls into question the suitability of the LOT-R for those populations who may have had a particularly bad event occur. Or in fact, perhaps it highlights there are more complexities regarding optimism that come to light in challenging times.

For the mother of all young infants, but in particular for those considered more at risk from depression, optimism is a particularly important tool. By increasing optimism levels, the risk of depressive symptoms can be lowered and thus the mother-infant relationship, and ultimately the infant's development, will benefit. A learned optimism

strategy (Seligman, 2002) could easily be adopted into intervention programmes and support services for this particular group of mothers. Further research into this area is recommended, gaining data from larger populations using the LOT-R as a measure. Also it is recommended that by talking to mothers in detail about how they are feeling about the arrival of their new baby, about their outlook on life, and perhaps how their attitude may have changed or not since the birth, would add further understanding of optimism, and whether or not it is a stable, or more transient state. A qualitative approach, rather than a brief questionnaire of 6 questions may be more appropriate (but more time consuming) to measure levels of optimism. It is encouraging that mothers in the current study had moderate optimism levels. For these new mothers, who are obviously going through an important life transition with the arrival of their new baby, either with or without Down syndrome, an optimistic attitude (and thus a reduced risk of depression) can only be of benefit to the mother-infant relationship (Field, 1998, Weinberg & Tronick, 1998).

It was asked whether maternal optimism related to particular aspects of infant temperament. Increased optimism in mother may relate (being cautious here regarding causal effects) to infants scoring higher on the positive emotional and behavioural Positive Emotionality/Surgency scale perhaps due to the premise that the more positive mother will enable a more positive relationship, and vice versa, a more positive infant will also enable a more positive, open relationship. As infant temperament was measured via maternal report, the optimistic mother may over- or under- emphasise particular infant behaviours. It was found that overall, maternal optimism did not correlate with any of the 3 dimensions on the temperament scales: Extroversion/Surgency, Negative Affectivity or Regulatory Capacity/Orienting. However, when this was broken down by group, it was found that the higher the optimism levels of mothers of infants with Down syndrome, the higher the infant with Down syndrome scored on the Negative Affectivity scale. Whilst it was argued that

increased maternal optimism might relate to increased infant positive emotion, this finding does not support this. It is possible that mothers of infants with Down syndrome who score higher on the negative affectivity scale, are adopting a heightened optimism as a strategy as a way to support their infant to reduce fear, anger, distress and sadness, or in fact as a way to compensate for the infant's increased negative affectivity temperament characteristics. In fact, this finding does go some way in supporting Baker, Blacher and Olsson (2005) who emphasised the importance for parents to increase dispositional optimism in order to be better equipped to manage behavioural challenges. Perhaps mothers of infants with Down syndrome who are presented with more behavioural challenges (interpreted as heightened fear, anger, sadness and distress to limitations) have increased their optimism levels in order to better manage the challenging situation they are in. Further investigation is required on this point as it is possible that there is a more complex relationship regarding infant temperament and maternal optimism than proposed here.

A further purpose of this study was to examine maternal optimism and how it may, or may not, relate to infant positive behaviour in play. The prediction that infant smiling behaviour in dyadic play related to levels of maternal optimism was not supported in this study, however the current study alone can not dismiss this rationale. It is possible that at this young age, the relationship between the two is more subtle than the approach taken in this study and more detailed analysis of positive emotion in young infants in dyadic play alongside maternal optimism will yield different results. Again, another explanation is that the LOT-R may not be sensitive enough in measuring the complexities of optimism in new mothers, who have recently undergone significant life changes.

Maternal parenting system preferences

Different cultures place emphasis on particular parenting systems in order to best enable their infants to thrive and develop (Keller, 2002). This is, to the author's knowledge, the first study designed to identify the parenting system preference of mothers in the South of England. It was predicted that overall, mothers would demonstrate preference to Westernised parenting systems – Face-to-Face Exchange and Object Stimulation. Group differences were also explored as it was tentatively suggested that for mothers of infants with Down syndrome different emphasis may be placed on particular parenting systems that would enable their infant with a disability to best develop. Individual differences in parenting system preference were also examined in relation to infant positive emotion in play. It was predicted that infant positive emotion in dyadic play would be higher with those mothers who placed more importance on Face-to-Face Exchange as a result of the higher focus on this parenting system.

Overall, mothers rated Object Stimulation, but not Face-to-Face Exchange as the most important parenting system for themselves and their 4-month-old babies. When analysing data by group, more mothers of TD infants rated object stimulation, face-to-face exchange and body stimulation as the most important systems. Mothers of DS infants ranked object stimulation as most important more often than any other system. Over half of all mothers rated body contact as the least important parenting system. Considerable variability in ranking order was observed. There were no significant differences between mothers who rated face-to-face exchange as either most 1st or 2nd most important and those who did not, in relation to infant positive emotion in play. Considerable variance was found relating to the order of importance mothers placed on different parenting systems.

These data go some way towards supporting the prediction that mothers in the South of England place emphasis on the importance of face-to-face play and object stimulation

compared to other parenting systems. This upholds the claims by Keller (2002), that these are particular westernised parenting styles that emphasise the development of social aptitude and independent learning. Furthermore, mothers of infants with DS did not markedly differ from mothers of TD infants with regard the importance they placed on each parenting system, suggesting that again, more similarities are drawn between the two groups than differences. The prediction that infant positive emotion in dyadic play would be higher with those mothers who placed more importance on Face-to-Face Exchange as a result of the higher focus on this parenting system was not upheld.

The current study used an abridged version of Keller & Demuth's (2005) parenting system investigative procedure. Their work involved further investigative interviewing relating to each parenting system photograph, supported by a further bank of photographs depicting different behavioural approaches to each parenting system. Interviews were then qualitatively analysed. This method was beyond the scope of the current work due to the variety of factors that were investigated. Future studies in this field are recommended, due to the interesting pattern of distribution regarding parenting system preference that has been identified in this study. It is proposed that a qualitative investigation of parenting system preference in relation to mothers with and without Down syndrome would have great worth.

Individual sociodemographic variables such as maternal education, whether infants were breast or bottle fed, and birth order did not relate to infant smiling behaviour. It should be noted that mothers of infants with Down syndrome were slightly older than mothers of TD infants, however maternal age did not relate to infant smiling behaviour during play. Interestingly, there were few relationships identified between the amount infants smiled during dyadic play and the variables considered here. Whilst this could call into question the validity of some of the measures, rather it is argued that a more detailed analysis of infant positive emotion during play alongside the variables considered here, may be necessary to

identify the subtleties that may, or may not, be evident in the interplay of environmental and biological factors with infant positive emotion.

Research strengths and limitations

The current study provides valuable findings that can only benefit the field of emotions and developmental research, alongside those interested in Down syndrome. To the researcher's knowledge, this is the first study that has investigated optimism in relation to mothers of very young infants with Down syndrome. It is believed that this is also the first study that has collected data relating to the caregiving preferences of mothers in the South of England, and of mothers of infants with Down syndrome. Furthermore, the data from these measures were then combined with observational data of infant positive emotional behaviour when in dyadic play. I also examined individual differences for all infants (see Table 4.4).

There was a tentative suggestion that arose in data analysis that mothers of infants with Down syndrome may have a tendency to be less optimistic than mothers of typically developing infants (however, this was only the case when the sample was necessarily reduced). Findings also suggest there may be a more complex relationship between maternal optimism and the temperament characteristics of infants with Down syndrome. As previously discussed, optimism moderates depressive symptoms and mothers of infants with Down syndrome are considered high risk of developing depression (Carver & Gaines, 1987; Bailey, Golden, Roberts & Ford, 2007). Thus, it is recommended that further studies are carried out in relation to maternal optimism, in particular with at-risk groups. Even if it is found that optimism is not negatively impacted for mothers of infants with Down syndrome, the introduction of intervention strategies could still be beneficial. By increasing maternal optimism, it may be possible to reduce the risk of depression, and to manage behavioural challenges.

Whilst much has come out from the current study, there are a few points to note. It would have been ideal if infants in both groups were gender-balanced, as it is thought that gender may relate to infant behaviour, however this was a symptom of recruitment factors and the effect of reduced power in introducing another between subjects variable. There is a higher incidence of Down syndrome in the male population, and during the period of recruitment, this was found to be the case. Due to the timescales and difficulties in recruiting the typical population, there was insufficient time to balance the typical population against the Down syndrome population in relation to gender. The sample size was relatively small, however it is comparable to, or larger than other studies regularly cited in the field (e.g. Berger & Cunningham, 1981). Another factor to acknowledge is that two of the infants with Down syndrome were born slightly prematurely (at 36 weeks gestation). Prematurity is a variable that ideally should be controlled for due to the possible impact on development. Each participant was screened, however it was decided that rather than exclude these two babies with Down syndrome from participating in the study, rather they would be seen toward the end of their fourth month of age. This decision was taken in order to limit any risk of a prematurity effect. Other limitations, which can be attributed to all studies, is that variability or not between individuals and groups, could just be specific to these particular participants. There is further discussion of potential methodological and sample issues in Chapter Five.

There were no apparent differences in the assessment of temperament between infants with and without Down syndrome, with the exception of infants with Down syndrome scoring higher on the Positive Emotionality/Surgency factor subscale Perceptual Sensitivity. The implication of this in relation to the Down syndrome population is that rather than identifying the negative impact of the disability, there is recognition of how, with regard emotionality, infants with Down syndrome may be the same as the typical population, and in

fact, may have aspects of more positivity (when considering the perceptual sensitivity scores). The clearest conclusion to make from examination of the data in Table 4.4 is that there is variability in scores for all infants and mothers. Most importantly, I would argue that from the data collected, specifically in relation to infant positive emotionality, infants with DS, either as a group, or considering just one individual, do not score markedly different to the typical population when examined on this individual level. Thus, for those families (and educators, health professionals and carers) involved with Down syndrome, the findings from the current study could well be seen as encouraging.

Chapter Five. General Discussion

In this thesis I sought to better understand the roles of positive affect, social experiences and expressions in developmental outcomes. I studied young infants in dyadic and triadic interactions, comparing a typically developing group to a group with Down syndrome. In this concluding Chapter, I will address questions regarding how infants with Down syndrome compared to typically developing infants in their very early social and emotional development. The thesis formed from my initial questions that were raised regarding the emotionality of infants with Down syndrome and how this might relate to their socioemotional development. I found inconsistencies in the literature, with some suggesting that infants with Down syndrome were emotionally flat, that is having a dampened emotionality (Emde & Brown, 1978). Others reported that for infants with Down syndrome, the expression of positive emotion was in some way dysfunctional (e.g. Berger & Cunningham, 1986). Yet, others have found no difference in the socioemotional behaviour of young infants with Down syndrome compared to the typical population (e.g. Carvajel & Iglesias, 2002). Further still, it is reported that those with Down syndrome have an overriding

positive personality (Fidler, 2005) and this is supported to some degree by infant temperament studies (e.g. Zickler, Morrow & Bull, 1993; Ratekin, 1993; Gartstein, Marmion & Swanson, 2006). It has also been argued that those with Down syndrome develop relative social and emotional strengths (see Fidler, 2005), gaze longer at a social partner in infancy than the typical population (e.g. Berger & Cunningham, 1981) and may have less negative affect (e.g. Moore et al, 2008). The core debates that this thesis was designed to contribute towards were, when compared to typically developing infants 1) that infants with Down syndrome may have some different patterns of attention 2) that infants with Down syndrome may have differences in emotionality, and perhaps social and emotional strengths 3) that the environment for infants with Down syndrome may in some way be different. This concluding chapter draws together findings from each of the studies in the thesis and discusses them under this context.

Positive emotion

In study 1, infants and partners played an ecologically valid, peekaboo game, which focused on heightened dyadic positive emotional interaction. In peekaboo, infants with Down syndrome smiled comparably to typically developing infants. There were no group differences regarding the overall duration of infant smiling during peekaboo, how often infants smiled, nor how long each smiling bout lasted. When in triadic interaction (study 2), infants with Down syndrome again smiled comparably to typically developing infants. Infants produced comparable rates of positive vocalisations, although a trend emerged which suggests that infants with Down syndrome may produce more positive vocalisations than typically developing infants. In study 3, infant temperament was measured using the IBQ-R (Rothbart & Hanson, 2003). On all the 3 overarching scales (Positive Emotionality/Surgency, Negative Affectivity and Orienting / Regulatory) infants from both groups scored

comparably. Infants with Down syndrome did score significantly higher than typically developing infants on the Perceptual Sensitivity subscale, 1 of the 6 dimensions that made up the Positive Emotionality / Surgency factor. Whilst perhaps this could be construed as a small indication towards a more positive temperament in infants with Down syndrome compared to typically developing infants, a more conservative interpretation is proposed. As discussed in Chapter 4, the questions that build the Perceptual Sensitivity scale focus on mothers' interpretations of infant responsiveness to sensory stimuli. Mothers of infants who may be at risk from sensory impairment are likely encouraged by professionals, and in fact may be drawn themselves, to emphasise sensory stimulation in interactions with their infant. Thus, it may be that mothers of infants with Down syndrome score their infant as functioning higher on the Perceptual Sensitivity scale as sensory stimulation has been more of a focus than within interactions between mothers and typically developing infants. Her infant may be practised, and more familiar with a variety of sensory stimuli. This does not mean that the finding is not of interest; in fact, quite the contrary. It is worthwhile investigating whether a possible increased focus on sensory stimuli at this early age has lasting implications for development. There is always the possibility however, that a significant finding is specific only to the current sample.

It can be concluded that with regard to levels of positive emotion, typically developing infants and infants with Down syndrome did not differ. In fact, where there was a suggestion toward difference, the indication was towards infants with Down syndrome having increased positive emotion compared to typically developing infants. However, the findings here are not strong enough evidence to conclude that there were differences in positive emotional functioning between groups.

The finding that infants did not differ in levels of positive emotional functioning using a variety of measures and experiments is of real scientific value, and adds support to

others who have concluded that the smiling behaviour of very young infants with Down syndrome is comparable to the typical population (e.g. Carvajel & Iglesias, 2000). Infants with Down syndrome smiled as frequently, and for as long as typically developing infants. Bouts of smiling were comparable for the Down syndrome and typically developing group (when measured as the duration of a smiling bout). Intensity in relation to the amplitude of the smile however, was not measured. It is proposed that a future investigation, utilising Baby FACS (Oster, 2008), is carried out in order to measure the intensity of infant facial expressiveness. Over the whole procedures of the two experimental studies, from all the measures of smiling and positive emotion that I utilised, infants with Down syndrome presented with no deficits. This finding suggests that infants with Down syndrome may well be as positively involved with dyadic face-to-face interactions and the interpretation is that they may enjoy them equally, as much as typically developing infants.

Positive emotion has an adaptive function of broadening experience and building on personal psychological resources (Fredrickson, 2003). As discussed in detail in chapter 2, positive emotions such as joy, contentment and interest spark urges to play, explore, interact and savour and evaluate the self. Thus, at 4 months of age, using a smile as an index of positive emotion, typically developing and Down syndrome infants have equal urges to play, explore and interact. Like typically developing infants, infants with Down syndrome seem open to broadened experiences. To the extent that 4-month-olds have the capability to broaden personal psychological resources, the levels are equivalent for both groups with respect to aspects of engagement they are experiencing in these early interactions. It is recognised that later cognitive difficulties may well disrupt how well infants with Down syndrome may be able to assimilate and further build up resources, but in the early months of life, they are open to learning much about their world. My findings do not support the conclusion that infants with Down syndrome have a dampened emotionality with respect to

positive emotion. Rather, I found that infants with Down syndrome are at the very least, comparable to the typical population with regard positive emotionality in dyadic and triadic interactions, and also in relation to temperament characteristics.

Negative emotion

A core finding that emerged in this thesis was with regard the negative emotionality of infants with Down syndrome. Infants with Down syndrome were less fussy over the experimental procedures when compared to typically developing infants. Some typically developing infants became distressed, fussy and the interactions had to come to an early close, resulting in a failure to meet the aim of three trials for each condition of studies 1 and 2. In contrast, infants with Down syndrome did not become so fussy, and were able to complete significantly more trials over both the dyadic and triadic studies than typically developing infants. Thus, Down syndrome infants met the experimental demands better than typically developing infants. Infants with Down syndrome also produced fewer negative vocalisations compared to typically developing infants during the triadic investigation. With regard to temperament measures, no difference was found between groups regarding scores on the Negative Affectivity factor, nor on any of the four discrete subscales. Thus, it can be concluded that whilst mothers rated their infants' temperament as comparable, infants with typical development did demonstrate more negative behaviours than Down syndrome infants during the sessions. This finding is similar to recent work by Moore et al (2008) who also reported infants with Down syndrome (aged 6 months) were less fussy than 4-month-old typically developing infants.

It would appear then, that infants with Down syndrome may be able to sustain prolonged periods of interaction compared to the typical population, before becoming upset. Some might argue that this is due to a dampened emotionality of infants with Down

syndrome (e.g. Emde & Brown, 1978) yet my findings do not support this. Infants with Down syndrome were not more passive in relation to the rate of socially directed behaviours produced in triadic interactions, nor in relation to levels of positive emotion. There were also no differences (with the exception of the Perceptual Sensitivity scale) in scores relating to temperament. My research supports the conclusion that 4-month-old infants with Down syndrome are not more emotionally flat than typically developing infants, just less emotionally negative.

Why might this be the case? Through reviewing the literature, there are suggestions that mothers of infants with Down syndrome may show more assertive warmth (Moore et al, 2008) than mothers of the typical population. Whether this was the case for mothers participating in this research was not examined in the current work, but is proposed for future investigation. If mothers of infants with Down syndrome do show more assertive warmth, this may act as a way of reducing infant negative emotion, which may explain how infants with Down syndrome are able to maintain prolonged social interactions. Maternal caregiving styles were examined however, and no difference was found between groups in their parenting system preferences. Further analysis of the behaviours of participating mothers may shed further light on whether mothers of infants with Down syndrome behave differently to mothers of the typical population. In peekaboo play, mothers of infants with Down syndrome did place different emphasis on aspects of the game when compared to mothers of typically developing infants, in particular in relation to the interplay phase. The interplay phase was shortened in mother—typically developing infant pairs compared to other dyads. It was discussed in study 1 how the interplay phase was crucial in order for play partner and infant to regulate the interaction, to reconnect together and to find harmony, a balance against the heightened play. The infant and play partner use this time as an opportunity to indicate the wish for continued engagement. The fact that typically developing infant - mother pairs spent

less time in this phase than any other partner- infant dyads (although still spending longer in the interval phase compared to other phases) could arguably mean that in the typical population, the intersubjective relationship is such that familiarity enables the pair to invest less time in this evaluative, reassuring and regulatory phase. Whereas mothers and typically developing infants moved through this phase comparatively quickly, mothers and Down syndrome infants did not, in the same way that the experimenter did not with infants from both groups. Could it be then that a reduced negativity in infants with Down syndrome, and the ability to maintain prolonged social interactions, may relate to the fact that mothers and infants with Down syndrome invest more time in enabling infants with Down syndrome the time to regulate their emotions. I would argue that it is possible that mothers of typically developing infants in a peekaboo play situation, may rush through this phase. By investing more time in calming, comforting and balancing the interaction, then this could explain how infants with Down syndrome were able to maintain prolonged social interactions before becoming fussy, unlike typically developing infants.

Yet, like positive emotion, negative emotion also plays a role in development. Negative emotion serves an adaptive purpose in that it narrows the focus of attention, ultimately enabling decisive and immediate evaluations of potential negative situations. Thus, perhaps for the infant with Down syndrome there are specific difficulties in this area that relate to the evaluative processes that develop negative emotional communication. This finding may in fact, relate to early cognitive deficits in infants with Down syndrome. Yet, given that emotions are related to infant intentions and motivations (Trevarthen, 1979), infants with Down syndrome do seem more motivated to engage with another social partner for longer than typically developing infants. Further investigation of the emotionality of very young infants with Down syndrome is recommended.

Dyadic and triadic social interactions

Dyadic interactions.

A difference did emerge regarding the smiling behaviour of infants with Down syndrome compared to typically developing infants, and this was not in relation to levels of smiling (as that was comparable) but rather related to the point at which infants smiled during the game of peekaboo. From reviewing the relevant literature, I raised questions that challenged the approaches used by others to examine young infants' social expectancies and emotion in peekaboo play. I found that of the two studies that utilised the peekaboo game with 4-month-olds (Rochat et al, 1999 & Montague & Walker-Andrews, 2001) to investigate infant social expectancy there were specific controls added that reduced the possibility of partner and infant having a true interaction. Thus, I argued that the findings of these studies were not relevant in relation to infant interaction. Following the review of the literature, I developed an investigation that enabled analysis of how the naturalistic game of peekaboo is played with 4-month-olds, also asking whether there are any differences in the game structure and also in infant behaviour, when the game is played with a familiar (mother) versus unfamiliar (experimenter) partner.

In the naturalistic game of peekaboo when played with 4-month-olds, I described 4 key phases, preparatory, hide, reveal and interplay. Each of these phases replicated the form and structure of naturalistic dyadic interactions that enable the infant and play partner periods of engagement, greeting and disengagement (as in Tronick, Als & Adamson, 1979). Peekaboo bouts were played repetitively, but with variation in the length of each phase, arguably to enable play partner and infant the opportunity to gain the most from the interaction. This was the case for all infants, both typically developing and infants with Down syndrome. As discussed in study 1, my findings question the methods of others who have attempted to use the peekaboo paradigm with 4-month olds to draw conclusions

regarding infant social expectancies. Playing naturalistically is perhaps the best way to enable dynamic social exchange.

From the examination of infant smiling behaviour during each of the phases of peekaboo it was found that typically developing infants smiled in a higher percentage of the preparatory and hide phases compared to infants with Down syndrome. As discussed in study 1, the preparatory phase builds the tension to the typical hide-reveal section of the game. The purpose of the phase is arguably to reach optimal engagement, but also to communicate to the infant that the next phase is about to occur. The preparatory phase possibly teaches the infant that there is a pattern to the interaction, that an expected event is about to happen. The hide phase is the time when mother hides her or her infant's face, and is the time when the socio-cognitive skill of person permanence is most practised. It is possible that as Down syndrome infants smiled in a lower proportion of these first two phases of the game, that perhaps infants with Down syndrome are less developed than typically developing infants with regard to social expectancies, or enjoy these aspects of the game less than typically developing infants.

It was asked whether infants gained more enjoyment from playing peekaboo with mother versus a stranger, and whether mother and stranger played the game in a comparable way to maximise a positive interaction. Infants smiled comparably with both play partners, but games with mother versus the experimenter did differ in relation to the emphasis placed on the phases of the game, and typically developing infant smiling behaviour during the early phases was increased when the play partner was the mother as opposed to the experimenter. This finding suggests that when playing peekaboo with mother, TD infants enjoyed the early phases of the game more when playing with mother compared to when playing with a stranger. Maternal optimism was not related to how much infants smiled during peekaboo play, nor was any sociodemographic or parenting system preference factor. In relation to the development of person permanence, infants with Down syndrome may not have smiled

during this phase as enjoyment was not felt when play partner hid away, and the socio-cognitive task too great for them at this age. Yet, some typically developing infants did not smile during these phases and some Down syndrome infants did. Also there was considerable variation within the samples. Therefore, it is concluded that investigating the social expectancy abilities of very young infants with Down syndrome in further detail would be of benefit in understanding whether this is a particular deficit in relation to Down syndrome, or whether it was a characteristic specific to the sample.

Upon further reflection, the point at which infants smiled during the game could be interpreted in a different way. Infants smiling during a phase may not be a direct result of that particular phase, but rather may be a form of emotional communication regarding the previous phase or phases. Thus, smiling in one phase may relate to an infant's emotional communication about one or another phase, or in fact, the accumulation of positive emotional feelings from the entire process of the game. The findings that infants with Down syndrome did smile at different points of the game compared to typically developing infants is interesting, and further investigation as to the precise timing of infant smiling in relation for example, to maternal smiles may offer further information on the extent to which infants with Down syndrome are able to access the game of peekaboo. Despite this finding, I would argue that the overriding conclusion is that in dyadic play, the positive emotion of infants with Down syndrome is more similar than different to the typical population. This is evidence that with regard to emotional communication, infants with Down syndrome are as active in social interactions in a similar way to typically developing infants.

Triadic interactions

The thesis was designed to investigate the role of social interaction in infant development. Alongside study 1, which investigated dyadic social exchange, the thesis investigated early precursors of the development of joint attention that may manifest as a result of early triadic interactions. Upon reviewing the literature, it became apparent that the shift from primary to secondary intersubjectivity (from which joint attention then emerges), where the infant has the capability to share feelings and intentions with another about an object, action or event (Trevarthen & Hubley, 1978) is unlikely to be a suddenly acquired skill, but is arguably stemmed in early foundations, built within dynamic social interactions (Fivaz-Depeursinge, Favez, Lavanchy, de Noni & Frascarolo, 2005; Tremblay & Rovira, 2007).

Four-month-old infants were observed in more, and less, social triadic interactions (person-person-person vs person-person-object conditions). It was hypothesised that at 4 months of age, infants would be able to detect the difference between these two triadic situations, and would produce more socio-communicative behaviours in the more social Person condition compared to the Object condition. The rationale was formed with the premise that in the early months of life, social interactions are the infant's primary focus. The social environment for infants in the early months is not just one of dyadic exchange. There is also the opportunity for the infant to experience more complex interactions. It was investigated whether infants with Down syndrome behaved similarly or not to typically developing infants within these two situations.

It was found that 4-month-old typically developing infants were able to follow gaze to some degree, but not consistently, a finding comparable to others (e.g. Tremblay and Rovira, 2007) who conducted a similar study with 3-month olds. Infants with Down syndrome followed gaze less often than typically developing infants (however, some still did and some

typically developing infants did not). Whilst findings were suggestive that typically developing infants did detect differences between more and less social, triadic interactions, the findings were not completely conclusive. I found a particular issue within this investigation that will require addressing in future research. I used the definition of socially directed behaviours that was used by Tremblay and Rovira (2007). Those behaviours that were considered socially directed were behaviours that coincided within a 7 second window of gaze to either person or the object. Yet, it leads to the question as to whether 7 seconds is the ideal timing in which to count whether behaviours are socially directed or not. How might setting the timeframe slightly longer or shorter influence findings? I utilised the same definition as Tremblay and Rovira (2007) in order to provide consistency across the studies and to see how infants at 4 months of age compared to infants at 3 months of age under this paradigm. Infants in study 2 produced considerably more socially directed behaviours than the infants in Tremblay & Rovira (2007). However, there was also considerable variance in the rate of socially directed behaviours produced by infants in their two studies of the same paper. It was argued that the interpretation of codes of infant behaviour made it difficult to directly compare rates across the two studies. This accentuates the need to carry through consistent measures in research. My results followed a similar pattern to Tremblay and Rovira (2007) which suggests that these findings were valid. It is concluded that in the first six months, infants seem able to detect a difference within a more, compared to less, triadic scenario, sharing gaze with one or other partner, but not with two partners, and communicating more when in a heightened social triadic situation. Thus, it would seem that early, particularly social triadic interactions could play a role in the development of later joint attention. At 4 months of age however, infants have not yet developed the full complexity of abilities to communicate with another about another within a triadic setting. Therefore, it is not clear as to the extent at which infants at this age have developed some precursors to

secondary intersubjectivity (Trevarthen, & Hubley, 1978), and by definition, a level of theory of mind (Baron-Cohen, Leslie & Frith, 1985).

Infants with Down syndrome behaved similarly to typically developing infants when in a triadic person situation, but when the object was the third addition to the interaction, typically developing infants reduced communicative behaviours, producing less single socially directed behaviours in the object compared to the person condition. Down syndrome infants did not reduce the rate of communicative behaviours produced in either condition. Yet this finding is understandable when analysing gaze behaviour. Infants with Down syndrome spent longer looking towards the social partner compared to the object. I found that infants with Down syndrome showed a preference to looking towards, and communicating with, a social partner over an object, whereas typically developing infants preferred looking towards the object over a social partner. This finding is similar to those found in other research where it has been reported that infants with Down syndrome maintain prolonged gaze to a social partner (e.g. Berger & Cunningham, 1981; Carvajal & Iglesias, 2000) in comparison to typically developing infants. Interestingly, no differences emerged between groups regarding the Orienting / regulatory capacity scores of temperament.

The interpretation of these findings could be that 4-month-old infants with Down syndrome have a deficit in relation to attending to objects. It would appear that there may be some differences between groups. Infants with Down syndrome may not have developed an interest in object play in a similar manner to typically developing infants. It should be noted that 4 months of age is on the cusp of when infants with typical development may begin to shift their attention from a social partner towards an object. Infants with Down syndrome may just have a slight developmental delay in this area. Testing slightly older infants under the same paradigm would address this issue. On examining the gaze shifting behaviour of infants during triadic situations, infants with Down syndrome shifted gaze at a comparable

rate to typically developing infants, and thus, it can be concluded that infants with Down syndrome do not have a prolonged gaze to a social partner because they cannot shift gaze competently (an argument offered by Berger & Cunningham, 1981), but perhaps they are more motivated to gaze at a social partner over an object. I would argue that it has become almost a truism through over-citing findings from Berger & Cunningham (1981) study that very young infants with Down syndrome have difficulties in shifting gaze. My research has found this may not be the case.

A preferable interpretation is offered. Regardless of whether infants with Down syndrome do have some difficulties regarding object interaction, I would argue that it is a strength that infants with Down syndrome are communicating and focusing more on a social partner than typically developing infants of the same age, having extra opportunity at this age to hone skills in socioemotional functioning. Imagine turning this finding on its head and it being found instead, that it was typically developing infants who showed preference to communicating and looking towards a social partner at 4 months of age, compared to Down syndrome infants, who would rather look at an object. It would be argued, I suspect, that typically developing infants having an increased focus on the social partner explained how they may be more skilled than Down syndrome infants at socioemotional communication. The findings and conclusions from my studies may sit more comfortably for example, if it was found that it were infants with Down syndrome, rather than typically developing infants, that were less able to maintain prolonged interactions without becoming fussy. These examples of findings and their interpretation stress the importance for researchers into disability to not jump into identifying deficits, problems and dysfunctions. The literature regarding the early socioemotional functioning of infants with Down syndrome is limited and much more work is needed to enhance knowledge.

Through the process of completing this thesis, I found many contradictions within the literature and my findings also contradicted some (e.g. Emde & Brown, 1978; Berger & Cunningham, 1981; 1986), and supported others (e.g. Carvajel & Iglesias, 2002; Moore et al, 2008). It was aimed to investigate the role of emotion, interaction and expression in early development, focusing on the role of positive emotion. Not only was infant emotion studied, but it was also investigated whether maternal optimism, a particularly positive emotional state (Peterson, 2006) related in any way to infant emotion in interaction. It was found that this was not the case. However, it emerged that the optimism levels of mothers of young infants, both with Down syndrome and typical development, was at the least moderate. This may have been a result of sampling bias, in that mothers who were less optimistic may have been less likely to participate. In a reduced sample, there was a suggestion that mothers of infants with Down syndrome had reduced optimism levels compared to the typical population. This finding was likely due to a lack of power, but however, it is recommended that further investigation in this area is required. Intervention strategies designed to increase maternal optimism levels would be relatively easy to introduce, and could have beneficial effects in reducing the risk of postnatal depression for all mothers (Carver & Gaines, 1987). There was a relationship found between maternal optimism in the Down syndrome group and infant negative affectivity, one of the three factors of the IBQ-R (Gartstein & Rothbart, 2003). The higher maternal optimism in the Down syndrome group, the higher the infants' score on the negative affectivity scale. It may be that for those mothers of infants with Down syndrome who are toward the higher end of the negative affectivity scale, there are more challenges for the mother to face. Baker, Blacher and Olsson (2005) emphasised how increasing optimism could enable better managing behavioural challenges. Thus, mothers of infants with Down syndrome may be using increased optimism to better manage and cope with their baby's environment. The literature on optimism suggests that optimism is a

relatively stable trait but that it is a trait that can be enhanced (Seligman, 2001). It is important to remember however, that in interactions, infants with Down syndrome were less negative emotionally than the typical population. Considering these findings, it is proposed that optimism may not be as stable a trait as some argue (Scheier & Carver, 1985), or the six questions on the LOT-R (Scheier, Carver & Bridges, 1994), the optimism questionnaire used in Study 3, may not be quite sensitive enough in measuring the complexities of an optimistic trait in mothers who have gone through a significant life change.

Research strengths and limitations

The design of the thesis enabled detailed analysis of infant socioemotional behaviour in complex dyadic and triadic interactions. Not only were behavioural observations carried out, but other factors that may relate to the developmental outcomes of infants were investigated. A particular strength of this work was that infants were matched by chronological age and thus, it was possible to compare infant behaviour as a result of social experience, rather than compounding this by compensating for possible cognitive deficits.

One of the most interesting findings from the current research was that infants with Down syndrome were less fussy over the entire experimental session compared to TD infants. Infants with DS, in both the dyadic and triadic investigation, completed significantly more trials than the TD infants. Trials were ceased if infants became distressed or unsettled, and were only restarted when the infant was able to continue. Despite this caveat (that the trials could be restarted) infants with TD still did not complete as many trials as DS infants. The finding that infants with DS completed more trials than TD infants was interpreted therefore, to mean that infants with DS were less fussy. My aim was to collect all data for each infant, and I sought to restart trials with all infants who needed a break. I was led by the mother, and also my own judgments of whether infants were becoming too distressed and / or unsettled

(interpreted as fussiness) to continue. A limitation of this interpretation is recognised as there was no measure for ‘fussiness that ceases interaction’, and therefore the decision not to run further trials on this basis could be criticised for being subjective. This may be the case, and it is certainly a factor that might be of value in measuring objectively in future studies. Other studies, however, have utilised similar criteria and it is perhaps a commonality in infancy studies of the sort.

In Jasnow et al (1988), similarly to the study here, trials were stopped if infants became fussy and were not restarted until such time as the baby was able to continue. No measure was reported for ‘fussiness’ in this instance. In a recent paper, Moore, Oates, Goodwin & Hobson (2008) reported on the ‘fussiness’ of infants during the still-face procedure, where it was reported that infants with Down syndrome were, equally positive emotionally, but less negative emotionally than the TD sample. Moore et al (2008) described the experimental procedure. Mothers were asked to first play with their infant and then after around 3 minutes cease interacting and maintain a still-faced pose. Mothers were then asked to re-engage, but “if they felt compelled to interact before this point – if for example, the infant seemed distressed – then this was fine..... The still-face phase was cut short either by the experimenter or mother for 1 infant with DS and 4 TD infants because of fussing” (pp84). No ‘fussing’ or ‘distressed’ definition or measure was reported. Whilst it may be that a measure was taken in Moore et al (2008) study, and just not reported; on the evidence it can only be assumed that there was a similar risk of subjectivity relating to this measure as in the current study. Findings from the current research and from Moore et al (2008) relating to infant fussiness may be comparable.

Another methodological issue to note is in relation to the triadic investigation. Mothers or the experimenter re-engaged with the infant when they felt the infant signified sufficiently vocally or through other means. Again, this criterion could arguably be

considered subjective. For others who may wish to replicate the study, a more stringent measure for re-engagement may be more appropriate. Yet, again, the similarities with other studies can be drawn. The criteria for re-engagement used in the triadic study were the same as that used in the study by Tremblay and Rovira (2007). Referring once more to Moore et al (2008), in their study, interactions with the infant were led by how the mother felt – “if mother felt compelled to interact.... then this was fine” (p84). Enabling mothers to make decisions about when and for how long to interact with her infant is an important ethical practice in infancy research. Carrying a procedure onwards, regardless of how mother or infant may be feeling, is not ethically sound. Therefore, whilst these methodological questions are valid to raise, there are similarities with other research methods. A solution in future would be to consider introducing more stringent measures, without risking the phenomenon one wishes to study, and whilst ensuring no undue distress is caused to mother and infant.

As discussed in detail in Chapter One, the research forming the whole thesis was carried out in one data collection session for valid reasons. Methodological decisions were taken as a result of this, one of which was the decision not to counterbalance conditions. The decision to not use a counterbalanced design was due to the fact that there was insufficient power as a consequence of sample size to introduce another between-subject variable. Increasing the sample size to enable counterbalancing was not an option due to the difficulties recruiting very young infants with Down syndrome. However, there is a risk of order effects as a result of not using a counterbalanced design.

In relation to the dyadic study, not counterbalancing may have resulted in the possibility of practice effects. Repeating the peekaboo play across the two conditions, may have enhanced (but perhaps lessened) infant performance due to practice. The design of the study sought to lessen an effect of practice by separating the peekaboo play out so that one

play session occurred at the beginning of the visit, and one at the end. It is possible, however, that infants performed differently in the second condition as a result of their experience in the first condition, but the directional influence of this can only be alluded to.

Fatigue was another potential order effect as a result of not using a counterbalanced design. Methodological design in advance again sought to minimise any effect. It was decided that the best option was to place mother-infant peekaboo as the second condition to counteract any effect of fatigue. If infants were fatigued, then the last condition would more likely result in less positive emotional exchange. Thus, if mother-infant peekaboo still offered more positive interactions than experimenter-infant then there could be no call for fatigue accentuating any effect. In fact, interpretation of results could be considered to be erring on the side of conservatism. The disadvantage of this approach however, is that it limits conclusions to be drawn if infants show more positive behaviour with stranger over mother. Results from the current study can be interpreted only regarding infants' preference to mother versus stranger in play, but not that they may prefer stranger over mother. There was a high drop out rate regarding trial 3 with mother, in particular with regard to TD infants. It is imprudent to draw any conclusions regarding trial completion in relation to infant play partner preference. It is most likely that this was a fatigue effect, due to the fact that play with mother was set as the final stage of the experimental procedure.

In relation to the triadic study, the lack of counterbalancing conditions also risked effects of fatigue and practice. It was predicted that infants would behave more socially in the person-person-person condition, and thus (for similar reasons as in the dyadic study), the person-person-person condition was carried out second. It was found that TD infants tended to produce more socially directed behaviour in the second, more social Person condition compared to the first, less social Object condition. If fatigue influenced results, then this only served to lessen the potential effect of condition, and this trend could be considered as

conservative. Counterbalancing conditions in any future investigation could increase the condition effect. A practice effect was more difficult to control for, yet arguably any practice effect would likely be minimal given the infant's young age, and different procedures used in the two conditions.

As the two separate observational studies were conducted at the same session, there is also a possibility that over the whole experimental procedures, there was the potential of order effects influencing results. As discussed, steps were taken in advance to limit potential confounds of the sort. Despite the difficulties discussed with not using a counterbalanced design, infants with and without DS did experience the same experimental demands. However, infants with DS were found to be better able to meet these experimental demands, being less fussy overall and completing significantly more trials than TD infants.

Another limitation of the current research is that it is possible that the samples studied were not reflective of the wider population. Particular issues are worth noting in relation to both groups. The recruitment of the Down syndrome population was carried out with the assistance of staff at the Down Syndrome Education International, a support service and research centre for families affected by Down syndrome. Staff at the Down Syndrome Education International approached all mothers of newborns with DS who made contact with them to request if they would consider participating in the research. Over the 10 months that recruitment was run, all mothers with a newborn with DS who contacted the Down Syndrome Education International (with the exception of 1) agreed to participate. As part of the recruitment process, mothers were asked if their infant had any particular, significant health problems, and would have been excluded if this was the case. To the best of my knowledge, no infant presented any relevant health problems. There were no significant differences between groups in relation to maternal age (although there was a trend that mothers of infants

with DS were older than TD infants) and education, whether infant was firstborn or not, nor in relation to feeding preferences (bottle or breast).

For the DS sample, the study was only publicised to those families who contacted the organisation, and therefore, the sample is reflective of those who sought support from this service in the early months. It is possible that families of those infants with DS who had very complex needs, perhaps those still hospitalised due to medical complications may not have sought service support. Also, families may not have sought service support, due perhaps, to initial coping strategies. It is also possible that families who were coping particularly well, perhaps with newborns with DS who may be considered high functioning, did not seek service support for that very reason. Therefore, it is possible that the sample in the current study is not reflective of the wider DS population. However, the Director of Down Syndrome Education International reported on this point, “as far as we can tell, families who contact us when their babies are born are a complete cross-section of the population...We certainly see the whole range of ability at our early intervention service there is no evidence we have unusually able children” (Buckley, personal communication, 2011).

The recruitment process used was similar to many others (for those who reported their recruitment process). Jasnow, Crown, Feldstein, Taylor, Beebe & Jaffe (1988) for example, recruited nine, CA matched 3½-month-old infants with Down syndrome and 9 infants with typical development. For their DS sample, recruitment was carried out via community groups that provided services for infants with DS (as well as media advertising). For their typical sample, notices were placed in parent-child newsletters. Berger and Cunningham (1981; 1983; 1986) recruited their DS sample via contacting medical centres and approaching those attending clinics, and similarly, Gartstein, Marmion and Swanson (2006). Others recruited participants with DS from attendees of centre-based programmes of Portage and other family support services (e.g. Brooks-Gunn & Lewis, 1984; Zickler, Morrow and Bull, 1998). It is

possible that through this recruitment approach, those infants with DS who do not access support services or clinics are not accessed. Thus, the current research, and that conducted by others, may not be reflective of the true DS population. However, given the similarities in recruitment methods, it is possible for researchers to compare across studies.

It should be noted that there is also a potential sampling bias for the typical population. Mothers tend to participate in research studies with their young infants if they are coping well, feeling confident and under control with their new situation. Therefore, those families who may be feeling less positive at this time are arguably, less likely to participate. Furthermore it is possible that the mothers who agreed to participate were not reflective of the population in relation to, for example, their financial, education, and family situation. All mothers in the current research were married for example, which is not the case in British society. This type of 'self-selection' sample bias is a potential problem for studies of the sort. Generalising findings to the wider population should be taken with these potential issues in mind.

Statistical analyses

The majority of analyses throughout the research yielded non-significant and marginally significant results. That is, in the main, only a few statistical differences were identified between the groups of 4-month-old infants with DS and 4-month-old typically developing infants on the variables measured.

From this, one could conclude that at 4 months of age, infants with and without DS are comparable in the areas of socioemotional functioning that were measured here. This conclusion is potentially valid as others do report similar findings (e.g. Carvajel & Iglesias, 2000; and see Fidler, 2005). Yet, it is possible that these findings (and perhaps those of others who report similar) may be a consequence of decisions taken in research design and data

analyses. The sample of infants participating in the research was small (however comparable to others in the field; e.g. Berger & Cunningham, 1981, 1983, 1986; Carvajel & Iglesias, 1997; 2000 ; Moore et al, 2008). Conducting research with small sample sizes runs a risk of making Type-II errors; that is, not identifying significant differences when in fact, they do exist, and would be identified if the sample size was increased. As discussed in Chapter 1, I took steps to limit the chance of making Type-II errors by running a power analyses to determine how many participants I would require to detect statistical significance at an alpha level of $p < 0.05$, and small to moderate effect sizes. The experimental designs of both the dyadic and triadic studies had a repeated measures element, a known advantage in strengthening the power of a study when dealing with small samples (see Bakeman & McArthur, 1998). Bakeman (2005) developed a statistical software programme that enables researchers to calculate power analyses for between-within designs that may have a variety of levels. As evidenced in the BW-power calculation in Chapter 1 (Table 1.1), for a between-within (with 2 levels) design, I calculated that I would have sufficient power with 22 cases. During the recruitment process, I managed to recruit 13 TD infant-mother pairs, and 10 DS infant-mother pairs; a total of 24 cases. Thus, with this number of participants sufficient power was possible. As part of my progression as a researcher, I came to realise that recruitment numbers and the actual total of participants' data that can ultimately be used for analyses is not the same. This is particularly so when working with young infants. I encountered technical hitches with video equipment (one camera videoing the close up of an infant, would sometimes, without explanation, stop functioning). I also encountered infants who were unable to complete a sufficient number of trials due to 'fussiness' to include in analyses. Thus, whilst my initial sample would produce sufficient power, some analyses used a reduced sample size. This may have negatively impacted the power of the analyses.

For this reason, it is possible that there was insufficient power in some analyses to detect significant differences and small enough effects. On the converse then, with this argument, where close to significance and significant effects were found then could this mean that when generalising to the wider population, these effects would be greatly increased? The process of addressing this would be to replicate with larger samples. Cohen (1990) discussed how replication is so rarely carried out in psychological research, yet, is necessary in order to make findings robust. Yet, raising the issue of significant findings, and those found to be close to significance, another question is raised. Are these findings a result of a Type-I error, finding statistically significant effects when there are none.

As discussed in Chapter 1, Type-I errors can occur through multiple testing on the same data. Increasing the number of tests, increases the chance of finding a significant effect purely by chance. In the triadic study, I ran a number of tests on one set of observational data. One could argue that the same data was not tested several times, as gaze data could be interpreted as a separate data set as, for example, mouth movements. Yet, it is given that I did run tests on several variables that related to group and so potentially had a ‘multiple-test problem’ (Cohen, 1990). In chapter 1 I discussed the rationale behind the decision not to use Bonferroni adjustments in order to control for Type-I errors. This decision was led by the recommendations of Cohen (1990) and Bakeman & Quera (in press), who take the stance that the Bonferroni adjustment should be used very cautiously (and see Wilkinson and the Task Force for Statistical Inference, 1999). If I had made Bonferroni adjustments, then (as the same statisticians confirm) a statistically significant finding would almost never be found.

So how might we decide which findings are ‘true’ and which are not, which findings may be a result perhaps of insufficient power, and others that may be a result of multiple testing and only exist due to chance? One answer, as recommended by Saville (1990) and the previous researchers mentioned in this part of the discussion, is to look at patterns of results.

With this argument in mind, the pattern of results throughout the thesis falls more heavily towards, rather than away from, a lack of differences between groups. At 4 months of age, infants with DS may be more similar than different to TD infants in relation to the aspects of socioemotional functioning I examined.

Through my research progression, I have increased knowledge of statistical methods and debates. An aim in future similar research would be to strengthen power and reduce any potential effect of multiple testing. Yet, the reality of having a large sample and testing, for example, just one variable when conducting infancy research is unlikely; studying infant emotions and social behaviour is rarely straightforward. As Cohen (1990) discussed, research with small samples may raise statistical questions, but through strengthening experimental design, informing the reader, and by replication and considered understanding, the contribution to knowledge is valuable.

To new mothers of infants with Down syndrome.

The key messages from this thesis are that in relation to positive emotionality in dyadic interaction, and communicative behaviours in triadic interactions, 4-month-old infants with Down syndrome may be at the least, comparable to typically developing infants and may well have areas of strength. It is possible that very young infants with Down syndrome are more open to maintaining prolonged social interactions with a social partner at this age, and are less fussy than typically developing infants. With all the measures used, infants with Down syndrome appeared equally as happy as typically developing infants when in social interaction, with contingent and easy to observe smiles, positive vocalisations and having an ability to share in mutual gaze. Infants with Down syndrome were also able to shift their gaze, possibly to enable, as is the case for typically developing infants, the time to regulate emotions and take some time in disengagement.

It is hoped that the findings from this thesis will contribute to knowledge about the affect of Down syndrome in the early months, and that mothers and family members will feel reassured about aspects of their infant's development. Following the arrival of a new baby, mothers are naturally sensitive to whether their infant is developing healthily, strong and comparably to other babies. Mothers take pleasure from seeing their baby thriving and developing, and often enjoy hearing from others how wonderful their infants are. When an infant is born with Down syndrome, new mothers have to re-evaluate their expectations for their infant, and the pleasure and pride that normally occurs with the arrival of a new baby may be dampened. The birth, and early weeks may be difficult. Infants with Down syndrome may have required early medical interventions, and mother and infant is immediately entered into an environment of appointments for physio-, occupational, and speech and language therapists for example, alongside other early interventions already dominating their daily life.

Whilst not devaluing the importance of these early interventions, it is arguably beneficial for mothers of infants with Down syndrome to be informed of the potential strengths their baby may have, rather than focusing solely on deficits. In practical terms, I would recommend that mothers take time with their infant in face-to-face play, in order to best enable their infant to maximise their learning at this time. Increasing positive interactions at this early age could have lasting benefits to the long term social and emotional development of the infant.

The implication of the findings from this thesis in relation to the Down syndrome population is that rather than identifying the negative impact of the disability, there is recognition of how, with regard early socioemotional development, very young infants with Down syndrome are likely similar to the typical population, and in fact, may have aspects of less negative and more positive emotion. The importance of this cannot be underestimated for those families (and educators, health professionals and carers) involved with Down

syndrome. Rather than emphasising difference, recognition of sameness promotes an inclusive attitude to enable those with Down syndrome to integrate and develop within a positive environment. This can only benefit the developmental process.

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Appendix A

Peekaboo study Coding Scheme (Draft)

Infant:

1. Gaze = g

Key	Code	Description
f	Face	Infant looks to experimenter or mother's face
h	Hands	Infant looks to experimenter or mother's hands
s	Self	Infant looks at own self
e	Elsewhere	Infant looks elsewhere
c	Can't see	Infant gaze unclear

Gaze Coding Guidance:

- The code 'elsewhere' should be used only when the infant makes no looks towards partner or self during a specific .5 sec interval.
- If the infant looks at partner or self during a .5 second interval, the relevant code is to be used. This is true even if the majority of the interval is spent looking elsewhere.
- The code 'can't see' should only be used in the event that the infant's gaze cannot be observed at all in any one particular interval.
- If there is an instance where the infant gazes at two or more target codes during the interval, then the correct code to use would be that which the infant turns gaze to.
[Example: at the beginning of an interval the infant is gazing at mother's face, then changes gaze to her hands} In this instance, the interval is coded as 'gaze to hands'.

2. Vocalisations = v

Key	Code	Description
l	Laugh, giggle	Infant makes a definitive positive emotional vocalisation that is readily identifiable as a laugh or giggle
p	Protoconversational voc	Infant makes vocalisations that have a conversational-like purpose
c	Cry, Whinge, whimper	Negative emotional vocalisation
o	Other vocalisation	Those vocalisations which do not fit any other criteria
n	None	No vocalisations

Vocalisations Coding Guidance:

- Vocalisations that can be readily identified as positive emotional expression (giggle, laughter), as conversational, or as negative emotional expression (whinge, whimpers, cries) should be coded 'l', 'p', 'c' respectively.
- Any vocalisations that cannot be identified as communicative (e.g. hiccups) should be coded as 'o' (other).
- Where no vocalisations are made, the code 'n' is used.

3. Mouth movements = m

Key	Code	Description
y	yes	Infant makes mouth movements (of FACS intensity C or over)
n	no	Infant makes no mouth movements over FACS intensity C
c	can't see	Infant's mouth is not visible

Mouth Movement Coding Guidance:

- Any mouth movement considered FACS intensity C or over within an interval leads to the interval being coded as 'y'.
- Smaller movements are not recorded
- In most instances, even if the mouth cannot be seen, it will be apparent from the surrounding areas of the face whether the mouth is moving equal to FACS intensity C or over.

4. Left upper movement = l

Key	Code	Description
l	large	Infant makes large left upper limb movements
m	medium	Infant makes medium left upper limb movements
s	small	Infant makes small left upper limb movements
n	none	Infant makes no left upper limb movements
c	can't see	The left upper limb is not visible

5. Right upper movement = r

Key	Code	Description
l	large	Infant makes large right upper limb movements
m	medium	Infant makes medium right upper limb movements
s	small	Infant makes small right upper limb movements
n	none	Infant makes no right upper limb movements
c	can't see	The right upper limb is not visible

6. Self comfort – s

Key	Code	Description
l	Self touching left arm	Infant touches self with left arm/hand
r	Self touching right arm	Infant touches self with right arm/hand
b	Both hands self touching	Both hands within one interval touch self
n	none	Infant makes no self comforting touches
u	Unsure	Unsure

6. Left lower movement = e

Key	Code	Description
l	large	Infant makes large left lower limb movements
m	medium	Infant makes medium left lower limb movements
s	small	Infant makes small left lower limb movements
n	none	Infant makes no left lower limb movements
c	can't see	The left lower limb is not visible

7. Right lower movement – i

Key	Code	Description
l	large	Infant makes large right lower limb movements
m	medium	Infant makes medium right lower limb movements
s	small	Infant makes small right lower limb movements
n	none	Infant makes no right lower limb movements
c	can't see	The left lower limb is not visible

Limb Movement Coding Guidance:

- Limb movement is coded through level of activity – large/medium/small/none. It is best to consider the level of activity as the amount of energy the infant uses to make the movement.
- Limb movement incorporates all shoulder, arm, hand and finger movements.
- Levels of movement are hierarchical – with bigger movements taking hierarchy over smaller. So, if the majority of an interval is taken up with small movement, yet there is a brief large movement, the code ‘l’ should be used.
- Small movements are often finger/hand movements although a small movement of the elbow for example, would also be coded as ‘s’. These are characterised as movements where little energy is expended by the infant to make these movements.
- Medium movements often (but not exclusively) include movement of the arm alone or could be accompanied with hand movements. These medium movements are often characterised by medium levels of energy.
- Large movements often (but not exclusively) include shoulder movements with or without elbow and/or hand movements. These large movements are often characterised by levels of high energy.
- If in doubt, use the lesser code – for example, if questioning whether a movement is large or medium, use the medium code ‘m’.
- Even very small movements should be coded as ‘s’ – for example, a finger twitch.
- If movement of the limb can be seen at any point during the interval, then the appropriate code should be used.
- The code can't see, ‘c’, should be used when the limb cannot be seen throughout the interval and the observer is unable to code the interval as ‘l’, ‘m’ or ‘s’.

8. Facial expression

Key	Code	Description
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s	Smile	Infant makes a positive facial expression – smiles
c	Cry face	Infant makes a negative facial expression – cry or whimper face
o	other	Infant has none of the above expressions
c	Can't see	Infant's face is not visible

Facial Expressions Coding Guidance:

- If two expressions are seen within one interval, then the codes are hierarchical with 'smile facial expressions taking priority over other codes, 'cry face, down to 'other' and 'can't see'.
Example: the infant makes a cry face followed by a smile. The code 's' would be used in this instance to indicate that the interval contained a positive facial expression. If no smile had occurred in this example, then the code 'c' would be used.
- The code 'c' should only be used if no other code is possible for the infant. If the infant's face is not visible for the majority of an interval but there is a moment where the observer sees the infant is showing a smile, than the code 's' should be used.

8. Emotional engagement

Key	Code	Description
e	Excitement	Infant's eyes are wide, intently focused, and facial muscle tone is increased. Body movements may be increased.
s	Surprise	Infant jumps with surprise – eyes shut tight, body flinches, then could be followed by surprised facial expression
j	Joy (full)	High pleasure – big smiles, laughter, may be accompanied with body movement increase
p	Pleasure (mild)	Mild pleasure – small smiles, calm body
a	Attentive	Infant is definitively attentive, highly focused towards the play partner
e	Mildly interested	Infant is engaged with partner, yet mildly observing, not emotionally charged
c	Not interested	Infant is not showing any interest in play partner
n	Negative	Infant is upset, distressed, fussy
u	Unsure	Unclear due to visibility

PEEKABOO STYLE:

Each peekaboo frame (preparatory to hide to reveal to exchange) identified from start to end.

Code:

P - preparatory

Start – partner begins to vocalise (maybe "I'm going to hide away", or "1,2,3") – preparatory with aim to engage baby in anticipation of game.

Preparatory style

Key	Code	Description
e	excited	High energy
s	calming	Partner plays boo, but in a soft, calming reassuring manner.
a	average	Neither particularly calmingly or excitedly
o	other	Other
n	None	No preparatory phase

Hide = H

Key	Code	Description
p	Partner hides	Partner hides own face behind hands
b	Baby hidden	Partner hides baby's face behind partner's or baby's hands
n	No hide	Partner doesn't actually hide either baby or self away
u	Unsure	Unclear due to visibility

Maybe accompanied with vocalisations of type “where am I”,

Reveal = R

Key	Code	Description
r	reveal	Partner or baby's face revealed

Maybe accompanied with vocalisations of “here I am”, “peekaboo”, “boo”

Reveal style:

Key	Code	Description
e	excited	High energy
s	soft	Partner plays boo, but in a soft, calming reassuring manner.
a	average	Neither soft or excitedly
o	other	Other

Exchange (when partner and baby have opportunity to exchange about the peekaboo event)

Exchange style: ???????

Key	Code	Description
e	excited Baby and mum not engaged together	High energy, high pleasure exchange
a	Engaged but no average	
o	other	Other

OVERALL RATING – think about whole trial.

How much pleasure did partner feel? Likert

How much pleasure did baby feel? Likert

How rhythmic was the game?

How irregular was the game?

Coding Scheme: Play partner

1. Infant touching = t

Key	Code	Description
c	Calming	Partner touches infant in a caressing manner
j	Jigging	Partner jiggles infant (often legs)
t	Tickling	Partner tickles infant
o	Other touching	e.g. Sitting baby back up, no clear engaging purpose
	No touching	
	Firm touching??	Partner firmly touches baby – (See DS baby)
c	Can't see	

Facial expressions:

Fixed wide eyed, open mouth

Smile

Pout

Neutral

Other

Can't see

Vocalisations: Don't want to do every vocalisation so.....

Emotion: Empathy, Excitement, High pleasure, Mild pleasure, Neutral, Negative