

An Exploratory Analysis of 4-Month-Old Infants' Behaviours Towards Picture Books in the Bookstart Programme Context

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Abstract

Infant behaviours were observed for 261, 4-month-old infants when they attended the Bookstart programme. Infant behaviours in this context were analysed in relation to child characteristics, such as gender, temperament, and birth order, and also in relation to the infant's home book-reading environment (i.e., frequency of parental book reading and parental attitudes toward books). Gender differences were found in infants' looking behaviours in the Bookstart programme context. When infant gender, birth order, and parents' familiarity with the Bookstart programme were controlled for, relationships were also found between the way infants attended to the book that was displayed and read by a reader in this study and infant temperament, and frequency of book reading experience in the home. The implications of early individual differences in the book-related behaviours observed in this study's context are discussed in relation to infant attention development and how early picture book related behaviour might affect the overall development of emergent literacy.

Keywords: book reading, early literacy, attention, temperament

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Shared Book Reading As a Means of Early Parent-Child Interaction

Shared book reading has been advocated as an important child rearing practice, and it is believed that such activities will benefit language and literacy development. Despite this assumption and research indicating that a history of early book sharing is correlated with language and literacy development (e.g., Debaryshe, 1993; Snow & Goldfield, 1983), reviews of scientific studies suggest that sharing books with very young children is by no means a universal practice (van Kleeck, Stahl, & Bauer, 2003). According to a review (Sulzby & Teale, 1991), book-sharing is a transactional process through which two parties interact and influence one another through the book. A transactional model suggests that book sharing is mediated by individual factors, such as the young infant's temperament (Kegan & Snidman, 2004) and the patterns of interactions that provide the basis for affective relationships that become established between an infant and caregivers, primarily the parents (Pellegrini & Galda, 2003). Studies on joint book reading have revealed that there are different patterns in such interactions across social groups and situations, and that these patterns change with the developmental timeline (Hoff-Ginsberg, 1991; Sulzby & Teale, 1991).

Fletcher & Reese (2005) reviewed research on joint book reading with children between birth and 3 years of age, noting that most of the research on shared book reading, to date, had focused on children between 3 and 5 years of age, not on infants and toddlers. If book-sharing is indeed transactional, infants' dispositions would likely influence the ways in which caregivers interact with their very young babies. The few existing studies that examined the affective quality of the relationship during shared book reading found that the infant's attention to the book and referencing behaviours, as well as maternal negative feedback and monitoring behaviours, differed with the quality of the attachment (e.g. Bus & van IJzendoorn, 1997). Their findings with 10- to 15-month-old infants suggest that the infant's book-sharing behaviours are sensitive to the affective dimensions of the parent-child relationship. In addition to effects related to the quality of the attachment relationship, Fletcher and Reese (2005) suggest that infant individual characteristic, such as temperament and attention, may also influence the baby's book sharing behaviour. Thus, these are important factors to examine through research, especially during the earliest months of infancy, when they would be expected to begin to exert an effect.

Early experiences with books may impact developmental outcomes for later reading behaviours. For example, early childhood education and care initiated in the UK encourage early communication through book-gifting campaigns, such as the Bookstart early reading intervention programme¹. The effectiveness of this campaign has been evaluated in terms of changes in parental attitudes toward book-sharing activities and the development of children's abilities in literacy and mathematics in their first year in school (Wade & Moore, 1998, 2000). Nevertheless, little has been reported on the interactional processes with respect to the infants' behaviours in such programmes. Given that infants are capable of gaze processing (Farroni, Massaccesi, Menon, & Johnson, 2007; Farroni, Massaccesi, Pividori, & Johnson, 2004; Farroni, Menon, & Johnson, 2006) and in identifying interactional contingency at very early ages (Tronick, Als, Adamson, Wise, & Brazelton, 1978), it is important to investigate how young infants behave during book-reading activities.

To uncover the effects of these early book sharing experiences with an adult on later language and literacy development, it is also important to understand how infants' social and perceptual competence contributes to forming the social contexts within which book sharing takes place. A transactional model assumes that early parent-child interactions are shaped by both the child's and the adult's behaviours. Particularly where pre-verbal infants are concerned, adults may play an important part in facilitating young children's behaviours and communicative interactions (Kaye, 1982; Snow, 1977). Knowledge about infant behaviour in social contexts could help parents better understand how they can best facilitate early book-sharing experiences.

Individual Differences in Infant Temperament and Behaviours

An investigation of very young infants' behaviour toward picture books is also important because early individual characteristics, if any, may affect subsequent behaviours of the adults who interact with and create a book-reading environment for infants. Individual differences in infant book-related behaviours are likely to be found, as individual differences in temperamental characteristics and attention are evident in early infancy, and appear to be

¹ Bookstart is a book-gifting programme for babies. In Japan, this one-off intervention programme involves a book-reading session to babies as young as 4 months-old, while their parents observe their babies closely. In so doing, it is hoped that their parents will recognize the importance of early book-sharing as a means of communication.

correlated (McConnel & Bryson, 2005; Vaughan et al., 2003).

It is well known that very young infants attend selectively to patterned stimuli, showing a preference for those with high contrast, such as bull's-eyes (Fantz & Nevis, 1967). Infants also have a sophisticated ability to acquire knowledge about physical objects, from both observing how objects typically behave (e.g., Baillargeon, 1995) and from manipulating objects in their hands, and looking at and mouthing them (e.g., (Rochat, 1989). Research also indicates that early attentional behaviours appear to show individual differences (Ruff & Rothbart, 1996). Furthermore, Moss, Colombo, Mitchell and Horowitz (1988), as well as Barten and Ronch (1971), found relationships between newborn behaviour, measured by arousal level and tolerance or reactivity to aversive stimuli (i.e. temperament), and the duration of attentional gaze a few months later. Thus, it is possible to identify individual differences in early attentiveness in a naturalistic environment when infants are just a few months old, and then determine whether these differences are related to infants' dispositional reactive behaviour (i.e., temperament) in specific contexts within the environment.

Temperament refers to the infant's emotional responses to novel stimuli, as measured through behavioural and/or physiological means (Rothbart & Derryberry, 1981). Infant temperament, using the Infant Behaviour Questionnaire (Rothbart, 1981), which codes behavioural reactivity, was consistent during the first year of life (Rothbart, 1981, 1986). These studies found that the infants rated as highly fearful showed more negative aspects of initiating joint attention, whereas those who had higher maternal ratings of pleasure showed more positive aspects of initiating joint attention. This result suggests that there is a relationship between temperament and joint attention development during infancy. More direct evidence was reported in a study that found a relationship between infant temperament, in conjunction with maternal behaviour, and infant attentional performance (Miceli, Whtman, Borkowski, Braungart-Rieker, & Mitchell, 1998). This research is consistent with the suggestion by Vaughan et al. (2003) that infant temperament plays a part in the development of joint attention during the period from 9 to 12 months of age.

A recent investigation into the effect of book-sharing activity (Karrass & Braungart-Rieker, 2005) indicates that parental reports of the presence or absence of shared reading in the home at 8 months, but not 4 months, was related to child language at 12 and 16 months. It has also been suggested that these relationships may be dependent on both the infant's and the parent's

gender. It is also possible that not only infant temperament, but also gender and birth order, influence whether parents provide a book-reading environment at home (Fletcher & Reese, 2005; Senechal, Cornell, & Broda, 1995). Especially when infants are young, parental behaviour may be driven by the infant's temperamental characteristics (e.g., Sroufe, 1985). In addition, having older siblings could create book-sharing experiences that are qualitatively and quantitatively different from those for infants who do not have older siblings (van Kleeck & Beckley-McCall, 2002).

This study investigated the relationship between 4-month-old infants' ability to attend to a picture book that was displayed in front of, and read to, them, and infants' early dispositions (i.e., temperament) and home book-reading activities. The study had three objectives: (1) To explore infant behaviours during a book activity that was part of the Bookstart programme; (2) to examine relationships between the infants' behaviours observed in the book session and environmental factors, such as how frequently parents read to their children at home, and how much they enjoyed this activity, which explores the extent to which infants experienced book-sharing activity; and (3) to investigate relationships between infants' behaviours and their temperamental characteristics (i.e., level of activity and reactions to novel environments). Because infants' gender and birth order might also influence infant behaviour and temperamental characteristics, these variables were also examined in our analyses.

Young infants' reactions to a book shown and read during a Bookstart programme session were of particular interest, given that experimental studies have revealed their rudimentary competence in visual and social processing. We expected infants of 4 months of age to show observable behavioural characteristics during shared reading.

Method

Participants

Participants included infant-mother dyads that visited a local health centre in a western city of Japan for their babies' 4-month health check-up. In this city, all 4-month-old babies receive a health check-up together with Bookstart programme book sessions as advocated by the

Booktrust in the UK. Each month nearly 80 babies who had become 4 months old attended the session with their parents. This setting was chosen for the study because a large number of infants could be accessed under similar book-related sessions. This suburban city is dominated by middle-class households. All mothers were native speakers of Japanese. Six dyads, from an original 267, did not complete the sessions because the infants became upset during the book-sharing activity ($N = 5$) or a parent did not fill out the questionnaire ($N = 1$). Therefore, these six sets of data were eliminated from the analysis, leaving 261, 4-month-old infants (132 boys, 129 girls, age range: 120–149 days) and their mothers as participants in the study.

Data Collection

Book Session Data Collection Procedure. Data collection for infant behaviour observation during a Bookstart programme book session was carried out over a one-year period at the community health centre. The mother-infant dyads were invited to participate in the study when they came to the health check-up, and informed consents were obtained from the mothers. During the course of the health check-up, each infant-parent pair was introduced to the Bookstart session through a demonstration in a quiet room, which was set-up to accommodate four or five mother-infant dyads with private spaces between them. This is a common practice to introduce Bookstart programmes in this city for 4-month-old infants and more than 48% of local authorities implement the Bookstart programme at the 4- or 10 month health check-up. Each dyad was guided to a seat facing a demonstrator, who was trained to read a book to babies to promote Bookstart sessions. There were four or five volunteers who accommodated the mother-infant dyads.

During the Bookstart session, the infant sat on its mother's lap facing one of the volunteers who read the picture book to the infant. Infant behaviours during this session, which lasted approximately 2 minutes, were observed and coded into the following seven categories, which were not mutually exclusive: (1) gaze at the reader; (2) reach for or touch the picture book; (3) turn a page; (4) rhythmic body movement; (5) vocalise; (6) intensely look at a part of a page for more than 3 seconds (focused look); and (7) exploratory look across the page. These categories were considered possible for coding, based on a pilot study that involved preliminary observations of the Bookstart programme book sessions. From the preliminary

observations, commonly occurring infant behaviours related to the book sessions were selected. Operational definitions for these categories are provided in Appendix A.

One observer coded all infant behaviours. In order to check the coder's reliability, 10% of the book-sharing sessions were video recorded, to allow their coding by a second, independent coder.

All infants were shown the same picture book during the session. The distance between the book and baby's face was approximately 30 cm. The picture book consisted of 13 double pages. Each double page was themed with a different background colour. The book began with a cat that went for a walk. The cat met other animals, one at a time, on each double page. For each double page, the volunteers read a sentence that illustrated the movement of the animal and used onomatopoeias in a soft voice. When the infant showed behaviours that met the definitions of the categories at least once for each double page, they were recorded as 'observed'. Thus, the quantitative data score for each category could range from 0 to 13.

Parental Questionnaire on Infant Temperament and Book Sharing at Home. After the observation, the mothers were asked by the observer to fill out the questionnaires about their infant's behaviour at home. The questions asking about the infant's temperamental nature (i.e., activity level, emotionality, adaptability, and reactivity) were drawn from the Japanese version of the Infant Behaviour Questionnaire (Rothbart & Derryberry, 1981), and adapted to fit the behaviour repertoires of the 4-month-old infant. The number of the questions was kept to a minimum to allow the mothers to complete the questionnaire in a short period of time during the health check-up session.

All questions related to how often the mother observed the described behaviours in her infant within the span of the preceding seven days. Additionally, other questions asked about the frequency of book-sharing experiences at home (*none, sometimes, a few times a week, and everyday*), and the mother's prior experience and knowledge of Bookstart (see Appendix B).

Data Analysis

Both the coded infant behaviours and the parental responses to the questionnaires were quantified to create the data set. The Cohen's kappa (Cohen, 1960) was calculated for each

category of behaviour observed in the 10% of the sessions that were video taped for viewing by a second coder. The mean index was $k = .71$ (range was between .68 and .77). For data reduction, principal component analyses (PCAs) were carried out for the parental questionnaires regarding infant temperament.

Results

Infants' Book Session Behaviours. The proportion of infants who exhibited behaviour from each category at least once during a book-session was calculated. More than 50% of the infants showed behaviours that met the categories of 'focused look' (94%), 'exploratory look across the page' (77%), and 'gaze at the reader' (79%). However, less than 50% of the infants were observed to 'vocalise' (17%), 'reach for or touch the picture book' (28%), 'turn a page' (10%), or engage in 'rhythmic body movement' (48%). Descriptive statistics for these frequency behaviours are provided in Table 1.

Table 1. *Descriptive Statistics for the Occurrences of Infant Behaviour during the Book-sharing Session and Summary of Independent-sample t-tests between Boys and Girls*

Variables	Boys ($n = 132$)		Girls ($n = 129$)		$t(259)$	p
	M	SD	M	SD		
Gaze at the reader	3.51	3.45	3.60	3.42	0.21	0.83
Reach for or touch the picture book	1.54	3.22	1.80	3.60	0.62	0.54
Turn a page	0.36	1.60	0.36	1.18	0.00	1.00
Rhythmic body movement	2.55	3.54	1.61	2.66	2.43	0.02
Vocalise	0.64	1.61	0.26	0.77	2.44	0.02
Focused look	5.96	3.85	5.60	3.38	0.81	0.42
Exploratory look across the page	4.75	4.24	4.60	3.74	0.29	0.77

The observation categories were also examined for sex differences. 'Vocalise' and 'rhythmic body movement' were observed more frequently in boys than in girls: $t(259) = 2.43$, $p = .002$, $d = .30$. In no other categories did behaviour differ significantly between boys and girls. There were also no birth-order effects for any of the observation behaviour

categories.

Correlation analyses indicated that 'exploratory look across the page' and 'focused look' were related negatively: $r = -.60, p < .0001$, while turning pages and touching the pages were related positively: $r = .38, p < .0001$.

When correlations were examined separately by sex, these two significant correlations, one negative and one positive, held for both sexes: different types of looking: $r = -.63, p < .0001$ for boys and $r = -.57, p < .0001$ for girls, and 'turn a page' and 'reach for or touch the picture book': $r = .26, p < .001$ for boys and $r = .55, p < .0001$ for girls. Additionally, there was a positive correlation between 'gaze at the reader' and 'turn a page': $r = .18, p < .05$, and a negative correlation between 'gaze at the reader' and 'focused look': $r = -.20, p < .05$, but only for girls

Infant Temperament Characteristics and Book-reading Environment at Home.

Parental responses to the questionnaire for infant temperament and book-reading environment at home were analysed. To reduce multivariate data for the temperament characteristics, a Principal Component Analysis was carried out first. The results are given in Table 2. Three components were obtained: (1) 'negative emotionality and difficulty of soothing', (2) 'positive emotionality and activity level', and (3) 'high reactivity', respectively. Infants who scored high in 'negative emotionality and difficulty of soothing' became easily upset during everyday routines, such as feeding and getting dressed, and once upset, were hard to soothe. The infants were also less adaptable and more nervous in response to novel stimuli and/or new environments. In contrast, infants who scored high in 'positive emotionality and activity level' tended to be very active and cheerful during everyday routines.

Table 3 gives descriptive statistics for temperamental components and the book-reading environment as a function of sex and birth-order groups.

There were no sex differences for temperament components: $t(259) = .97, p > .1$ for 'negative emotionality and difficulty of soothing', $t(259) = 1.16, p > .1$ for 'positive emotionality and activity level', and $t(259) = .50, p > .1$ for 'high reactivity'. As for the book-reading environment, there were no sex differences: $t(259) = .60, p > .1$ for 'recognition of Bookstart programme', $t(259) = 1.17, p > .1$ for 'like reading', and $t(259) = .28, p > .1$ for 'reading books to child'.

Table 2. *Factor Loading for the Temperamental Components*

Infants' temperament	Components		
	I	II	III
Difficulty of soothing	.714	-.103	-.143
Negative emotionality (1) ^a	.698	.169	-.109
Negative emotionality (2) ^b	.681	-.001	-.062
Positive emotionality	-.170	.636	-.095
Activity level	.210	.633	-.252
Difficulty to adapt	.367	-.177	.714
Reaction to novelty	-.007	.562	.622
Eigenvalues	1.669	1.192	1.005
(%)	23.845	17.032	14.355

Note. Extracting method: Principal Component Analysis.

Component I: 'negative emotionality and difficulty of soothing'

Component II: 'positive emotionality and activity level'

Component III: 'high reactivity'

^awhen infants are changed; ^bwhen infants are fed

Table 3. *Descriptive Statistics for Temperamental Component Scores and Home Book-reading Environment as a Function of Birth Order*

Birth-order* ^a	First-born (<i>n</i> = 107)		Later-born (<i>n</i> = 153)		<i>t</i> (258)	<i>p</i>
Variables	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Temperamental components* ^b						
negative emotionality and difficulty of soothing	.01	.98	.01	1.01	.03	.98
positive emotionality and activity level	.05	.98	-.04	1.02	.69	.49
high reactivity score	-.57	.90	.40	.86	8.84	< .0001
Home book-reading environment* ^c						
like reading books	3.08	.73	3.03	.70	.56	.575
reading books to child	2.35	1.15	3.42	.82	8.30	< .0001

Note. ^ano record of one child's birth order, ^bprincipal component scores, ^cLikert-scale (0–4) raw scores

The possibility of a birth-order effect for these components was examined by comparing infants who were an only child with those having older siblings. There were significant birth-order effects for 'negative emotionality and difficulty of soothing' : $t(258) = 8.84, p < .0001, d = 1.11$ and 'reading books to child' : $t(258) = 8.30, p = .002, d = 1.08$, with later-born infants perceived as less negative emotionally and less difficult to soothe. Later born infants were also read to more often than first-born infants by their parents.

There were significant intercorrelations between the home book reading environment and variables related to 'Bookstart recognition' (e.g., 'like reading books', 'reading books to child', and 'birth order'), as indicated in Table 4. As some of the variables violated normal distribution, Spearman's rho was applied to test correlations. Intercorrelations between these variables for boys and girls were similar except for a significant correlation between the 'Bookstart recognition' and 'like reading' for girls. Parents who had more than two children tended to recognize the Bookstart programme more than parents of first-born infants. The later-born infants also received more frequent book-sharing sessions at home from their parents. There was also a correlation between the 'Bookstart recognition' and 'reading books to child' items, suggesting that parents who recognise the Bookstart programme tend to read to their children more often.

Table 4. *Spearman's Rank-order Correlation Coefficients between Birth Order and Home Book-reading Environment as a Function of Infant Sex*

Measure	1	2	3	4
1. Birth-order group	-	.429**	.032	.548**
2. Recognition of Bookstart programme	.383**	-	.177*	.366**
3. Like reading books	-.087	.084	-	.209*
4. Reading books to child	.407**	.353**	.018	-

Note. Intercorrelations for girls ($n = 129$) are presented above the diagonal (1,1 to 4,4) in the top right hand side of the table. Intercorrelations for boys ($n = 132$) are presented below the diagonal in the bottom left hand side of the table.

Relationships between Infant Bookstart Behaviours, Book-reading Environment, and Temperament. Infants' book-session behaviours were examined in relation to infant temperament items and book-reading environment at home, taking into account the infant's

gender and birth order. Birth-order effects were found for temperament and book-reading environment at home. Correlational analyses were performed controlling for the birth-order effect (1 = first-born, 2 = later-born), infant sex (1 = boys, 2 = girls), and recognition of Bookstart programme (1 = no, 2 = yes). Correlational coefficients between Bookstart behaviours and book-reading environment at home, and temperament, are given in Table 5. Albeit small, there were significant or near-significant correlations between infant looking behaviours in the Bookstart session and the book-reading environment at home, and infant temperament characteristics. Specifically, infants who showed more focused looking in the Bookstart session received fewer book-sharing sessions at home, and infants who were perceived by their parents as highly reactive to novel stimuli tended to show more focused looking, whereas those infants who were perceived as less highly reactive tended to show more exploratory looking behaviours toward the book.

Table 5. *Partial Correlation Coefficients between Infant Book-sharing Behaviours, Home Book-reading Environment, and Temperament, Controlling for Infant Sex, Birth Order, and Recognition of Bookstart Programme*

	Like reading books	Reading books to child	Negative emotion & difficulty of soothing	Positive emotional ity & activity	High reactivity
Gaze at the reader	.027	.019	.037	.110	-.013
Reach for or touch the picture book	.006	.073	.023	.098	-.016
Turn a page	-.028	.040	.029	.016	-.076
Rhythmic body movement	.031	.052	.107	.142	.045
Vocalise	.027	.007	-.047	.012	.044
Focused look	.008	-.149*	.065	-.050	.191**
Exploratory look across the page	.064	.100	-.002	-.009	-.108 ^a

Note. ** $p < .01$, * $p < .05$, ^a $p = .085$

Discussion

In summary, this study found that 4-month-old infants showed different styles of attentional looking at a book when they were read to in the Bookstart programme. Moreover, these individual differences were correlated to both temperament and the book-reading environment at home. Infant sex and birth-order effects were also found relative to the home book-reading environment.

Young Infants' Book Session Behaviours. Of the seven categories of behaviour observed during the Bookstart session, the most frequent behaviours were attention to the book and to the reader. The results indicate that infants as young as 4 months of age can show basic attention to the reader and/or a picture book when they are directly facing the book and the reader.

Studies that have examined early interactions with infants in different settings identify the special features of book-sharing compared with toy play. For example, parents label objects more frequently with a book (Ninio & Bruner, 1978) and their utterances include higher levels of linguistic abstraction, compared to other contexts (Crain-Thoreson, Dahlin, & Powell, 2001; Ninio, 1980). As Fletcher and Reese (2005) put it, book-sharing activities can be supportive of “parental efforts to guide their children’s attention and participation” (p. 66).

Based on the intercorrelations, infants who engaged in more exploratory looking during the Bookstart book session tended to show less focused looking at the book. It appears that infants differed in how they attended to/engaged with the book, perceptually, even for the brief period of time they were observed in the study context.

In the Bookstart session, the behaviours ‘vocalise’ and ‘rhythmic body movement’ were observed more frequently in boys than in girls. The increased level of rhythmic body movement in the boys supports the finding for sex differences in infant motor activity level in a meta-analysis, suggesting that such a sex difference was considered as trait-like and emerges early in development (Campbell & Eaton, 1999). On the other hand, the current result for increased ‘vocalise’ behaviour in boys is at odds with general findings for greater vocalisation for girls (e.g., Kagan, 1969). The present study also failed to find sex differences in the temperament component of ‘positive emotionality and activity level’, which may be

related to the particular question items used in this study. For example, questions were asked with regard to the infants' typical daily routines, whereas the observations of the Bookstart session involved a non-routine (i.e., not daily) context.

In addition to early sex differences in activity level, sex differences have also been reported in the literature on social perception, emotional expressivity, and self-regulation (Connellan, Baron-Cohen, Wheelwright, Batki, & Ahluwalia, 2000; Weinberg, Tronick, Cohn, & Olson, 1999). In these studies, boys appeared to show higher activity levels, while girls were better than boys in looking at human-like faces, expressing affect to others, and in regulating their emotional states, once distressed.

The findings regarding sex differences from the current study partially support Fletcher and Reese's (2005) hypothesis that gender might affect the parent in the book-sharing context (i.e., may create an extra burden for parents in creating a reading environment for an infant) and, thus, affect book-sharing opportunities. Although studies of book sharing with preschool children report sex differences in interest in and interaction with books (Anderson, Anderson, Lynch, & Shapiro, 2004; Ortiz, Stowe, & Arnold, 2001), such differences may already exist before the preschool years begin. Because these early sex differences in behaviours might affect emerging literacy development, they need more attention. For example, studies might indicate how male infants can best be helped to maximise early book-sharing opportunities.

The observed individual differences in infant exploratory and focused looking behaviours could be related to early development of attention. The attention development literature suggests that infants' looking duration decreases nonlinearly during the first year (e.g., Colombo & Cheatham, 2006). Longer fixation times are assumed to indicate slower information processing (Colombo, 1993; Colombo & Mitchell, 1990). As infants develop during the first year and become more efficient at processing information, their fixation time typically decreases.

For this study, it is reasonable to assume that infants who showed more focused looking were fixating on a particular picture in the book, while infants who showed more exploratory looking were able to move their brief attention between the pictures in the book. Perhaps the characteristics in attentional behaviours reflect individual differences in the development of attention.

Support for this speculation comes from a study by Richards (1987) that found speed of

infant turning away from a central target toward a peripheral one increased from 2 to 6 months of age. In addition, the differences in looking times for 3.5-month-old infants were reported to predict later cognitive development, specifically, that short lookers had better recognition memory at 12 months, compared with long lookers (Courage, Howe, & Squires, 2004). Courage et al. argue that long looking may be due to an immaturity in information processing. Their short-looking infants could be analogous to infants in the current study who engaged in exploratory looking. If this is the case, the infants who showed more exploratory looking may be more advanced developmentally than those who engaged in more fixed looking at the book. Alternatively, as seen in well-documented infant long looking behaviours at an unexpected scene (Kotovskiy & Baillargeon, 2000; Wang, Baillargeon, & Brueckner, 2004), the focused looking infants might have been responding in such a way due to the infants noticing a discrepancy in the illustration compared to their expectancy. However, this observation was made for 7.5 month old infants and it is less likely that a discrepancy from expectations would account for longer looking in 4-month old infants.

An awareness of the development of early attentional ability may be important for caregivers, not just for researchers. Early interactions between a caregiver and young infant involve sharing attention in a face-to-face manner when in close physical proximity. Beyond this well-known context for early interaction, the picture book context enables caregivers to engage in shared experiences with their infants in an additional context. For example, the Bookstart project advocates book-sharing experiences for infants of this age. If the campaign is to have a beneficial effect on parenting, it is crucial to promote parents' understanding of how young infants are able to participate in book-sharing activity in everyday life.

Bookstart Book Behaviours, Book Reading at Home, and Relation to Individual Differences. Parental recognition of the Bookstart programme was related not only to birth order, confirming that parents with more than two children already knew about the Bookstart programme, but also, and more importantly, to how frequently parents read to their children at home. This finding suggests the possible effect of early book-sharing activity on parental attitudes. Although the current study did not provide any longitudinal data about the effect of the Bookstart programme on children's later literacy development, it suggests that such a programme might facilitate parental attitudes toward book reading activities at home.

In both sexes, birth order correlated significantly with the frequency of parents reading to their children at home (i.e., infants with elder siblings were read to more frequently). For female infants, parental preference for book reading was also related to the recognition of Bookstart programmes, although the correlation was small in magnitude. It was not possible in this study to tease out whether Bookstart experiences changed parental preferences for reading books. Given that maternal expectations for shared book reading at the time of a child's birth is one of the predictors for shared reading behaviours (Berkule, Dreyer, Klass, Huberman, Yin, & Mendelsohn, 2008), experiencing a book-sharing session such as Bookstart early in a child's development could motivate parents to engage in book-sharing interactions with their infants. It is also possible that parental attitudes towards shared book-reading varies, depending on the infants' sex, and that such a difference in parental attitudes is linked to the child's interest in booksharing (Ortiz, Stowe, & Arnold, 2001).

Temperament characteristics did not differ between the sexes, but did between only-child and sibling groups. The only-child infants showed more 'negative emotionality and difficulty of soothing' than those who had elder siblings. This result might be due to parental contrast effects (Saudino, Wertz, Gagne, & Chawla, 2004), in which parents rate a child's temperament compared to siblings, which leads to a wider discrepancy than really exists.

Infants who showed more focused looking behaviours were also rated as more highly reactive to novel stimuli and were read books less often at home. In contrast, infants who showed more exploratory looking behaviours were rated as less reactive to novel stimuli. Although these correlations cannot be assumed to involve causal relationships between temperament characteristics, precocious attentional behaviour, and book-sharing activities at home, causal relationships are possible, and it is interesting to speculate about their direction. Given a close relationship between attentional behaviours and infant temperament, which was interwoven with maternal interactional behaviours (Miceli et al., 1998), perhaps parental perception of a specific temperament could lead parent to interact with an infant in a certain way, which is then reflected in the frequency of book-sharing opportunities provided. Attentional orientation may be one of the consequences of variations in book-sharing experiences.

Temperamental characteristics for 'high reactivity' included questions regarding the degree of difficulty in adapting to new environments and the strength of reactions to new stimuli in

the environment. The finding of a relationship between the way infants attended to the book, their temperament characteristics, and home book-reading environment suggests that temperament may be related to how infants allocate their attention.

According to the studies on infant temperament, Rothbart and Derryberry (1981), for example, argue that temperament is related to an individual infant's reactive responses to sensory stimulation, their ability to regulate reactivity through the allocation of attentional resources, and the inhibition of motor behaviours. Thus, the current finding of a relationship between the level of reactivity to novel stimuli and/or environment, and different ways of attending to books, supports Rothbart's model of temperament. Moreover, Ruff and Rothbart (1996) claim that a certain type of attention is important in regulating an infant's temperament reactivity. In this view, early attention plays a crucial role in how infants show temperament in an environment.

Limitations and Future Research

In terms of sample size and the method of approaching infant-parent pairs for their participation, the current study analysed a representative data set of 4-month-old infants. This sample size enabled the examination of book-related behaviours in relation to children's characteristics (temperament, sex, and birth order) and home book-reading environment, and it clarified some of the inconclusive effects of these factors identified in previous studies. However, due to time constraints for accessing the infant-parent pairs during health check-ups, the assessment of temperament was by no means comprehensive. Further studies using a full version of a temperament assessment are needed to clarify the current relationships between attentional behaviours and temperamental characteristics.

Although joint book-reading sessions at the age of 4 months may not have direct effects on later language development (Karrass & Braungart-Rieker, 2005), emerging book-related behaviours shown in this study may become a precursor for developing infant-parent book-sharing interactions that facilitate later development of literacy. To determine whether they do, it is necessary to conduct longitudinal studies.

It is also important to note that the present study examined infant behaviour using one kind of book. Future research will need to address whether infants' behaviours vary depending on

the different features found in different picture books.

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Appendix A

Categories of infants' behaviour and operational definitions

Category	Definition
Gaze at the reader	Infants look at the reader of the book either spontaneously or responding to the reader
Reach for or touch the picture book	Infants reach for the book to touch the page or hold the book but not to turn a page
Turn a page	Infants explicitly turn a page.
Rhythmic body movement	Infants move their legs and/or hands corresponding to book reading
Vocalise	Infants make clear vocalisation (babbling)
Focused look	Infants look at one part of the page for 3 seconds or more.
Exploratory look across the page	Infants look across different parts of the book.

Appendix B

Parental questionnaire on book-reading environment at home and infant's temperamental characteristics

Book-reading environment

- 1) Have you experienced a Bookstart session before?
(yes, no)
- 2) Do you like reading books?
(very much, a little, not so much, not at all)
- 3) How often do you share books with your child (children)?
(everyday, a few time a week, sometimes, never)

Infant's temperamental characteristics

How often have you seen these behaviours in your baby recently?

(almost never, seldom, sometimes, often)

- 4) When you dress or undress your baby, do they move their body actively?
- 5) When you dress or undress your baby, do they become upset?
- 6) When you dress or undress your baby, are they very cheerful?
- 7) When you feed your baby, do they become upset?
- 8) Once your baby becomes upset, is it difficult to sooth them?
- 9) When your baby sees novel people or things (on TV or in environment), do they easily react to it?
- 10) When your baby is in an unfamiliar place or environment, do they become easily upset (get angry or cry)?