Infant Temperament, Home Environment and Developmental Competence

by

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ABSTRACT

To date, few empirical studies have directly addressed the question of how temperament, cognitive development and home environment mutually interact. Focussing on the activity level dimension of temperament, the present study longitudinally examined this question in a sample of 91 infants at two ages, 6- and 12-months.

Using Bell's control theory and relevant empirical studies, specific predictions were made concerning the activity level-home environment and cognitive competence-home environment relationships. Primary caregivers (usually mothers) completed Infant Behavior Questionnaires for the infants at both 6- and 12-months. Observers administered the Home Observation for Measurement of the Environment and the Bayley Scales of Infant Development, as well as measures of infant weight and infant length in the infants' homes.

Of the predictions made, only one, that more active children would be more distressed by limitations, was confirmed. Two problems necessitated caution, however, in the interpretation of results. The first was positive skewness in distributions of HOME subscale scores due to

the predominantly middle-class nature of the sample. The second was the presence of observer drift or other unspecified tester effects on the BSID scores and on certain of the HOME subscale scores, despite careful reliability procedures at the beginning of both the 6- and 12-month data collection phases. Supplementary repeated measures analyses of variance suggested the existence of parent-perceived developmental increases in the IBQ scales measuring activity level, fearfulness and anger. These analyses also indicated significant increases over the same 6-month developmental period on the following HOME subscales: Emotional and Verbal Responsivity of Parent, Provision of Appropriate Play Materials and Opportunities for Variety in Daily Stimulation. Other analyses suggested that parents viewed female infants as more fearful than males and believed that male infants smiled and laughed more. Parents of male infants also obtained higher Emotional and Verbal Responsivity HOME subscale scores.

Results were discussed in terms of their implications for Bell's control theory and for other literature on temperament-home environment and cognitive competence-home environment relationships.

CONTENTS

INFANT TEMPERAMENT, HOME ENVIRONMENT AND DEVELOPMENTAL COMPETENCE

Although temperament is a very old concept, serious research on individual differences in temperament has been a comparatively recent development. A major reason for the resurgence of interest in temperament is to be found in the reassessment of the child's role in the socialization process; this more recent perspective assumes that children's behaviour is not wholly shaped by their parents, but rather views children as active participants in the socialization process, participants who influence adults as much as they are influenced by them (Bell, 1968; Lewis & Rosenblum, 1974; Zeits & Prince, 1982). Individual differences in temperament, having a constitutional basis, appearing in infancy, and showing continuity in later life, are likely candidates for child-effects which elicit reciprocal responses from adults and consequently influence future parent-child interactions (Bell, 1968). Furthermore, the concept of temperament now has clinical relevance; a certain pattern of temperament dimensions (difficult temperament) has been hypothesized to be the precursor of later behaviour problems (Thomas, Chess & Birch, 1968).

Most temperament theorists (e.g. Rothbart & Derryberry, 1981; Thomas & Chess, 1977) conceptualize temperament and environment as mutually interactive. For example, the goodness of fit model of Thomas and Chess (1977) presupposes an interaction with

> the individual's abilities and motives and external environmental stresses and opportunities. This interactive process produces certain consequences in behavior, which then interact with recurrent and new features of the environment to reinforce certain previous patterns, or attenuate some, or produce new behavioral characteristics, or all three. (p. 10)

Goodness of fit and optimal development occur when "the properties of the environment and its expectations and demands are in accord with the organism's own capacities, characteristics, and style of behaving"; less optimal development is a result of dissonance between environment and temperament. The interactionist perspective now dominates temperament research. Very few empirical studies, however, have directly addressed the question of how temperament and environment are related, an omission which this study proposes to correct.

In examining the infant temperament-environment relationship, this paper will first focus on the question of how to define temperament, and so the major temperament theories will be reviewed. Second, as a background for the choice of an instrument to assess infant temperament, the psychometric characteristics of various temperament instruments will be reviewed, followed by a detailed description of the development and psychometric properties of Rothbart's (1981) Infant Behavior Questionnaire, the instrument chosen for this study.

Activity level has been chosen as a focal temperament dimension in part for theoretical reasons and in part because it is perhaps the best validated dimension of temperament; consequently activity level's status as a temperament dimension is reviewed in the third section of the paper. Also, research linking activity level with motor development and weight is described.

The environmental measure selected for use in this study was the Home Observation for Measurement of the Environment Inventory. One of a class of instruments called environmental process measures, its development and psychometric characteristics are described in detail, and the empirical research on infant temperament and home environment is reviewed.

A final goal of this study was to examine the evidence for environmental influences (as measured by the HOME) on infant cognitive competence. To this end, empirical research linking environmental measures with infant cognitive competence is reviewed with special attention paid to the topic of sex differences.

Definition of Temperament

Although temperament research is currently flourishing, as a number of reviewers have pointed out (Goldsmith & Campos, 1982; Plomin, 1982; Hubert, Wachs, Peters-Martin & Gandour, 1982), it has done so in the absence of a precise definition of temperament. Goldsmith and Campos point out that the concept of temperament over the years has acquired a host of surplus meanings and connotations such as immutability, lack of any environmental influence, presence at birth, and connection with body type. In addition, the predominant interactionist viewpoint presupposes that individual differences in temperament interact with the environment, making it difficult to define temperament in other than a situational context. Because of its historically elusive nature, researchers have tended to define temperament operationally, i.e. if intelligence is what intelligence tests measure, then temperament is what temperament questionnaires measure.

Despite the confusion, a definition which has some consensus has emerged. For example, many theorists define temperament as involving "style rather than content, the how rather than the what or why of behavior" (Plomin, 1982, p. 6). Temperament, however, closely resembles another concept, personality. Temperament theorists have attempted to distinguish the two by outlining certain criteria for dimensions of temperament: stability and heredity. Plomin presents a definition of temperament which emphasizes these points:

> Temperament involves those dimensions of personality that are largely genetic or constitutional in origin, exist in most ages and in most societies, show some consistency across situations, and are relatively stable, at least within major developmental areas. (p. 8)

Plomin's definition of a temperament dimension is adopted in this paper.

Theories of Temperament

New York Longitudinal Study. Possibly the best known and most influential developmentally oriented temperament theory derives from the New York Longitudinal Study (Thomas, Chess & Birch, 1968; Thomas and Chess, 1977). The questionnaire used by Thomas, Chess and their

associates has constituted the basis for numerous other temperament questionnaires such as Rothbart's (1981) Infant Behavior Questionnaire (see Hubert, Wachs, Peters-Martin & Gandour, 1982, for complete listing).

Beginning in the late 1950s, the NYLS group interviewed the parents of 133 infants from well-educated, middle-class families. Interviews were conducted from the time the infants were three-months-old and continued well into their adolescence. In 1961, Thomas et al. broadened their sample by adding the infants of working class Puerto Ricans to their study.

Based on an inductive content analysis of parent interview protocols from the first 22 children studied, Thomas et al. selected nine dimensions or categories of temperament for further consideration: activity level, rhythmicity, approach, adaptability, threshold, intensity, attention span, distractibility, and persistence. They also observed the occurrence of certain patterns of temperament in their sample of infants which they characterized as easy, difficult, and slow to warm up.

Their work on the NYLS led Thomas and Chess (1977) to conceptualize temperament as early appearing behavioural style, as opposed to the content and motivation of behaviour. They emphasized the interaction between temperament and environment rather than taking a strictly environmentalist position:

> Temperament can be equated to the term behavioral style. Each refers to the how rather than the what (abilities and content) or the why (motivations) of behavior. In this definition, temperament is a phenomenologic term and has no implications as to etiology or immutability. On the contrary, like any other characteristic of the organism--whether it be height, weight, intellectual competence, perceptual skills--temperament is influenced by environmental factors in its expression and even in its nature as development proceeds. (p. 9)

Thomas and Chess's style definition of temperament has been criticized on the grounds that it implies that infant characteristics should, because they are stylistic, be evident in all behviours, regardless of context. A style definition also implies that dimensions of temperament should be consistent across all expressive modalities, e.g. an infant who scores high on the intensity of reaction category would also be expected to be very active and to display very negative or very positive moods (Rothbart & Derryberry, 1981).

The derivation of the nine dimensions of temperament also has been criticized. Reviewers have pointed out that the nine categories are not fully independent, and that

three or four factors account for most of the individual differences found on them (Goldsmith & Campos, 1982; Wilson & Matheny, 1983). Goldsmith and Campos claim that the derivation of the nine scales has not been properly specified and that therefore it is impossible to replicate their construction. Rothbart (1981; Rothbart & Derryberry, 1981) has commented that it is impossible to determine the extent of the homogeneity within any given scale, i.e. an infant's high score on the activity level dimension could result from an observation of activity level only in the feeding situation. She also (Rothbart & Goldsmith, 1985, p.247) has suggested that the "rational assignment of items to scales . . . provides little opportunity for disconfirming initial notions or enduring discriminant properties." Goldsmith and Campos point out that the nine categories refer to different levels of analysis. For example, activity level and mood are broad constructs with many behavioural manifestations while approach/avoidance could apply to many constructs (e.g. fear, attachment).

There are also problems with the sample upon which the NYLS survey is based: Age differences at the time of the interviews may have been confounded with individual differences in temperament. Furthermore the sample was restricted in terms of SES and ethnic group, and 47% of the families interviewed contributed more than one subject (Rothbart, 1981).

In addition, the typological approach adopted by Thomas and Chess has been criticized. Rothbart (1982) feels that the difficult concept has negative connotations which far outweigh its usefulness in predicting later childhood behavioural problems. Bates and his associates (Bates, 1980; Bates, Freeland & Lounsbury, 1979) suggest that the link between the difficult infant and the behaviour problem child is one of parent perception, not just child constitution.

EASI. Another influential theory of temperament was formulated by Buss and Plomin. In their book, A Temperament Theory of Personality Development (1975), Buss and Plomin endorse Gordon Allport's definition of temperament:

> Temperament refers to the characteristic phenomena of an individual's nature, including his susceptibility to emotional stimulation, his customary strength and speed of response, the quality of his prevailing mood, and all the peculiarities of fluctuation and intensity and mood, these being phenomena regarded as dependent on constitutional make-up, and therefore largely hereditary in origin. (p. 5)

They stipulate that their conceptualization of temperament refers more to the stylistic aspects of behaviour, to

expressive behaviour rather than to instrumental (coping) behaviour and to what a person brings to the situation instead of what the situation demands from him. Buss and Plomin define temperament dimensions as broad inherited dispositions which are expected to differentiate during development, much like intelligence. They suggest five inclusion criteria to be used to decide which personality dispositions should be called temperaments:
1) heritability, 2) stability, 3) predictability of adult behaviour, 4) adaptiveness (in the evolutionary sense), 5) presence in other animals. Employing these criteria, Buss and Plomin delineate four broad dimensions of temperament: emotionality (E), activity (A), sociability (S), and impulsiveness (I). The EASI questionnaire was constructed to operationalize this formulation.

Buss and Plomin's theory has been criticized for practical problems involved in the application of the inclusion criteria. Goldsmith and Campos (1982) point out the unobservability of the evolutionary adaptiveness criterion; it is apparently possible to make a plausible case for the adaptiveness of almost any temperament dimension. Goldsmith and Campos also suggest there is a conflict between heritability and evolutionary adaptiveness. On the other hand, stability and predictability are relatively easy to investigate empirically. Goldsmith and Campos cite evidence from

another study (Goldsmith and Gottesman, 1981) which suggests significant but moderate levels of genetic variance for activity level, but not for interest in persons (i.e. sociability). Other studies support the heritability of activity level and sociability but not the other two EASI dimensions.

Concerning the EASI scale itself, Goldsmith and Campos feel that it demonstrates some factorial validity, but that this may be artificially enhanced because the items within each scale are very similarly worded and based upon a global judgement by the respondent. They also cite others who have pointed out the limitations of paper and pencil questionnaires.

Psychobiological theory. More recently, a highly comprehensive, multilevel theory of temperament has been developed by Rothbart and Derryberry (1981, 1982). In their psychobiological theory, they have sought to integrate previous views on temperament with Eastern European concepts of the reactivity of the nervous system (e.g. Pavlov) and research on social and emotional development during infancy.

Rothbart and Derryberry (1981) define temperament as "individual differences in reactivity and self-regulation assumed to have a constitutional basis" (p. 40). Reactivity is defined as "the overall excitability,

responsivity or arousability of the behavioral and physiological systems of the organism" and self-regulation "refers to neural and behavioral processes functioning to modulate this underlying reactivity" (p. 40). As an example of self-regulation, Rothbart and Derryberry suggest the attentional and behavioural processes of approach-avoidance. Constitutionally based factors are those which derive from the "relatively enduring biological makeup of the organism influenced over time by heredity, maturation, and experience" (p. 40). The two key concepts, reactivity and self-regulation, can be used to describe temperament at the neural level, the level of interacting physiological systems and at the behavioural level. Reactivity and self-regulation can be expressed through different response systems: somatic, endocrine and autonomic (including motor activity, facial expressions, vocal activity and emotional reactions). Rothbart and Derryberry also discuss the intensive and temporal response characteristics of these response systems: intensity (peak level of excitement), threshold (sensitivity to low-intensity stimulation), latency of response, rise time of response (interval from onset to peak intensity), and recovery time. Individuals are not expected to be consistent in these elements across various response systems (Goldsmith & Campos, 1982).

Rothbart and Derryberry (1981) reject the notion of temperament as merely style and see "affective-motivational systems at the center of the developing personality" (p. 38). They delineate a connection between temperament and affect in that one of the response systems for reactivity is the emotion system. They emphasize the centrality of temperament in social development. Their postion is clearly interactionist and they endorse the notion of infant and caregiver as an interacting couple:

> We are now aware of some of the infant characteristics that influence and are influenced by caregiver behavior; these correspond closely to constitutionally based responsivity, including distress and smiling, attentional activity, soothability, and activity level. (p. 38)

The infant can initiate behavior, as well as react to it, because the self-regulatory mechanisms can act in an anticipatory fashion. Goldsmith and Campos (1982) point out that individual differences in the direction of attention, for example, can determine which objects become reactivity-eliciting stimuli.

Rothbart and Derryberry's temperament theory has been reviewed by Goldsmith and Campos (1982). Its positive features, according to those reviewers, are its

commonality with the neo-Pavlovian tradition and its integration of contemporary investigations of caregiver-infant interaction. Two other positive characteristics are that Rothbart and Derryberry examine the relationship between temperament and cognitive development and that their theory provides a guide for laboratory-based research.

On the other hand, Goldsmith and Campos point out that Rothbart and Derryberry's theory is so wide-ranging that it is difficult to establish which personality dimensions are not subsumed under the temperament construct. They also question the analogy between temperament phenomena and sensory and perceptual phenomena because a relationship between response characteristics at different levels (e.g. behavioural and neural) has not been demonstrated. They suggest that a whole host of variables (cognitive, emotional and social) must be looked at before clear predictions can be made at a more molar level and that this constitutes a weakness in Rothbart and Derryberry's theory. Finally, they point out that there is, as yet, little research directly on psychobiological temperament theory, although Rothbart and Derryberry's review and integration of research not directly based on their theory gives it much plausible support.

Rothbart developed the Infant Behavior Questionnaire, a caregiver report infant temperament instrument, to operationalize her psychobiological model of temperament (Rothbart, 1981). It will be described in further detail later.

Psychometric Properties of Temperament Instruments

It is helpful to review the psychometric properties of temperament instruments in general in order to evaluate the characteristics of a particular instrument. Several reviewers (Plomin, 1982; Hubert et al., 1982) have provided detailed critiques of the current state of temperament instruments. To date, research has been largely instrument-oriented since there has been no real consensus regarding an integrative, theoretical definition of the temperament construct. Consequently there is an instrument for every different definition of temperament; Hubert et al. have collected and reviewed standardization, reliability and validity data on 26 different temperament instruments at infant, preschool and school-age levels. By far the largest number of these instruments represent operationalizations or expansions of the theoretical framework of the NYLS group.

Standardization. Standardization samples from the various instruments vary greatly in range and size from 30

to over 300. A problem with the majority of the instruments is that standardization samples are largely drawn from a middle-class white sample, limiting generalizability to other groups.

Reliability. Test-retest reliability presents a problem for many of the temperament instruments. For many of the less well-known instruments, test-retest reliability is not reported. Hubert et al. suggest that most test-retest reliability coefficients are based on small samples and that it is low or moderate over even short periods of time. Plomin indicates that stability of and prediction from neonatal temperament is especially poor. For example, although stability coefficients at three-month intervals are significant, Rothbart and Derryberry (1981) report that stability from 3- to 9-months is minimal with the exception of activity level (for both home observations and maternal ratings). The NYLS group (Thomas & Chess, 1977) found, in their interview data, that stability was only modest during the first five years of life, and, although it tended to be greatest for Activity and Adaptability, the highest correlations for these dimensions was not very much higher than the others (Plomin, 1982).

A plausible explanation other than instrument failure for the poor test-retest reliability of many of the

instruments has been suggested by both Hubert et al. and by Wilson and Matheny (1983); it is that temperament changes with age. In their theoretical formulation of temperament, Thomas and Chess allow for the possibility of systematic, cumulative changes with age in specific temperament dimensions. Therefore, high short-term reliability and low-moderate long-term reliability are consistent with Thomas and Chess's position. Similarly, Wilson and Matheny explain Carey's (1981) position that there are shifts in temperament with age due to "varying rates of maturation for the underlying central nervous system structures, and the appearance of age-linked behavioral competencies" (p. 182). Rothbart (1986) has also noted that developmental changes "may lead to earlier periods of instability in reactions that later may demonstrate higher levels of stability" (p. 356, footnote).

For the 26 instruments reviewed by Hubert et al., interrater reliability is generally high. Hubert et al. do find problematic, however, those studies which report interparent agreement and/or parent-observer agreement. If temperament is a stable characteristic, then poor interparent and parent-observer correlations may be due to unsatisfactory instrument reliability, the possibility of one parent's (the father's) having relatively little contact with the target child or the possibility that the

child is showing different aspects of temperament for different observers. Hubert et al. opt for instrument failure, possibly due to ambiguities in what is being rated.

Hubert et al. generally find measures of internal consistency to be of moderate magnitude with no patterns of exceptionally high or low values (except for approach/withdrawal which tends to be consistently high).

Validity. Compared to reliability data, information on validity of temperament measures tends to be much less available and of poorer quality. According to Hubert et al., the information that is available tends to be based on small sample sizes or is characterized by low, barely significant correlation coefficients which account for little total variance. Problems are also posed by inadequate reporting of data and the use of retrospective reports. Carey's (1983) comment on the difficulty of demonstrating the external validity of questionnaires in the absence of a standardized professional rating scheme for comparison is especially relevant.

Generally, reviewers find the evidence for concurrent validity for most temperament instruments to be inconsistent. Several studies have reported significant correlations between one or more temperament characteristics and other aspects of development (e.g.

intelligence), and some of these concurrent correlations have theoretical implications, e.g. for temperament and parent-child interactions. For example, significant correlations have been reported between difficult temperament and an optimal home environment and between difficult temperament and lack of maternal responsivity. Hubert et al., however, regarded these findings as quite tentative in view of very small sample sizes, use of extreme groups, insufficient instrument reliability data, and contradictory results.

On the issue of convergent validity of temperament measures, recent research has been somewhat more optimistic in tone. Plomin (1982) finds that there is some modest convergence between parent reports and more objective criteria such as laboratory measures and observations. He also points out, however, that global ratings by observers other than parents tend to correlate more highly with parental ratings than do specific laboratory or observational measures. Eaton's (1983) results suggest that where objective measures are aggregated over a number of occasions, large validity correlations with observer ratings are obtainable. Carey (1983) points out that, in the past, researchers (e.g. Crockenberg & Acredolo, 1983) have unjustifiably relied on comparison of brief, unmatched professional observations with maternal reports when attention should be paid to

matching maternally and professionally rated behaviours for content and dimension. Recently, Hagekull, Bohlin and Lindhagen (1984), by achieving a higher degree of equivalence between criterion and BBQ questionnaire data, have obtained higher coefficents of concurrent validity. As Rothbart and Goldsmith (1985) have suggested, however, for statistical reasons, high cross-method correlations may be an unrealistic expectation:

> Not only will the lower (and usually unknown) reliabilities of home observation and laboratory approaches constrain correlations with perfectly reliable external criteria to a theoretical maximum (the square root of the reliability of the measure), but the sources of systematic, reliable variance also differ from method to method. (p.245)

Less research has addressed the issue of predictive validity. Hubert et al. conclude that the results pertaining to predictive validity are even less definitive than for other types of validity because of methodological problems. They also point out the important implications this type of validity has for theory. For example, Thomas and Chess's temperament theory suggests that a difficult temperament predicts later behavioural problems. So far research on this issue has been inconclusive.

In general, construct validity evidence for the various temperament measures is scarce. What information there is pertains to the temperament theories of Thomas and Chess or Buss and Plomin. Little evidence exists for or against the construct validity of other temperament models.

Hubert et al. describe two methods used to evaluate construct validity. The first involves using factor analysis to assess factorial validity, the degree to which scales based on a particular theoretical orientation yield factor structures reflecting that orientation. Hubert et al. conclude that factor analyses of the various scales have provided inconsistent results at best. Factor analyses by the NYLS group and Buss and Plomin support their respective positions, but results from other researchers do not necessarily agree. Plomin also finds that there is little support for the NYLS primary dimensions, except for the Activity dimension.

An alternative procedure mentioned by Hubert et al. for evaluating construct validity is to examine evidence for the cross-validation of frequencies of temperament constellations or patterns across different procedures or samples. Here again, Hubert et al. find the NYLS model deficient.

An additional way to evaluate an instrument's construct validity is to assess its convergent validity (Brown, 1970). As previously discussed, convergent validity results for different instruments supposedly measuring the same temperament dimensions (e.g. parent questionnaires and observer ratings or behavioural observations) have been inconsistent, probably because of dissimilarity of scale content (Hubert et al., 1982). Convergence between parent questionnaires and observer ratings or behavioural observations has been inconsistent. Hubert et al. find especially disturbing the inability to find a consistent pattern of specific marker factors across studies. The nearest to a marker factor is activity level which is the temperament dimension most commonly reported across studies (Matheny, 1980). Rothbart (1986), however, disagrees with Hubert et al.'s position and finds considerable overlap between IBQ temperament dimensions and those proposed by other investigators.

Hubert et al. raise the interesting point that a major construct validity problem involves inconsistencies in concurrent validity studies relating patterns of infant temperament to patterns of parent-child interaction. If the interactionist position were true, some sort of predictable relationship between child temperament and parent-child interaction should emerge. There are,

however, major inconsistencies: Parental ratings of difficult infant temperament are sometimes associated with positive parent-child interactions and vice versa. Hubert et al. advance the hypothesis that the nature of the relationship between infant temperament and parental interaction may be a slow and cumulative process, not necessarily observed in concurrent relationships.

Conclusions. Given the poorly defined nature of the temperament construct, the inadequacy of standardization, and the inconsistent reliability and validity data, the best conclusion to draw about temperament measures is that of Hubert et al.: There is no single psychometrically sound and adequately validated measure of early temperament currently available. Hubert et al. do, however, continue that while "no single satisfactory instrument currently exists, certain instruments have demonstrated adequacy with regard to some psychometric properties" (p. 581). They recommend selecting the instrument most psychometrically suited to fulfilling the purpose of the study. For example, if the purpose of the study involves an assessment of long-term stability, then the use of an instrument with good test-retest reliability characteristics is required.

Parent Report Measures of Temperament

Hubert et al.'s conclusions underline the importance of a careful selection of measure for the assessment of early temperament. Although there is a need for more objective measures or instruments, this does not necessarily mean that parent report should be discarded in favor of laboratory methodology. Plomin (1982) reviews five different types of temperament measures (interviews, parental rating questionnaires, teacher rating questionnaires, unstructured observations and structured observations) and describes advantages and disadvantages for each type of measure. The parental rating questionnaire seems to be simultaneously the most popular and the most controversial of the temperament measures. Along with conserving valuable researcher time and resources, parental questionnaires have the advantage of being based on a behavioural sample aggregated over long periods of time and across many situations (Epstein, 1979). Plomin also cites evidence to support Bates's (1980) conclusion that there is modest convergence between parent reports and other more objective criteria: For example, global ratings by observers other than parents tend to correlate more highly with parental ratings than specific observational or laboratory measures. Although critical of parent report measures, Bates has argued that eliminating these approaches to temperament in favor of

more objective behavioural indices may minimize the important contribution that parental perceptions make in terms of the way in which parents react to their child (Hubert et al., 1982) thereby sacrificing predictive validity for accuracy and stability. Rothbart and Derryberry (1981) also argue for the utility of parental reports while cautioning that they do not represent a pure measure of infant temperament:

> aside from possible response biases in the parent. . . either the caregiver report or observation of temperament-related behavior in the home assesses the results of a complex of social and constitutional factors. Temperament as assessed in the home thus cannot represent an <u>independent</u> contribution of the child to family interaction. (p. 69)

Bates's suggestion, however, that parental ratings of infant temperament represent parent perceptions rather than accurate reflections of behaviour explains some of the lack of congruence between parental reports and other temperament measures and underlines one of the disadvantages of using parental ratings. There is evidence to suggest Bates is correct in pointing out parental perceptions (i.e. biases) operate in assessing their children's temperament (Kelly, 1976; Campbell, 1979; Bates, Olson, Pettit & Bayles, 1982). The evidence is

becoming increasingly stronger that parental biases substantially contribute to their perceptions of their children's easy or difficult temperament (Affleck, Allen, McGrade & McQueeney, 1984; Ventura & Stevenson, 1986; Vaughn, Bradley, Joffe, Seiffer & Barglow, 1987).

Hubert et al. suggest that a way to overcome the problem of parental perception bias in the construction of future scales is to focus on the identification of the specific behavioural elements used by parents in rating their child's temperament (i.e. not to target whole behaviour patterns such as difficult temperament). They also suggest that future research focus not on measurement of temperament alone, or on environment alone, but on temperament-environment interaction and that, where possible, multiple measure methodology be employed. Just as Hubert et al. suggest isolating specific behavioural elements used by parents to rate their child's temperament, Plomin (1982) advocates the greater use of structured observations, the assessment of temperamental reactions of children in roughly the same situations, rather than the broad assessment of temperament across situations. Following their review of different types of temperament measures, Rothbart and Goldsmith (1985) recommend that parental rating biases be minimized with questionnaires incorporating an adequate sampling of questions and well-written items about temperament; then

"what more could the researcher ask than objective judgments made by a practically full-time observer?" (p. 242).

The Infant Behavior Questionnaire

The Infant Behavior Questionnaire (IBQ), designed by M.K. Rothbart (1981), is one example of a parent report measure of infant temperament designed to minimize the problem of parental perceptual bias. An example of what Plomin (1982) calls the structured observation technique, the IBQ asks the parent only about infant behaviour occurring over the last week: It does not rely on retrospective report and it does not ask parents to make global judgements of their child's temperament in comparison to other children whom they do not know. Yet it retains the chief advantage of other parent report measures, the large quantity of observational knowledge parents have about their infants.

The IBQ has several other advantages over other measures of infant temperament. It is based on an extremely comprehensive theory of temperament which integrates much of the currently available temperament, personality and physiological research. The individual scales are designed to avoid conceptual overlap and are easily operationalized (Wilson & Matheny, 1983) making it well designed for research purposes.

Rothbart's (1981) purpose in developing the IBQ was to create a parent report instrument which was

> a psychometrically adequate instrument as reflected by high internal reliability that would measure not only the Thomas, Chess et al. (1963, 1968) dimensions, but would tap other aspects of reactivity and self-regulation that had been identified as involving individual differences with a possible constitutional basis. (p. 571)

Rothbart also had the aim of identifying conceptually independent dimensions of temperament, allowing no overlap among definitions, unlike the NYLS temperament scale.

Test construction details are carefully explained by Rothbart (1981). Eleven temperament dimensions were selected for initial investigation from work by Thomas, Chess, and their associates (1963, 1968), Escalona (1968), and Shirley (1933) together with studies of behavioural genetics and temperament in animals and humans, and longitudinal studies of personality. The initial eleven dimensions were: Threshold, Intensity, Adaptability (Soothability) of Response, Rhythmicity, Activity Level, Fear, Distress to Limitations, Overall Negative Emotionality, Smiling and Laughter, Duration of Orienting and Distractibility.

Initial items were developed from the same theoretical work and from interviews with parents of 3-, 6-, 9-, and 12-month old infants. To avoid possible bias, items were carefully worded to refer to specific behaviours occurring during the previous week, so parents did not have to make global judgements or attempt to recollect child behaviours from the past. For example, one item reads: "During the past week, when being undressed, how often did your baby: Wave his/her arms and kick? Cry? Smile or Laugh?" etc. Responses are recorded on a scale from one to seven with a Does not apply alternative for items which may not be relevant, eg. a carseat item for a baby who's never been in one.

Conceptual and item analyses were performed on the scales. Two scales were discarded because of unavoidable conceptual overlap with other scales: negative emotionality and distractibility. Parents of 463 three-, six-, nine- and twelve-month old infants from various socioeconomic groups filled out the IBQ. This standardization sample includes some children who were rated more than once in order to provide longitudinal data for stability estimates.

Following items analyses, the threshold, rhythmicity and intensity scales were eliminated because of unsatisfactory item characteristics and internal reliability. The only items with satisfactory interitem

correlations were extracted from the original adaptability scale and used to create a soothability scale.

Psychometric Properties of the IBQ

Although it is true that there is currently no completely adequate measure of temperament, the IBQ is the most psychometrically sophisticated instrument available to date.

Standardization. The IBQ was standardized on a large (N = 463; n of 3-month-olds = 94; n of 6-month-olds = 115; n of 9-month-olds = 149; n of 12-month-olds = 106) sample of heterogeneous socioeconomic status (representing the Eugene-Springfield, Oregon population). Further standardization details are clearly described by Rothbart (1981).

Reliability. Interrater reliability was calculated on a subsample of 22 mothers by having a second adult living in the household (either father or babysitter) fill out a second questionnaire for each infant. Coefficients ranged from r = .45 for Smiling and Laughter to r = .69 for Activity Level, all significant.

Stability correlations were also calculated across ages with highly variable results r = -.14 for Soothability at 9- to 12-months, to r = .81 for Smiling

and Laughter, 6- to 9-months, Mdn r = .57 (Hubert et al., 1982). Activity Level and Smiling and Laughter showed considerable stability, and stability was found for most cohorts and age comparisons for the scales of Duration of Orienting and Soothability. For the Fear and Distress to Limitations scales, however, 3-month scores did not predict later scores and stability was found only with predictions from 6-months (Rothbart, 1981).

In subsequent studies, Rothbart (1986) reports excellent stability coefficients for infants over the 3- to 9-months age range. Lamb, Frodi, Hwang and Frodi (1983) found significant, although modest, stability over time on most dimensions of infant temperament for mothers and fathers of 45 Swedish infants over the age range from 4- to 8-months. In a study which focuses on stranger sociability and its relationship to temperament in infants in the second year of life, Thompson and Lamb (1983) found scores on all six IBQ subscales to be remarkably stable over the 12 1/2- to 19 1/2-month-old period.

Hubert et al. (1982) evaluate the internal reliability coefficient values for the IBQ as amongst the highest for any temperament instrument. They range from r = .72 (Duration of Orienting at 3- and 12-months) to r = .85 (Smiling and Laughter at 3-months) with a median r of .80. Item-scale correlations are also presented, and range from r = .41 to r = .61 with a median r = .50.

Validity. Although still a new instrument, information concerning the validity of the IBQ has been growing. Rothbart and Derryberry (1981) report a few significant correlations between maternal ratings and observer reports. These occur generally at around 9-months of age and are of moderate levels (Hubert et al., 1982). In a study which compared longitudinal IBQ data from 46 infants at 3-, 6-, and 9-months of age with three (30-45 min. in length) home observations at each age, Rothbart (1986) concluded that IBQ and home observation assessments showed considerable convergence (Soothability and Duration of Orienting were not included in the analysis). This was especially true at the 9-month assessment.

On the other hand, Eaton and Dureski (1986) did not find a correlation between 24-hour actometer readings and parent IBQ scores for a sample of 3-month-olds. The authors cite Rothbart's (1986) similar failure to find a significant correlation between IBQ Activity Level and home observations for 3-month-olds, but point out the much better results for 6- and 9-month-olds.

Crockenberg and Acredolo (1983) found only one significant correlation between newborn NBAS motor maturity and IBQ Smiling and Laughter; they speculate that this was due to the IBQ's tendency to reflect infant

behaviour in a social context. Crockenberg and Acredolo's study was critiqued by Carey (1983) for trying to compare brief unmatched professional observations with maternal reports.

Evidence for the construct validity of the IBQ is excellent. Although factor analysis was not used in its construction, item-scale correlations were used to select items.

Status of Activity Level as a Temperament Dimension

Of the many temperament dimensions suggested by different theorists, activity level, defined by Rothbart (1981) as level of gross motor activity, has probably been the most widely studied. The activity level dimension has been included in nearly all scales of child temperament; Hubert et al. (1982) suggest that it is the closest thing to a marker factor of temperament to emerge so far.

If temperament is used to refer to dimensions of personality which are largely genetic or constitutional in origin and which show some consistency across situations and time, then activity level comes closest to satisfying these criteria (Eaton, 1984). Evidence for a constitutional or genetic contribution to activity level variability is found in animal research (McClearn, 1970; Fuller & Thompson, 1978) and in human twin studies (Scarr,

1966; Willerman, 1973; Willerman & Plomin, 1973; Matheny, Dolan & Wilson, 1976; Torgerson, 1982). For example, Goldsmith and Gottesman (1981) find there is evidence for moderate but significant levels of genetic variance for an infant activity level factor. Goldsmith (1983) also suggests there is moderate heritability for activity level and that, of most temperament characteristics, there is the strongest evidence for genetic effects on the broad dimension of sociability, followed by emotionality and activity level. In a sample of 576 pairs of twins, Stevenson and Fielding (1985) also find considerable support for a genetic factor in the Activity dimension of Buss and Plomin's (1975) EASI Scale. Matheny (1980) concluded that "genetic influences can be demonstrated most for variations in activity level" (p. 444) and Riese, Wilson and Matheny (1985) concluded that genetic effects were more obvious in the second year of life than in the first.

Evidence for the stability of activity level across situations and across time, originally somewhat ambiguous, has been steadily growing. In 1983, Halverson and Post-Gorden (1983) reported that interrater reliability was generally good, but there is little information on test-retest reliability. They suggest that a failure to find stability may be due to a failure to aggregate data. They also point out that lack of stability may be a result of

activity level being reflective at different times of different temperament characteristics, i.e. exogenous stimulation-seeking after one year. Rothbart (1981) cites contradictory evidence for stability, although she found significant stability in infant activity level using her own scale and home observations across 3-, 6-, and 9-month periods. Eaton (1984) found stable individual differences in activity level of fetuses for the last eight weeks of pregnancy. Plomin (1982) indicates that, although the evidence for the stability of neonatal temperament is generally poor, the evidence is greatest for activity and adaptability (using NYLS dimensions). In a longitudinal study using the BSQ (a parent rating scale based on the NYLS temperament dimensions) Korner, Zeanah, Linden, Berkowitz, Kramer and Agras (1985) found that highly active neonates became the most highly active 3- or 4-year-olds whereas the least active became the least active preschoolers.

In summary, of the many temperament dimensions proposed by temperament theorists, activity level is perhaps the best validated: Not only does it come closest to fulfilling the twin criteria of heritability and stability, but it also has been included in almost every temperament theory as a kind of marker factor. Does this marker variable relate to other facets of development? Research done to date suggests that it may.

Activity Level, Motor Development and Weight

A possible positive association between infant activity level and motor development has been identified. Fish and Crockenberg's (1981) study investigated the stability of irritability, motor activity and sociability through the first nine months of life and the relationship between mother and infant behaviour during that time. The Neonatal Behavioral Assessment Scale was given in their homes to 16 infants at 5- and 10- days of age. In addition, behavioural observations were made of the infants interacting with their mothers for 3 1/2 hours at 1- and 3-months and for 3 hours at 9-months of age. Fish and Crockenberg found that observed infant large motor behaviour (defined as sitting unsupported, walking alone or holding onto person or object, rolling, creeping or crawling, pulling up, or standing) correlated positively (r = .51, p < .05) with Motor Maturity measured by the Neonatal Behavioural Assessment Scale.

Additional indirect support for a correlation between motor maturity and motor activity level comes from Eaton (1984). He reviewed and coded the relationship between age and activity level as being positive, negative or unclear and ranked them according to subject age. A consistent pattern was found, with activity level increasing with age from the prenatal period to the

preschool period (between 2 and 5 years of age--roughly the time when motor maturity is attained) and then decreasing in later years.

A study by Walters (1965) provides evidence that an infant's weight is related to motor development and consequently possibly related to activity level. Thirty-five women recorded fetal movements during the last three months of pregnancy (1 1/2 hours weekly). Fetal activity was then correlated with infants' weights and with Gesell Development Schedule scores (in the areas of motor, adaptive, language, personal-social, and total Gesell scores) given the infants at 12-, 24-, and 36-weeks of age. Seventh, eighth, and ninth months of fetal activity significantly correlated with motor development (Gesell scores) at 12-, 24- and 36-weeks. Birthweight correlated with adaptive and total Gesell scores at 12-weeks and with motor behaviour at 24-weeks. Walters suggests that at 24-weeks, weight is more related to motor development than at any other time; for her sample, as infants became older, weight had an insignificant effect. The possibility exists that length, as an index of an infant's maturity, has a similar relationship with activity level.

Environmental Measures

Along with the renewed interest in the socialization process from the interactionist viewpoint and the subsequent interest in child temperament as a possible child-effect has come an increasing interest in the relationship between infant temperament and environment. The study of the temperament-environment relationship is only now getting under way in any meaningful sense (Bates, 1980). In addition to the problems discussed earlier concerning the measurement of temperament, part of the reason for the delay is the difficulty encountered in developing environmental measures that are sensitive, practical and psychometrically adequate.

A class of instruments called environmental process measures (Bradley and Caldwell, 1978) show some promise as measures of children's environments. Developed mainly to determine which environments placed children at risk for future developmental problems, these instruments and their history have been reviewed by Caldwell, Bradley and their associates (Bradley & Caldwell, 1978; Elardo & Bradley, 1981a; Caldwell & Bradley, 1984).

Before 1965, social class or socioeconomic (SES) indices were the most commonly used measures of a child's developmental environment. The discovery that measures of specific aspects of the early environment were more

closely related to measures of child development than SES per se, however, necessitated an examination of the processes which explained the relationship between SES and problem learning behaviour. Elardo and Bradley (1981a) credit Bloom (1964) with having provided the framework for the development of environmental process instruments upon which researchers such as Marjoribanks (1972) and Henderson (Henderson, Bergan & Hurt, 1972) have built. Marjoribanks developed an instrument which measures eight environmental press areas: achievement, activeness, intellectuality, independence, English language usage, second language, mother dominance, and father dominance. Henderson and his colleagues created the HELPS (Henderson Environmental Learning Process Scale) which measures the environment along five factorially developed scales: extended interest and community involvement, valuing language and school-related behaviour, intellectual guidance, providing a supportive environment for school learning, and attention.

The work of Roger Barker and Herbert Wright is considered a second major influence on the development of environmental process instruments (Bradley & Caldwell, 1978; Elardo & Bradley, 1981a). The environmental coding systems developed by White and Carew (1973) at the Harvard Preschool Project were derived from the theories of Barker and Wright. Using such a coding system, White and Carew

found that the social environment of well-developing children, regardless of SES, could be characterized by a greater quantity of caregiver-child interaction, more time spent together in intellectually valuable activities, more common participation in intellectually valuable activities, and more overt encouragement of those activities. Also, regardless of SES, parents of well-developing children encouraged them more and were more often successful in controlling them (Elardo & Bradley, 1981a).

In addition, Elardo and Bradley (1981a) describe a number of environmental process measures which do not rely exclusively on any single theorist or theory. These so-called eclectic methods are derived from several sources, and are often a combination of theory and specific research (e.g. Yarrow, Rubenstein, Pedersen & Jankowski, 1973).

Home Observation for Measurement of the Environment

Major problems encountered with the instruments described above include not only psychometric inadequacies, but also impracticality: They contain large numbers of items and require considerable time to administer, e.g., scales using the Barker-Wright methodology (White & Carew, 1973). The observational

scales require considerable training or else rely more or less exclusively on interviews which share the problems of parental reports described earlier. Caldwell (cited in Elardo & Bradley, 1981a) has expressed the opinion that interview techniques do not adequately assess critical parent behaviours such as responsivity and warmth.

The Home Observation for Measurement of the Environment (HOME) inventory was developed by Caldwell and her associates in response to these problems. To paraphrase Caldwell, the HOME was created to provide a sensitive, reliable and easy-to-administer measure of the home environment to screen for potential developmental problems in children before the age of three. It is a combination of interview (about one-third) and observational (about two-thirds) techniques. There are now two versions of the inventory: In addition to the one designed for use with families of infants and toddlers (0-3 years) there is a HOME for families of preschool children (3-6 years).[1]

The HOME Scale for infants has undergone two major revisions since it was originally developed in 1966. Initially items were composed to assess the presence of a list of characteristics of stimulating environments

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[1] Validity and reliability information on an experimental form of the HOME Inventory for use with families of elementary children (6- to 10-years-old) is currently being gathered and readied for publication.

proposed by Caldwell (Caldwell & Bradley, 1984). The original 72 items were reduced to 45 by means of factor analysis (although factor analysis was employed, the subscales do not represent orthogonal factors and show a modest degree of intercorrelation). An item analysis was done using data from families in Syracuse, New York. Cronbach alpha coefficients were calculated to estimate the reliability of the six subscales and the total scale: They ranged in magnitude from .49 to .78. Point-biserial correlations were also calculated between individual items and their factor scores; these correlations ranged from .39 to .73. Caldwell and Bradley felt that, based on these results, the factor structure was sufficiently clear and the subscales sufficiently stable to permit using the HOME. A detailed description of the test construction process is presented in the test manual (Caldwell & Bradley, 1984).

The current (1984) version of the HOME Scale for Infants has 45 items arranged in six subscales: Emotional and Verbal Responsivity of Parent (Responsivity), Acceptance of Child's Behavior (Acceptance), Organization of Physical and Temporal Environment (Organization), Provision of Appropriate Play Materials (Play), Parent Involvement with Child (Involvement), and Opportunities for Variety in Daily Stimulation (Variety). All items are scored in a binary fashion (Yes-No). The HOME is

administered by having an observer visit the child's home when the child is awake and can be observed in interaction with the primary caregiver. The psychometric properties of the HOME are considered next.

Psychometric Properties of the HOME

Standardization. The HOME was standardized on 174 lower- and lower-middle class families in Little Rock, Arkansas. Since then, it has been given to families of middle and upper-middle socioeconomic status (Ramey, Mills, Campbell & O'Brien, 1975; Wulbert, Inglis, Kriegsmann & Mills, 1975; Hollenbeck, 1978).

Reliability. Internal consistency estimates were calculated for the total scale and for each subscale. For the whole scale, the Kuder-Richardson-20 (KR-20) coefficient was .89; for subscales, KR-20s ranged from .44 for Variety to .89 for Organization and the total HOME.

Test-retest reliability was calculated on data from 91 families in Little Rock when the children were 6-months, 12-months and 24-months of age. Coefficients for subscales ranged from a low of .27 (Organization for 6- vs. 12-months) to a high of .77 (Variety and Total HOME for 12- vs. 24-months). Stability for the total scale between 6- and 24-months was $r = .62$. The authors (Caldwell & Bradley, 1984) describe these coefficients as

moderate to high and suggest they are low estimates of the subscales' stability, firstly, because there are no more than eleven items per scale and, secondly, because the 6-month and 1-year intervals between tests represent a considerably longer period of time than is usually used in calculating test-retest coefficients. Elardo and Bradley (1981a) present the view that the HOME scale presents only a moderate degree of stability precisely because it is a dynamic measure, unlike status or structural measures of family environment, and changes as a function of child maturation, as a function of individual differences in child capability (Bradley, Caldwell & Elardo, 1979) and as a function of participation in parent education programs (Hamilton, 1972). They point out the need for further reliability studies.

Adams, Campbell and Ramey (1984) report somewhat lower stability estimates (r = .38 at 6- and 12-months) than Caldwell and Bradley (1984) but concluded that these estimates were satisfactory. The least stable subscale estimates were for Acceptance of Child's Behavior and Variety. Allen, Affleck, McGrade and McQueeney (1983) report moderately high stability except for the Responsivity subscale in a sample of high risk and developmentally delayed infants. Finally, Ramey, Yeates and Short (1984) have reported stabilities comparable to other studies with median one-year stabilities of .48 and

.62 for experimental and control groups in an early intervention project.

Elardo and Bradley (1981a) report an average inter-observer agreement figure of 89.6% calculated across six different studies. Zimmerman (1981) points out that Elardo and Bradley neglected to include a study by Stevenson and Lamb (1979) which would have significantly reduced this figure (Stevenson and Lamb report interrater reliability of only 66%). In their comment on Zimmerman's critique, however, Elardo and Bradley (1981b) claim that Stevenson and Lamb's observers were not properly trained to administer the HOME in accordance with the procedures suggested by Caldwell. More recently, Bradley, Casey and Wortham (1984) have reported an overall reliability estimate of 95% over 10 visits in a sample of 23 failure-to-thrive and 23 normal infants.

Validity. Hollenbeck (1978) reached the conclusion that the HOME can discriminate among diverse populations in predictable ways. He contrasted three populations: his own sample of 70 six-month-olds from lower- and lower-middle class families, Caldwell's original sample of 124 lower-class infants from birth to three years, and Ramey et al.'s (1975) sample of 30 six-month-old middle-class infants. Hollenbeck found that the middle-class samples (his own and Ramey et al.'s) achieved higher HOME scores.

Examining the research for concurrent validity, Elardo and Bradley (1981a) cite evidence (Elardo, Bradley and Caldwell, 1977; Hollenbeck, 1978) to indicate that HOME scores are moderately related to measures of SES and maternal education level. Since part of the rationale for developing the instrument was to provide a more sensitive environmental measure than SES, this is not surprising. Caldwell and Bradley (1984) present evidence which indicates that mother's education, father's presence, father's education, father's occupation and crowding in the home are all significantly associated with the home environment variables. Only the association with mother's occupation was not significant. Yet the HOME is more sensitive than any of these variables in assessing the developmental environment (Bradley, Caldwell & Elardo, 1977; Caldwell & Bradley, 1984).

Caldwell and Bradley (1984) and Elardo and Bradley (1981a) cite a number of studies supporting the HOME's construct validity. Ramey and Mills (1977) correlated performance on the HOME with mother-child interactions observed in a laboratory and found that mothers who achieved high HOME scores were generally more responsive to their infants. Barnard and Gortner's results (cited in Elardo & Bradley, 1981a) indicated that mothers with higher HOME scores communicate positive (mean $\underline{r}$ =.30) and fewer negative (mean $\underline{r}$ = .18) messages to their children

during two standardized situations: teaching and feeding. Ramey et al. (1975) reported that the HOME successfully discriminates between normal homes and homes at risk for developmental retardation. Two studies have concluded that children identified as malnourished lived with families who achieved low HOME scores (Cravioto & Delacardie, 1972, cited in Caldwell & Bradley, 1984; Chase & Martin, 1970). Finally, a number of studies (Wulbert et al., 1975; Van Doornick, Caldwell, Wright & Frankenberg, 1981; Fowler, 1974, cited in Caldwell & Bradley, 1984) have shown that high HOME scores are associated with good cognitive development.

Most of the evidence in support of predictive validity of the HOME suggests that it is an efficient predictor of cognitive development as measured by IQ scores, language development measures, achievement tests, and evidence of success in school.

In a longitudinal study, Elardo, Bradley and Caldwell (1975) administered the HOME to families when infants were 6-, 12- and 24-months of age. The Bayley Mental Development Index (MDI) was administered to the infants at 6- and 12-months and the Stanford-Binet Intelligence Test was administered at 36-months. The predictive validity of the MDI was contrasted with the predictive validity of the HOME. The MDI at 6-months correlated .28 ($p < .05$) with

Stanford-Binet IQ at 36-months; the HOME and 36-month Stanford-Binet multiple correlation was $\underline{R} = .54$ ($\underline{p} < .01$). A similar pattern of results was obtained between Stanford-Binet IQ obtained at 12-months and Stanford-Binet IQ at 36-months, and between HOME scores obtained at 24-months and Stanford-Binet IQ at 36-months. In a follow-up study conducted when the children were 54-months (Bradley & Caldwell, 1976a) further evidence was found for the persistence of a strong association between HOME scores and 54-month Stanford-Binet IQ. Multiple correlation for 6-month HOME and 54-month Stanford-Binet was .50 accounting for 25% of the variance; for 24-month HOME and 54-month Stanford-Binet, it was $\underline{R} = .63$, accounting for 40% of the variance.

Elardo et al. (1977) found that all HOME subscales correlated with performance on the Illinois Test of Psycholinguistic Abilities. Jordan (1978) also reported a significant relationship between the HOME and vocabulary development.

Van Doornick et al. (1981), in a five-year longitudinal study of 94 infants, compared the HOME as a predictor of school achievement versus the childrens' social-class indices. Van Doornick et al. defined success in school as absence of: repetition of a grade, referral to a learning disability program, grades of D or F in

reading or math. Eighty-one per cent of infants whose scores were in the high range on the HOME (30-35 out of 45 points) were achieving at grade level, while 71% of the infants with low scores (0-15 out of 45) later developed school problems. The HOME proved to be a better predictor of success in school than social class.

Stevens and Bakeman (1985) conducted a factor analysis on HOME scores of low-income black and white urban mothers of 13- to 30-month-old children. Three distinct factors emerged: Emotional and Verbal Responsivity, Avoidance of Punishment, and Support for Intellectual Development (comprising provision of concept-development toys, maternal involvement in children's play and story reading activities). The Support for Intellectual Development factor made a unique contribution to variance accounting for 4-year-old Stanford-Binet IQ, although total HOME still correlated most highly with criterion scores.

Finally, there is evidence to suggest that early HOME scores are related to increases and decreases in mental test performance during the period from 6- to 36-months. Bradley and Caldwell (1976b) administered the Bayley Scales of Infant Development to 77 normal infants at the age of 6-months and the Stanford-Binet Intelligence Test at 3-years. The HOME was administered to the infants'

families when the infants were 6-months old. A multiple discriminant analysis showed that it was possible to differentiate among the group that improved in mental test performance, the group that remained stable, and the group that declined on the basis of home environment scores.

Use of the HOME with middle-class families. Several researchers and reviewers (Stevenson & Lamb, 1979; Van Doornick et al., 1981; Zimmerman, 1981; Belsky, Garduque & Hrncir, 1984) have pointed out a possible shortcoming of the HOME scale when used for research purposes: reduced variability in the scores of middle and upper-middle class families (a kind of ceiling effect) so that their scores cannot be used for analysis. Evidence on this point is still somewhat contradictory: Hollenbeck's (1978) cross-validation study showed that the HOME was able to discriminate between diverse populations in predictable ways, with the middle class having higher scores but not necessarily a ceiling effect. Elardo and Bradley (1981b) have presented a defense of the HOME's usefulness as a screening instrument but concede that there may be a tendency towards a ceiling effect for middle-class families.

Summary. In conclusion, the HOME is the most appropriate of the environmental process instruments for assessing the home environments of infants and

preschoolers. The only drawback in its use as a research instrument is a tendency towards reduced variability in scores (a ceiling effect) for middle-class and upper-middle class families. Its advantages, however, clearly outweigh this disadvantage: The HOME is practical and easy to administer. Its properties, in summary, make it the environmental instrument best suited to the purposes of this research.

Models of Parent-Child Interaction

The processes in an infant's environment may be categorized into social environmental processes (i.e. caregiver-child interaction variables such as emotional and verbal responsivity, acceptance of child's behaviour, parent involvement with child), and physical environmental processes (such as organization of physical and temporal environment, provision of appropriate play materials, and opportunities for variety in daily stimulation). A number of theoretical models have been proposed to describe parent-child interaction; however little empirical research exists to either support or contradict these theories.

Bell's child-effects model. Re-evaluation of the child's contribution to the parent-infant relationship, as described previously, has resulted in a major redirection

in the literature over the last several decades. As early as 1963, Yarrow stated that, although it was becoming possible to point to some fairly direct relationships between aspects of the maternal environment and infant characteristics, it was also necessary to "take into account what the infant imposes on his environment. There is a complex interactive relationship between the mother's behavior towards the infant and the infant's basic response patterns, predispositions, and individual sensitivities and vulnerabilities" (p. 110). In accordance with this perspective, research on parental influence on the development of children has been increasingly criticized for being unidirectionally biased, since it ignores the contribution of one-half of a complex, interactive parent-child relationship.

In response to the need for a more complex, multidimensional model of parent-child interaction, Bell (1968; Bell & Harper, 1977) has formulated a detailed child-effects model of parent-child interaction, a model which represents an historical precursor to the currently predominant interactionist perspective towards parent-child interaction. The child-effects model emphasizes the role of the child's own cues in influencing parental behaviour. Bell defines a child-effect as simply the effect of the child on its parent. Bell (Bell & Harper, 1977) infers the existence of child-effects from a number

of observations about child behaviour. He points out that even the youngest of infants is more powerful than its new parents in its ability to control their behaviour. Also, if parents can change the behaviour of their children, it seems only logical to assume that those changes will in turn expose the parents to altered behaviour in their children, causing even more changes in parental behaviour. Bell reasons, moreover, that there have to be some congenital differences between children to explain differential caretaker behaviour in certain cases and at very young ages. He cites Schaefer's (1963) description of a case in which a mother was differentially affectionate towards her schizophrenic quadruplet daughters. He also points out that, in the case of child abuse, often the parents are motivated to abuse the target child because of its persistent nagging or crying. In fact, some abusive parents are reported to feel that they are more the abused than the abusers.

Bell's child-effects model postulates that the parent-child interaction is a reciprocal social system, involving mutual adjustment and accommodation. According to Bell's model, parental control is exerted through power and long-range intentional behaviour. It is offset by the child's sheer activity in starting interaction, its resistance to domination and its appealing nature. A basic proposition of the model is that each participant in

the child-parent interaction has upper- and lower-limits "relative to the intensity, frequency or situational appropriatenes of behavior shown by the other" (p. 65). When either parent or child reaches an upper-limit, the other reacts to redirect or reduce the excessive or inappropriate behaviour of the other. This is an upper-limit control reaction. If, on the other hand, behaviour reaches a lower-limit, the reaction of the other is to increase the insufficient or non-existent behaviour by stimulating or priming it. This is a lower-limit control reaction. Parental control behaviour is thus exercised to maintain child behaviour within an optimal range.

Bell also suggests that parents do not emit behaviours at random, but that they have whole repertoires of hierarchically and sequentially organized control behaviours. That is, the "probability of occurrence of responses in a set may very according to order and levels of stimulation" (p. 66). Parents, therefore, respond differentially to different kinds of child behaviour (e.g. aggression, dependence, etc.). Responses are hierarchically and sequentially ordered in that the parent responds first with a low-level control response (e.g. distraction) and proceeds to higher-level, more intense responses (e.g. punishment) if the first control behaviours do not succeed. Selection of control responses will also be based on the parent's previous experience with the child's behaviour.

Bell gives some examples of situations in which upper- and lower-limit control behaviour might be employed in response to certain congenital qualities of the child i.e. characteristics inherited and acquired in utero but not necessarily rigid and inalterable. It seems likely that parents would increase upper-limit control behaviour in response to impulsive, hyperactive, or overly assertive children (Bell outlines evidence to suggest that all of these qualities probably represent congenital, individual differences among children). Types of upper-limit control behaviour might be, in rough order: distraction, quick tangible reinforcement, holding, prohibiting verbalizations, and physical punishment. On the other hand, if the child's behaviour tends towards "low activity, inhibited behaviour, low assertiveness, slow development and general lack of competence" (p. 67) lower-limit control behaviour such as "drawing attention to stimuli, positively reinforcing increases in activity, urging, prompting, and demanding increased performance" would be elicited from the parent.

Thomas and Chess's goodness of fit model. Further theoretical support for Bell's child-effects model comes from the research on temperament by Thomas and Chess (Thomas, Chess & Birch, 1968; Thomas & Chess, 1977). Thomas and Chess's findings suggest that children differ along certain dimensions of temperament and that certain

temperamental types are correlated with certain kinds of behaviour problems. If individual differences in temperament exist, as Thomas and Chess's evidence suggests, then as Bell's theory predicts, they could constitute powerful child-effects which interact with the child's environment to produce certain developmental outcomes as Bell's theory predicts.

Though operating from a more applied, clinical viewpoint, Thomas and Chess (1977) have, like Bell, formulated an interactionist model of the developmental process. In analyzing the nature of the temperament-environment relationship, they use the concept of goodness of fit. Goodness of fit occurs "when the properties of the environment and its expectations and demands are in accord with the organism's own capacities, characteristics, and style of behaving" (p. 11). If the fit between organism and environment is consonant, optimal development results. If there is dissonance between environmental opportunities and demands and the properties of the organism, development is less than optimal. Consequently, Thomas and Chess emphasize the necessity of analyzing data on a child's temperament within the context of his environment and the need to assess the parent's contribution to the developmental process while simultaneously considering the child's temperament and its influence on the parent.

Sameroff's transactional model. Another formulation of the interactionist perspective on the developmental process is that of Sameroff (Sameroff & Chandler, 1975; Sameroff, 1979; Sameroff, Seifer & Zax, 1982) who has used it extensively in connection with children at risk for developing schizophrenia. In examining the various etiological models for schizophrenia, Sameroff et al. (1982) conclude that studies done from either a constitutional or environmental perspective alone have little explanatory power. Sameroff's own transactional model, like the child-effects and goodness of fit models, is multidimensional and assumes there is no special developmental precursor (either constitutional or environmental) to schizophrenia; rather schizophrenia is one of a a full range of potentially normal developmental outcomes (normal in the sense of the ability of the organism to adapt to its environment). Sameroff et al. underline the interactionist nature of the model in stating that its defining characteristic is that all the elements in the system do in fact influence the development of other elements.

Research on Difficult Infant Temperament and Environment

By far the greatest quantity of infant temperament-environment research has focussed on the infant's social environment, primarily his interaction with his parents.

Perhaps because of its clinical relevance (Thomas and Chess's suggestion that the so-called difficult infant may become the child with behaviour problems), a considerable amount of research has investigated the fit between the difficult infant and his social environment. In their classic study, Thomas, Chess and Birch (1968) identified three temperament patterns: easy, difficult and slow-to-warm-up. The difficult type was characterized by irregular biological functioning, frequent negative mood, slowness to adapt to change, and extremely intense responses.

Of the parent-child interaction variables, maternal responsivity and involvement are perhaps the most studied. Moss (1967) directly observed 30 first-born infants over the first months of their lives and discovered that the amount of maternal contact given to infants at 1-month of age was positively related to observed crying and fussing. Moss found evidence for a sex difference in his sample: At 3-weeks, mothers tended to be more responsive to their sons than to their daughters, but, by the time infants were 3-months-old, mothers tended to spend less time with the male babies, who were also found to be more irritable.

In another classic, psychoanalytically oriented study, Escalona (1968) presented, from a syndrome analysis of previous work, evidence for the existence of a

difficult temperament type similar to Thomas and Chess's. In her sample of 16 active and 16 low active infants, Escalona found that only two of the active infants could be soothed with any degree of success. Maternal style did not show much variation as a function of the activity level types, but varieties of interaction were somewhat different for the two types, and there was a slight tendency for the mothers of the inactive babies to be judged as more competent than their counterparts. Escalona suggested that the mothers of very active infants facilitate their infants' development by calming, organizing and modulating their activity, while mothers of less active babies provide stimulation in order to encourage their infants' development.

In the previous decade, a number of researchers concluded that infant irritability and/or fussiness are associated with reduced levels of maternal responsivity and involvement. Using a sample of 8- to 11-month old infants, Beckwith (1972) determined that babies who cry more have mothers who ignore them, but that the direction of the effect is unclear. Similarly, from observational data collected on 36 infants and their mothers over a period of nine months, Clarke-Stewart (1973) found evidence for the existence of a factor she called "optimal maternal care" which was negatively related to children's fretfulness. Analyzing frequency of interaction rather

than quality, Korner (1974) found support for the hypothesis that long wakefulness and a high degree of restlessness evoke more frequent interactions with an infant's mother than quiet sleeplessness. Korner cited evidence to indicate that infants differ in soothability, and that more difficult, less soothable infants are apt to affect the mother-infant relationship adversely because they contribute to the mother's feelings of inadequacy.

Several more recent studies have also found an association between reduced maternal responsiveness and involvement with difficult infant temperament. Milliones (1978) found that the more difficult the infant (mean age = 11.5 months) the less responsive his mother. Field (1979), using a sample of 4-month-old normal and high-risk infants and their parents, found, during videotaped observation sessions, that parents tended to play fewer games with the more difficult, medically at-risk babies. Campbell (1979) found that mothers who rated their 4-month-old infants as irregular tended to spend less time in play with them, were less responsive to them, and generally spent less time interacting with them than did mothers of controls with their infants. Furthermore, although at 8-months the difficult infants no longer cried more than the control infants and were no longer rated as more negative in mood or less adaptable (although they were still slightly more irregular), their mothers

remained significantly less responsive to the infants' cries and vocalizations. Kelly (1976) identified easy-difficult dimensions from her factor analysis of Carey Temperament Questionnaires filled out by psychiatrically disturbed and control normal mothers. Negative responsivity from the infant was positively associated with negative responsivity from the mother in both groups.

Vaughn, Crichton and Egeland (1982) also concluded that neonatal behavioural organization influences the kind and quality of interactions in which newborns and mothers engaged. Vaughn et al. discovered that an Active/Alert factor obtained from nurses' ratings of activity level and fussiness in the nursery discriminated between the optimal and more worrisome infants in their study: Infants described as more optimally functioning on the NBAS were rated by the nurses as more active and alert. They also found that maternal interest/skill in the newborn period correlated with later skill and affect during feeding and play and with later maternal sensitivity to infant signals. Vaughn et al. found sex differences in their results which suggested that mothers are influenced more by the behaviour of their newborn sons than their newborn daughters.

Crockenberg and Smith's (1982) work cast into doubt the validity of the fuss and cry measure of infant

irritability. They found that neonatal irritability showed some consistency when time to calm was the criterion, but not when observed fussing and crying were the criteria. In addition, Crockenberg and Smith found that fussing and crying were associated with unresponsive maternal attitudes and behaviour for their sample of 56 mothers and their newborns. They also found that time alert was a strong predictor of maternal contact and that parity and maternal attitudes predicted mother contact.

A few more recent studies have produced evidence for the existence of the difficult temperament syndrome and have explored the relationship between this syndrome and parent-child interaction in preschool and school-age children. For example, Barron and Earls (1984) concluded that Inflexibility (the renamed and negatively keyed NYLS Distractibility dimension), high Intensity and low Adaptability were highly correlated with behaviour problems in 3-year-olds. Barron and Earls also tentatively concluded that child inflexibility and the quality of parent-child interaction represent important pathways through which family stress affects the presence of behaviour problems. Similarly, Garrison, Earls and Kindlon (1984) found that scores on NYLS dimensions Persistence, Intensity and Mood at age 3-years were predictive of maladjustment in school-age children.

Although a sizeable body of research (the studies described above, as well as those of Carey, McDevitt & Baker, 1980; Korn, 1984; Hubert & Wachs, 1985; Zeanah, Korner & Anders, 1986) has supported the existence of the easy/difficult temperament pattern, recently other studies have been highly critical of the position that such a syndrome exists or that it adversely affects mother-child interactions. For example, Bates et al. (1982), employing a sample of 168 mother-infant pairs, found evidence for only a modest positive effect of maternally perceived infant difficultness on maternal behaviour, and no evidence of any adverse effects of actual infant difficultness on maternal behaviour. Bates et al. concluded that, if difficult temperament does adversely affect mother-child interactions, this probably occurs at an age later than 6-months. Daniels, Plomin and Greenhalgh (1984) found few significant relationships between difficult temperament type and the HOME, and concluded there was no evidence for a family or genetic influence on difficult temperament in infancy. Rothbart (1982) has also called into question the usefulness of the whole infant easy/difficult temperament question.

Perhaps the most serious criticism comes from those researchers who have found evidence suggesting there is a serious parental confound in determining which infants are easy or difficult. Although they discovered that children

sensitive to strong environmental stimulation showed a high frequency of negative behaviours, Hagekull and Bohlin (1986) also determined that a mother's concept of her child's manageability predicted her positive or negative interactions with the child more than did the child's ongoing behaviour. Lerner and Galambos (1985) determined that mothers dissatisfied with their roles showed more rejection of their children and had more difficult children. Using IBQ dimensions to determine easy/difficult temperament patterns, Ventura and Stevenson (1986) found that depressed parents saw their infants as having more difficult temperaments. High socioeconomic status was associated with parental depression, with high SES infants being perceived as less soothable and more distressed.

Perhaps the most devastating criticism of the easy/difficult temperament distinction is found in a study by Vaughn et al. (1987). Vaughn et al.'s evidence indicates that prenatal maternal anxiety and maternal mental health variables significantly predict maternal perceptions of infant difficult or easy temperament which suggests that maternal perceptions are not the result of actual infant behaviour.

Summary. Many studies on the relationship between difficult infant temperament and parent-child interaction

suggest that the parents of difficult infants will be less responsive to their child and interact with him less. Several studies (Moss, 1967; Campbell, 1979) suggest that the mother tries hard to soothe her difficult infant, and then discouraged by her lack of success, becomes less responsive to him over time.

Some reviewers (Bates et al., 1982; Bates, 1980; Crockenberg & Smith, 1982) have argued that this research is suspect because of methodological problems, including relationships accounting for too small a proportion of the variance and failure to replicate. Bates et al. (1982) have presented an especially comprehensive critique: poorly understood generalizability of operational measures, role of third variables unknown, limited generalizability due to small sample sizes, questionnable use of multivariate statistics due to small sample sizes, and atypical samples.

More recent studies have questioned the validity and utility of the whole easy/difficult concept, citing serious parental biases in determining which infants are easy or difficult (e.g. Daniels et al., 1984; Lerner & Galambos, 1985; Ventura & Stevenson, 1986; Hagekull & Bohlin, 1986; Vaughn et al., 1987). These criticisms have yet to be answered satisfactorily.

Individual Infant Temperament Dimensions and Environment

Although many studies have focussed on the relationship between the difficult pattern of infant temperament and its effect on parent-child interaction, few studies have been directly concerned with exploring the relationship between specific temperament dimensions and parent-child interaction. With so much telling criticism of the easy/difficult temperament pattern, focussing on one temperament dimension is the most plausible way to proceed. The specific temperament dimension of interest for this study is activity level since, as previously discussed, it is perhaps the best-validated of the temperament dimensions and the one which comes closest to being a marker factor across various temperament theories.

Bradley and Caldwell (1981) have conducted one of only a few studies which examine the relationship between parent-child interaction and child activity level. The aim of the study was to explore the relationship between the infant's social behaviour and his home environment. The early social behaviour of 72 one-year-old children was assessed using the Infant Behavior Record from the Bayley Scales of Infant Development (which has been used as a measure of infant temperament; see Hubert et al., 1982). The infants' home environments were assessed using the

HOME scale. Factor analysis of the IBR yielded five behaviour dimensions: positive orientation and involvement, fear and reticence, enthusiasm and alertness, activity level and self-absorption. More exact descriptions of these factors were not provided, but the activity level and fear and reticence factors are similar to the Activity Level and Fear scales of the Infant Behavior Questionnaire. Bradley and Caldwell found a similar pattern of relationships between the HOME scores and IBR scores for males and females. The relationship between the two variable sets, however, was much stronger for females: The activity level factor was significantly related to four of the six HOME subscales (Maternal Responsivity, $\underline{r} = .47$, $\underline{p} < .01$; Organization of the Environment, $\underline{r} = .39$, $\underline{p} < .05$; Provision of Appropriate Play Materials, $\underline{r} = .69$, $\underline{p} < .01$; Maternal Involvement, $\underline{r} = .58$, $\underline{p} < .01$); and to total HOME score ($\underline{r} = .58$, $\underline{p} < .01$). For males, the activity level factor was related to total HOME score only ($\underline{r} = -.34$, $\underline{p} < .05$). The fear and reticence factor was unrelated to HOME scores for both sexes.

Two other studies present contradictory conclusions about the relationship of sex differences in conjunction with temperament and environment variables. Although Klein (1984) found no main effect for sex in the analysis of observed maternal behaviours, mother's perceptions of

boys were differently related to their behaviours towards boys as compared with girls. For example, intensity in girls (Carey ITQ) was related to auditory stimulation and contingent positive vocalization whereas in boys intensity was related to increased physical contact. Klein found that more distractible children received less stimulation and concluded that this was more significant for boys because low distractibility was reported to be "stubbornness". On the other hand, Simpson and Stevenson-Hinde (1985) report no support for their hypothesis that sex differences and temperament affect mother-infant interaction.

A study by Buss (1981) examined the relationship between children's activity level and parent-child interactions in a group of 117 preschool children. Using Bell's control theory (Bell & Harper, 1977), Buss predicted that parent-child interactions involving active children would be marked by more conflict than those involving less active children. Children's activity level was measured using actometers, and parent-child interactions were observed and rated by Q-sort in a standardized expeimental situation. Results generally confirmed Buss's prediction: Parents of very active children tended to get into power struggles with their children, tended to intrude physically into the tasks and had difficulty establishing a good working relationship

with their children. Interactions with less active children were more peaceful and harmonious.

The relationship between activity level and parent-child interaction has been explored, from a pathological perspective, in studies employing samples of older hyperactive children rather than normal infants (e.g. Mash & Johnston, 1982; Battle & Lacey, 1972). For example, Cunningham and Barkley (1979) used a sample of 6- to 12-year-old hyperactive boys and their mothers in addition to a control sample. In an observed structured task situation, they found that mothers of the hyperactive boys were less likely to respond positively to the child's social interactions, solitary play activities or on-task behavior. They employed a "controlling intrusive" style, imposing more structure and control on the child's play, social interactions, and task-oriented activities. These results are suggestive of the kind of interaction that probably occurs between parents and high active (but not necessarily hyperactive) children.

In a longitudinal analysis of 27 boys and 27 girls from the Berkeley Growth Study, Schaefer and Bayley (1963) reported findings which are relevant to two of the IBQ scales: activity level and smiling and laughter. Schaefer and Bayley found that early (before the age of walking) observed ratings of activity and rapidity were positively

related to observed maternal hostility for boys, whereas girls' activity and rapidity were independent of maternal behaviour. They also discovered that maternal love (versus hostility) was significantly correlated with happy, calm, and positive behavior of both sons and daughters during the first three years.

Rothbart and Derryberry (1982) have provided a persuasive theoretical argument on how activity level, for example, ought to affect parent-infant interaction:

> the active infant who continually approaches and 'gets into' things around the home may require extensive monitoring. A less active child may be satisfied with a more limited number of proximal and familiar sources of stimulation and will not require constant watching. We expect that the experience of both parent and child will be affected by the activity level and stimulation-seeking of the infant. The active child, who is often thwarted in his or her efforts to seek out additional stimulation, may come to construe parents as potentially frustrating agents, and the parents, in turn, may view the child as something of a 'nuisance.' In contrast, the less active infant may not be subject to the same amount of frustration and scolding, and the parents are likely to

> appreciate his or her relative contentment, even though at a later age they might wish the quiet child were more energetic at household and other tasks. (p. 393)

In a study whose purpose was to examine the relationship between temperament and mother-child interactions, Simpson and Stevenson-Hinde (1985) concluded that there was no evidence of an association between activity level and family interactions. They especially caution against relating patterns of temperament (e.g. easy/difficult) to family interactions.

Schroeder and Cooper (1983) found a moderate (r = -.45, $p < .01$) correlation between total HOME score and Toddler Temperament Questionnaire-measured activity level. High activity level was negatively correlated with Maternal Involvement (r = -.45, $p < .01$) and Provision of Appropriate Play Materials (r = -.44, $p < .01$). Because of the very small sample size (N = 20), however, Schroeder and Cooper's findings must be interpreted cautiously.

Clarke-Stewart (1973) presents additional data that are relevant to the smiling and laughter dimension of the IBQ: she found that, for her sample, based upon nine months of repeated observation, positive involvement with mother and expression of happiness were most closely related to the mother's expression of positive emotion

towards the child. On the other hand, Bates et al. (1982) in their sample of 168 six-month-olds, report no correlation between observed active and happy behaviors of the infant and dimensions of maternal behavior.

Summary. In summary, there are too few studies on the relationship between individual temperament dimensions (e.g. activity level, smiling and laughter, and fear on the one hand, and parent-child interaction on the other hand) to draw any firm conclusions. The few relevant studies on activity level suggest that, in accordance with Bell's control theory, parents tend to be more responsive and more involved with highly active children, and that they tend to structure their environment more (in terms of organizing the environment and providing play materials). Although they may be more responsive and more involved, the quality of the interaction may not always be positive: Buss's (1981) study suggests that, as their children get older, parents tend to become more controlling and intrusive and less positively oriented towards extremely active children. Also, the findings of Bradley and Caldwell (1981) and others (e.g. Klein, 1984) suggest that sex may be an important factor in the relationship between infant temperament and home environment.

Methodological Issues in Temperament-Environment Research

Two important methodological issues emerge from the literature on infant temperament and social environment. The first of these issues concerns the validity of maternal perceptions of temperament, especially the maternal perceptions of the infant's temperament as difficult or easy. Bates (1980) has argued that the possible link between the difficult infant and the behaviour problem child is as much parent perception as it is child constitution. Bates emphasizes the inadequate external validity of parent report measures and the low level of agreement between parent reports and researcher-observer reports (e.g. Campbell, 1979). He claims that parent reports measure the perceptual qualities of the parents more than the actual qualities of the child. Bates's claim has since been corroborated by a number of other researchers (e.g. Vaughn et al., 1982, etc., reviewed earlier). It has become, therefore, increasingly important to focus on solid, well-validated measures comparing specific infant temperament dimensions rather than unvalidated behaviour patterns comprising several temperament dimensions.

The second issue concerns direction of effect: Does a certain type of infant temperament precede negative parent-child interaction or does the negative quality of

the interaction predict the infant's temperament? A number of researchers have raised this point (Clarke-Stewart, 1973; Campbell, 1979), but few have attempted to answer it. Clarke-Stewart (1973) examined correlations across time and concluded, tentatively, that it looked as if maternal behaviour influenced children's development rather than the other way round. Similarly, Fish and Crockenberg (1981) performed a cross-lagged panel analysis on their data and concluded that infant social behaviour appeared more a function of maternal involvement and stimulation than a result of initial infant receptiveness to social interaction. They felt that infant influence on mother behaviour was suggested, however, by the positive correlation between NBAS cuddliness and caregiving when infants were 9-months-old. Cross-lagged panel analysis appears to be a viable technique of learning more about primary direction of effect in studies of infant temperament/parent-child interaction. The authors of both studies, however, caution that cross-lagged panel analysis doesn't "permit the same degree of confidence in a causal relation as does deliberate experimental manipulation" (Clarke-Stewart, 1973).

Environmental Influences on Infant Cognitive Competence

There is growing evidence that newborn behaviour has predictive value for individual differences in later cognitive status (Vaughn et al., 1982). The research evidence linking maternal behaviour in the first year with later mental test performance, however, remains inconsistent (Crockenberg, 1983). The most consistent correlations to emerge between early developmental competence and social environmental variables are correlations relating early developmental competence to secure parental warmth and responsiveness either through the facilitation of cognitive development or indirectly by creating a secure mother-infant attachment which allows infant exploration (Bates et al., 1982).

HOME and Cognitive Competence

Bradley, Caldwell and associates have conducted numerous studies examining the relationship between the HOME and cognitive competence in infants and young children.

In an early longitudinal study, Elardo et al. (1975) sought to determine whether or not the HOME as a measure of environmental process characteristics contributed more strongly to the prediction of children's abilities than social status or family structure indices. Infants were

given the Bayley Mental Development Index at 6- and 12-months of age and were assessed with the Stanford-Binet Intelligence Test at 36-months. In addition, the HOME was used to assess the children's environments at 6-, 12- and 24-months. At 6-months, multiple R between Bayley MDI and HOME subscale scores was .31; at 12-months, it was .30. At 36-months, multiple R between Stanford-Binet IQ and HOME subscales was .54. Elardo et al. concluded that aspects of the environment measured by the HOME have an important relationship to cognitive development during the first three years. They also concluded that HOME scores measured at 6-months were not related in any important fashion to Mental Development Index scores at 6- or 12-months but did have an important correlation with Stanford-Binet IQ at 36-months.

In a follow-up study by Bradley and Caldwell (1976a), HOME scores measured during the first two years of life were strongly related to 54-month IQ scores, especially Emotional and Verbal Responsivity of Mother, Maternal Involvement with Child, and Provision of Appropriate Play Materials. Bradley and Caldwell interpret their results to mean that, if parents assist their children during the first two years of life in terms of organizing their environment, the children may move more easily from sensorimotor to preoperational thinking. They also suggest that parents who encourage achievement may

facilitate "continuous cognitive striving" by their children (p. 1174). Furthermore, mothers who interact frequently with their children and are emotionally responsive to them "may develop in their children a sense of trust and enjoyment in the environment" which allows them "to behave in accordance with motives for competency and curiosity, thus facilitating cognitive growth" (p. 1174).

Through partial correlation, Bradley and Caldwell (1980) aimed at determining whether the association between environment and later IQ was due to the salience of early environment or because the quality of the environment remained stable. They found little relationship between 6-month HOME scores and 36-month IQ scores when HOME scores at 12-months were partialled out. This led them to conclude that the relationship between early HOME and 36-month IQ reflected a generally stable environmental impact rather than the unique contribution of the early environment. The one exception to this finding was a significant partial correlation between 6-month Provision of Appropriate Play Materials and IQ score for boys.

In a follow-up study to those of Bradley and Caldwell (1976a) and Elardo et al. (1975), Bradley and Caldwell (1984a) examined the relationship between 12- and 24-month

HOME scores and 12-month MDI, 36-month Stanford-Binet IQ and 7-year-old SRA Achievement Test Battery scores for 37 children. They found several significant correlations between 12-month HOME subscale scores and later achievement scores, the most notable involving the Play Materials scale. Four of the six 24-month HOME subscale scores were moderately correlated with 7-year-old achievement scores; the authors again noted the remarkable consistency of the Play Materials subscale score in relation to achievement scores. By employing a partial correlation technique, Bradley and Caldwell were able to conclude that part of the correlation between early environment and school achievement test scores results from the correlation between early environment and late environment rather than from a unique early environmental contribution. They suggest there is some degree of age specificity in the relationship between maternal behaviour and achievement, with maternal responsivity lessening in importance for cognitive development as the child grows.

Van Doornick et al. (1981) found a significant correlation (r = .37) between 12-month total HOME scores and elementary school centile scores (comprised of achievement test scores, letter grades and curriculum levels in reading and math) among lower-class children.

Two other recent studies have discovered relationships between HOME scores and mental development scores. Siegel (1981) found significant correlations between 12-month Play, Involvement, Variety and total HOME scores and 2-year-old Bayley MDI scores. Data is not presented for relationships between 12-month MDI and 12-month HOME scores. In a factor analytic study described in detail earlier, Stevens and Bakeman (1985) found that three factor scores derived from the HOME (Support for Intellectual Development, Verbal Responsivity and Non-Punitiveness) significantly predicted 3-year-old and 4-year-old Stanford-Binet IQ scores, with Support for Intellectual Development making a unique contribution to the variance of 4-year-old Stanford-Binet IQ scores.

On the other hand, the results of Bates et al. (1982) did not support a relationship between an optimal maternal care factor and infant competence at 6-months as assessed by the Bayley Mental Development Index. From a pool of maternal stimulation variables, Bates et al. found evidence for the existence of two major factors: a Social Contact factor which they interpret as very similar to Clarke-Stewart's (1973) optimal care factor, and a Maternal Teaching factor (including HOME Involvement and Provision of Appropriate Play Material scores). Neither factor was significantly related to infant competence. Bates et al. suggest there may be no "widely generalizable

'connection'" between infant competence and mother practices at 6-months.

Bradley and Caldwell (1976b) found evidence suggesting early home stimulation was related to increases and decreases in mental test performance during the period from 6-months to 36-months. Increases in performance were related to increases in Maternal Involvement and Provision of Appropriate Play Materials. Decreases were related to inadequate Organization of Physical and Temporal Environment.

The evidence on whether the relationship between home environmental variables and children's cognitive growth is mediated by parental education, parental IQ, and/or hereditary influences is still unclear. In a study of 183 adoptive and 165 non-adoptive families, Thompson, Fulker, DeFries and Plomin (1986) examined the relationship between 24-month-old HOME scores and 24-month-old MDI scores and concluded that the HOME's relationship to MDI was somewhat mediated by heredity. Wilson and Matheny (1983) found that a weak association between HOME and mental development when children were 6-months-old became increasingly stronger, reaching $\underline{R}$ = .66 when the children were 6-years-old. They argue that heredity is a significant mediator between home environment and mental development.

In sum, research on the relationship between home environment and cognitive competence suggests that certain aspects of the home environment measured by the HOME are related to cognitive development in the first three years of life and that parents can enhance their children's cognitive growth by organizing their environments appropriately. There is evidence to suggest that there is some specificity in the relationship, i.e. different environmental factors may be more or less important to cognitive development as the child ages.

Other Environmental Measures and Cognitive Competence

Crockenberg (1983) attempted to predict performance on the Bayley Mental Development Index at 21-months from characteristics of 3-month-old infants and their mothers. She found evidence to support the theory that maternal responsivity mediates the relationship between maternal education and infant mental test performance. Mental Development Index scores were positively correlated with mother's education, responsive attitude, observed smiling and eye contact, and negatively correlated with routine contact. Mothers with responsive attitudes had more persistent, less active babies; mothers with responsive behaviour (as measured by rapid response to crying) also had less active babies. Crockenberg interprets her data as suggesting that responsivity to emotional needs may

have a motivational affect on mental test performance because it affects persistence in the face of difficulty.

Yarrow et al. (1975) found contingent maternal responsiveness to distress was related to measures of infant attachment and speculated that maternal responsivity to distress may increase an infant's motivation to interact with the environment. They found a variety of other social environmental variables related to measures of infant competence. Level and variety of stimulation was related to infant goal directedness ($\underline{r}$ = .45 and $\underline{r}$ = .48). Mother's expression of positive affect was also related to infant functioning, and variety of stimulation correlated significantly with object permanence. Various inanimate environmental measures were also related to infant development: variety of objects available, complexity of objects, and their responsiveness.

Clarke-Stewart (1973) found that her optimal maternal care factor was strongly related to children's competence measured by the Bayley Mental Development Index. The second variable most highly related to infant competence was verbal stimulation; this factor was especially strongly related to a child's language ability. Clarke-Stewart found that maternal restrictive behaviour seemed to be associated with the child's less frequent and less

sustained involvement with objects and was negatively related to the child's MDI score. Scores on the MDI were related to the mother's social, nonphysical stimulation (looking and talking). They were also highly correlated with mother's responsiveness to the child's social behaviour. Clarke-Stewart speculates that contingent reinforcement doesn't just reinforce specific behaviours, but creates an expectancy of control in the infant that generalizes. For her sample, responsiveness to social behaviour seemed especially important in the second year.

Finally, in her syndrome analysis of two groups of high active and low active infants, Escalona (1968) reached the conclusion that a highly stimulating home environment was associated with high developmental status. She also concluded that high developmental status was related to frequent contacts with the mother.

In summary, the research linking cognitive development with environmental measures other than the HOME suggests that parental responsivity is an important influence on infant cognitive competence. The literature also suggests the nature of the cognitive development-environment relationship differs according to such factors as temperament and sex of child.

Sex Differences in Environment and Cognitive Competence

Since the question of sex differences often arises in socialization research, it is useful to examine the question of sex differences in the relationship between the home environment and cognitive competence.

Sex differences in HOME scores. A study by Bradley, Caldwell and Elardo (1977) compared the relationship between 24-month HOME scores and Stanford-Binet IQ at age 36-months separately for males and females. Results showed that the HOME was more strongly associated with IQ for females than for males. Avoidance of Restriction and Punishment (later renamed Acceptance of Child) and Organization of Physical and Temporal Environment showed a much less pronounced association with mental abilities for males than for females, suggesting two alternative hypotheses: 1. females may be more amenable to environmental events during the first three years of life, or 2. mothers tend to be more sensitive and effective when interacting with infant girls than with infant boys. In this context, Bradley et al. note that there seemed to be a greater diversity of stimulation in the home environments of females rather than males: The standard deviations of HOME scores were greater for females than for males. These results were similar to those of another study which examined the relationship between HOME scores and language development (Elardo et al., 1977).

In a study which examined the relationship between home environment, cognitive competence and IQ, Bradley and Caldwell (1980), assessed the homes of 72 children when they were 6- and 12-months of age. Performance on the Bayley MDI was assessed when the children were 12-months and Stanford-Binet IQ was assessed at age 36-months. Organization of Physical and Temporal Environment was the only subscale score that was consistently related to MDI scores at 12-months of age. Although the correlation of MDI and HOME scores was similar for both sexes, 12-month HOME scores were modestly but significantly related to a number of Bayley scores according to sex. For girls, Organization of Physical and Temporal Environment, Provision of Appropriate Play Materials and Maternal Responsivity were significantly related to cognitive competence. For boys, Play Materials, Maternal Responsivity and Maternal Involvement were significantly related to MDI scores. Looking at the relationship between HOME scores at 6- and 12-months and Stanford-Binet IQ at age 36-months, there were generally more significant correlations between the HOME subscales and IQ for girls than for boys. Bradley and Caldwell note three additional sex differences in their findings:

1. The most efficient set of predictors for boys' IQ at 36-months included assessments of Play Materials at 6- and 12-months and assessment of behavioural

competence (MDI). For girls, it was 12-month Play Materials and Maternal Responsivity.

2. For boys, the correlation between HOME and IQ scores were very similar, whether the home was evaluated at 6- or 12-months, but, for girls, scores were more correlated with 3-year IQ than the 6-month scores.
3. Maternal Responsivity and Avoidance of Restriction and Punishment were more highly correlated with IQ among girls than boys.

Findings were interpreted to suggest that cognitive development for boys was facilitated by a home in which the parents provide, in the first six months of the infant's life, an organized environment filled with appropriate play materials and encouragement for development. Bradley and Caldwell feel the relationship for girls may be somewhat more diffuse, with parent practices fine tuned to meet their unique needs and capabilities.

Bradley and Caldwell (1984b) noted, however, that, compared with other family demographic measures (race, crowding, birth order and SES), sex, with no overall multivariate main effect, showed the fewest significant correlations with HOME scores assessed at 6- and 12-months. On the whole, girls made higher scores on

Acceptance of Child subscale: Bradley and Caldwell (1980) found that this subscale is predictive of mental test scores in girls but not in boys.

Sex differences in other environmental measures. In their landmark study based on the Berkeley Growth Study sample, Bayley and Schaefer (1964) concluded that there was considerable evidence for sex differences in the relationship between intelligence (measured on a forerunner of the Bayley Scales) and mother-child interaction. Bayley and Schaefer's findings indicate that, during the first twelve months of life, for boys, there is a negative correlation with maternal ratings of equalitarianism, expressing affection, etc., but a positive correlation with punishment, use of fear to control, and strictness. On the other hand, for girls, mental scores correlated positively with accepting, loving behaviours, although, for both sexes, maternal controlling behaviours were correlated with intelligence. By the age of 4-years, the pattern for males changed and boys with equalitarian, positively evaluating mothers tended to make higher scores, while, for girls, patterns established in infancy were maintained or strengthened. For school-age boys, correlations were similar to those observed at 4-years and were almost complete reversals from what they were in infancy. Correlations between maternal behaviours and intelligence broke down almost completely for girls.

Bayley and Schaefer point out that, in their sample, there was a much stronger correlation between boys' IQs and maternal behaviours than between boys' IQs and assessed level of maternal intelligence. For girls, the correlation between IQ and mothers' estimated intelligence was .5. Similarly, for girls, there was a larger correlation between IQ and education of both mothers and fathers. Bayley and Schaefer therefore speculate that girls' intellectual functioning has a greater genetic component whereas boys are more influenced by the environment.

In their study of the relationship between the environment (both social and inanimate stimulation as measured by the Yarrow scale) and infant functioning (as measured by clusters derived from the Bayley), Yarrow et al. (1975) found many more significant relations for females than for males (44 for females vs. 6 for males). Direction of correlation was basically the same for both sexes even though correlations were lower for males. Yarrow et al. noted that mothers of boys tended to score significantly higher on the Level and Variety of Social Stimulation measure and tended to be higher on all other measures (i.e. boys seemed to be in a higher range of stimulation altogether), although this did not affect the number of statistically significant correlations. Yarrow et al., however, were able to dismiss the suspicion that

the discrepancy between the sexes was due to lower reliability in measurement of male infant characteristics because of a greater instability in the boys' behaviour.

Clarke-Stewart (1973) found few sex differences in the relationship between mother-child relationships and children's Bayley mental test scores. Her data tended to support Bayley and Schaefer's conclusion that, for girls, in contrast to boys, Bayley scores were more closely related to inherited ability than to environmental conditions: For girls the correlation between mothers' Peabody Picture Vocabulary Test (a measure of verbal ability) and the child's Bayley mental test score was higher.

Summary. In summary, research findings on sex differences in the relationship between cognitive competence and environmental processes is highly inconsistent. Some researchers (e.g. Bayley & Schaefer, 1964; Clarke-Stewart, 1973) have concluded that, for girls, cognitive competence is more related to inherited ability than to environmental processes, while the opposite is true for boys. Others (e.g. Bradley et al., 1977; Yarrow et al., 1973) have suggested that girls are more susceptible to environmental influence in that their mental test scores are more strongly associated with environmental processes.

Direction of Effect

The child-effects or interactionist view toward socialization presupposes that different children elicit different responses from their environment and that, therefore, the pattern of interaction between caregiver and child is partly determined by the child. Consequently, high correlations between parent behaviour and children's developmental competence cannot necessarily be explained unidirectionally in the sense that the parent behaviour causes competent behaviour in the child.

Bradley et al. (1979) attempted to unravel the problem of reciprocal influence by doing a cross-lagged panel analysis. Home environments of 93 children were assessed using three subscales of the HOME (Provision of Appropriate Play Materials, Maternal Responsivity and Maternal Involvement) when the children were 6-, 12-, and 24-months old. Results indicated that, in the first year, children appeared to exert a greater influence on their environment than the environment did on their mental test scores, especially in terms of eliciting greater maternal involvement and more adequate provision of developmentally advanced play materials. In the second year, parental behaviours such as actively encouraging developmental advances and, to a lesser extent, providing appropriate play materials, appeared to exert a significant impact on

competence. Bradley et al. warn that the cross-lagged method does not permit strong causal inferences but does suggest directions for further study.

An earlier cross-lagged panel analysis performed by Clarke-Stewart (1973) on data collected from 9- to 18-month-old children and their mothers suggested that stimulating, responsive maternal behaviour (optimal maternal care) influenced the child's intellectual development, but in terms of social relations, the child's behaviour affected the mother. Clarke-Stewart suggested, however, that this relationship did not always hold true but rather that children and their mothers alternated assuming the causal role.

A succinct summary of the limitations of environment-cognitive development relationships has been presented by Bradley and Caldwell (1980):

1. measures of environmental processes and developmental processes are not comparable across studies,
2. the available sample for most studies is small and restricted, and,
3. most studies are not longitudinal and/or not developmental in conception (i.e. they do not examine changes in environmental conditions and cognitive performance). To be meaningful, future research should address these three issues.

Hypotheses

In keeping with Bradley and Caldwell's suggestions, the present study was designed to longitudinally examine the activity level-home environment and the cognitive competence-home environment relationships in a large sample of infants at 6-months and 12-months of age. The Infant Behavior Questionnaire was selected as the temperament measure best suited for the purposes of the study, and the HOME was chosen as the most suitable instrument for assessment of the home environment. The Bayley Scales of Infant Development, comprising a Mental Development Index (MDI) and a Psychomotor Development Index (PDI), was the measure selected to assess infant cognitive and motor development.

The following specific hypotheses were investigated:

1. The families of children with extreme scores (high and low) on the Activity Level scale of the IBQ would have high scores on the Parental Involvement and Parental Responsivity subscales of the HOME. The literature (Moss, 1967; Escalona, 1968; Clarke-Stewart, 1973) suggests that parents tend to be more involved with and more responsive to active, alert infants and under-active infants. Escalona (1968) suggests that mothers of active babies tend to facilitate their child's development by calming,

organizing and modulating their activity while mothers of less active infants encourage their development by providing stimulation. Bell's control theory (Bell & Harper, 1977) also suggests that extremely high or low activity level in the infant activates upper- or lower-limit control behaviour on the part of the parent while the child of moderate activity level goes relatively unnoticed.

2. Similarly, extreme children's Activity Level scores would be associated with high scores on the Organization of Physical and Temporal Environment subscale of the HOME. Bell's model suggests that parents would structure the environment more for high- and low-active children in order to either control or to stimulate them. This would be especially true for the older infants in the sample who would be more mobile and so require more environmental constraints.
3. Activity Level would be negatively correlated with the Infant Acceptance (formerly Avoidance of Restriction and Punishment) subscale of the HOME since, according to Bell's control theory, parents would find it more necessary to use physical restrictions with extremely active children. Again, this should especially hold true for the

more motorically mature older infants in the sample.

4. For females, there would be a strong association between scores on the Activity Level scale of the IBQ and the HOME subscales. Bradley and Caldwell (1980) found that the activity level of one-year-old female infants was significantly related to four of the six HOME subscales.
5. Activity Level scores from the IBQ would be correlated positively with scores on the Psychomotor Scale of the BSID. Fish and Crockenberg (1981) found that Motor Maturity measured by the Brazelton Neonatal Behavioural Assessment Scale was positively correlated with observed large motor behaviour.
6. Activity level scores would correlate positively with the infant's weight and length. This is consistent with Walters's (1965) finding that birthweight correlated with adaptive and total Gesell scores at 12-weeks and with motor behaviour at 24-weeks.
7. Children who have high scores on the Activity Level Scale of the IBQ would also have high scores on the Distress to Limitations scale. This is consistent with a finding reported by Rothbart (1981).

8. Children's scores on the Mental Development Index of the BSID would correlate positively with their scores on the HOME. This pattern of results would be similar to results reported in other research (Elardo et al., 1975; Bradley & Caldwell, 1976b; Bradley, 1981).
9. For females, scores on the Mental Development Index of the BSID would be associated with their families' scores on the Acceptance of Child subscale of the HOME. This is consistent with results reported by Bradley et al. (1977), although for the present study correlations may be smaller because of the young age of the subjects. The children in Bradley et al.'s sample were administered the HOME at 24-months and the Stanford-Binet at 36-months.
10. Using a cross-lagged panel analysis, Bradley et al. (1979) found evidence to support the notion that children in the first year of life appear to exert a greater influence on their environment than the environment does on their mental test scores, especially in terms of their eliciting greater maternal involvement and more adequate provision of developmentally advanced play materials. Similar results were expected for the present sample. It was also hypothesized that, in the first nine

months of life, children's temperament (as measured by the IBQ) would have a greater effect on their environment (as measured by the HOME) than vice versa.

Summary

In summary, the purpose of this study was to determine if and how infant temperament and home environment are related. Little research to date has addressed this issue. This study focussed on the temperament dimension of activity level in part because of its theoretical interest and in part because it is the best validated temperament dimension suggested by various temperament theorists. More specifically, it asked the question whether activity level predicts certain aspects of the home environment, especially parental responsivity, parental involvement, organization of the physical and temporal environment, and acceptance of child (avoidance of restriction and punishment) as measured by the HOME scale.

Early sex differences in the relationship between infant temperament and environment could have serious implications for the socialization process and the eventual development of psychological sex differences: Therefore sex differences in the temperament-environment relationship were a central concern of the study.

Another question that arises frequently in the literature concerns direction of effect: Does infant temperament precede a certain kind of environment, or is the opposite the case? Through cross-lagged panel analysis, this study attempted to provide some tentative answers which would provide guidelines for further research.

In addition, there was some empirical evidence that highly active infants were heavier and more advanced motorically than their less active counterparts. The current study attempted to replicate this finding.

An additional concern was the relationship between infant cognitive development and the home environment: whether infant cognitive development predicts higher scores on relevant environmental process dimensions and whether there are sex differences in the relationship between cognitive development and home environment. Again, the question of direction of effect arises. Through cross-lagged panel analyses, it was expected that some weak causal inferences could be drawn about the relationship between the infant's developmental status and the infant's home environment.

METHOD

Subjects

Sample recruitment began with the birth announcements in the classified section of the Winnipeg Free Press. Addresses of parents of infants, born from September 11 to November 30, 1985, were obtained using the telephone directory and Henderson's City Directory. Before letters were sent, obituaries covering the period from September 10, 1985 to April 30, 1986 were first scanned to screen out parents whose infants might have died. The letter (see Appendix D) explained the purpose of the study, requested the participation of the infants and their parents (or other primary caregivers) and explained what their participation would involve. One week after letters were mailed, parents received a telephone call to request their participation in the study and to answer questions about it. Written consent was obtained on the first visit to the home.

Letters were mailed to 164 prospective participants. Of these, 96 parents (58.5%) agreed to their infants' participation in the study. Before the 6-month assessment could be conducted, parents of one infant were obliged to

drop out of the study because of the infant's illness; the starting sample therefore consisted of 95 six-month-old infants and their parents (48 males and 47 females).

Before the 12-month assessment, four more babies had to be excluded from the sample: One infant's family moved out of province, two infants' 6-month IBQs were received too late, and a fourth infant's family could not be located. The final sample therefore comprised 91 infants (45 males and 46 females).

Instruments

Infant Behavior Questionnaire. The Infant Behavior Questionnaire (IBQ), a parent report measure of child temperament, was designed by Rothbart (1981) for use with infants from 3- to 12-months of age (see Appendix A). It consists of 94 items, asking parents to rate their infant on a 7-point scale on various behaviours observed during specific situations (e.g. feeding, bathing, etc.). It is composed of 6 scales: Activity Level, Smiling and Laughter, Distress and Latency to Approach Sudden or Novel Stimuli, Distress to Limitations, Soothability, and Duration of Orienting. The development and psychometric characteristics of the IBQ have been described in detail previously.

HOME Inventory. The Home Observation for Measurement of the Environment was designed by Caldwell and her associates (Caldwell & Bradley, 1984) as an observational/interview measure of the quality and quantity of developmental support available to a child from the home environment. The version used in the current study was designed for use with families of infants from birth to three years of age (see Appendix B). It consists of 45 items and requires approximately 45 minutes to administer. It is comprised of six subscales: Emotional and Verbal Responsivity of Parent, Acceptance of Child's Behavior, Organization of Physical and Temporal Environment, Provision of Appropriate Play Materials, Parent Involvement with Child, and Opportunities for Variety in Daily Stimulation. The HOME's development and psychometric characteristics have also been described more extensively elsewhere in this paper.

Bayley Scales of Infant Development. The Bayley Scales of Infant Development developed by Nancy Bayley (1969) were designed to evaluate a child's developmental status from the age of 2- to 30-months. It consists of two main parts:

1. The Mental Scale was designed to assess sensory-perceptual abilities; early memory, learning and problem-solving abilities; vocalization and

beginning of verbal communications; and the beginnings of the ability to form generalizations and classifications for later abstract thinking. The Mental Development Index (MDI) is a standard score derived from administration of the Mental Scale.

2. The Motor Scale was designed to provide a measure of body control, coordination of the large muscles and finer manipulatory skills of the hands and fingers. The Psychomotor Development Index (PDI) is the standard score derived from the results of the Psychomotor Scale.

The current version of the Mental Scale contains 163 items arranged in terms of months and covering activities such as shape discrimination, sustained attention, purposeful manipulation of objects, imitation and comprehension, vocalization, memory, problem solving, and naming objects (Sattler, 1982). The Motor Scale contains 81 items and measures gross and fine motor abilities such as sitting, standing, walking and grasping. On the average, both scales take about 45 minutes to administer. The BSID was standardized on a representative national sample of 1262 children in fourteen age groups from 2-months to 30-months-old.

The BSID is probably the most widely used test of infant development. In his definitive textbook, Assessment of children's intelligence and special abilities, J.M. Sattler (1982) describes the Bayley Scales as "the best measure of infant development available" with "excellent" norms and "satisfactory" reliability and validity.

Physical measures. On each visit, infants were weighed using a portable scale. Then, recumbent length was measured using an anthropometer, an instrument which resembles a set of giant calipers and is commonly used in physical anthropology.

Procedure

Along with the initial letter, parents were sent a copy of the IBQ. Parents who agreed to participate in the study were requested to have the primary caregiver complete the IBQ within a few days of receiving the telephone call securing preliminary consent. The questionnaire was picked up by the observer on the first visit to the home, which was arranged within two weeks of the telephone call (see Appendix E for telephone protocol form).

Observer training. Two observer/examiners were trained in the use of the Bayley Scales of Infant

Development (Mental and Motor Scales) and the Home Observation for Measurement of the Environment (HOME). Observers practiced giving the BSID at the beginning of each assessment phase, using infants in the appropriate age range as practice subjects. During each practice session, held in the observation rooms of the nursery at the Department of Family Studies, Faculty of Human Ecology, University of Manitoba, one observer administered the BSID while the other observer scored from behind a one-way mirror. Each session was videotaped. Later, videotapes were reviewed and discussed, with special attention paid to resolving scoring disagreements between observers. In addition, observers attended a session in which a clinician experienced in the use of the BSID critiqued their videotapes and answered questions arising from the practice sessions.

During the training sessions, attention was also paid to such issues as how observers could make the caregiver feel at ease and how to establish rapport with the infant when giving the BSID. Observers also discussed the issue of handling parental questions about infant development and anxiety about parenting skills. If an infant's situation ethically warranted further intervention, arrangements were made for consultation with Dr. David Martin, a Registered Psychologist, to provide appropriate referral for psychological or other forms of assistance. No such instances arose.

Reliability. Before each assessment phase began, reliability for the HOME was assessed according to the procedure outlined by Caldwell and Bradley (1984). Observers worked as a pair on the first 11 home visits prior to the 6-month assessment and on the first 10 home visits prior to the 12-month assessment. During each of the reliability home visits, observers alternated serving as interviewer; both observers scored each assessment. Observers were instructed not to consult with each other during the assessment. Later, after obtaining reliability data, disagreements arising from each assessment were discussed and the manual consulted to resolve differences in scoring. This procedure continued until a suitable degree of reliability was reached. Reliability coefficients were calculated using Cohen's kappa, a procedure which takes into account agreement by chance, for the observational categories on the HOME, as recommended by Zimmerman (1981).

Reliability for the Bayley Scales was assessed in a similar fashion prior to both 6- and 12-month assessments. At the 6-month assessment, reliability data were collected on the first 11 visits; because one of these 11 families could not be located, at the 12-month assessment, reliability calculations were based on the first 10 home visits. During each of these reliability visits, one observer administered and scored the BSID while the other

observer watched and scored. Again, after reliability data had been obtained, differences in scoring were discussed and resolved by consulting with the Bayley Manual. Both per cent observer agreement and kappa reliability coefficients were calculated.

Two independent observations of the infant's length and weight were made on each visit. This was accomplished by having the caregiver record his or her scale reading of the infant's weight; blind to the first reading, the observer then recorded his own second weight estimate. The same procedure was followed in measuring length. Means of the two readings were used in subsequent analyses.

Six-month Assessment. Within two weeks of the infant's 6-month birthday, observers contacted the mother (or primary caregiver) in order to arrange a two-hour appointment. The observer explained to the caregiver that the child had to be awake, alert and at home with the caregiver when the interview took place. If the observer arrived to find that these conditions were not met, she arranged another appointment for a more suitable time. Each home visit took approximately 1 1/2 hours. When necessary, other siblings were present during the interview, but caregivers were requested to discourage other children's interference, especially during the administration of the BSID.

Identifying data (name, sex and birthdate of child) were first collected. With the intention of circumventing a possible ceiling effect with the HOME scores of middle-class and upper-middle class families, information about both parents' education and occupation was obtained. Educational level was assessed simply in terms of highest grade level or degree obtained and number of years of secondary and post-secondary education. Questions asked about occupation are listed in Appendix C.

Each interview began with a few questions from the HOME, as this provided a period of acclimatization during which the infant and his mother could become used to the observer's presence. In order to prevent infant fatigue, the Bayley Scales were administered early in the home visit and according to the standardized procedures outlined in the Bayley Manual. Then the rest of the HOME was administered; information relevant to HOME parent-child interaction items was sometimes obtained during administration of the BSID. Finally, weight and length were assessed using scale and anthropometer.

Twelve-month assessment. Within two weeks of the infant's 12-month birthday, the caregiver again was mailed a letter (see Appendix D) and an Infant Behavior Questionnaire. The IBQ was collected by the observer on the second home visit. A diploma attesting to their

infant's participation in the study accompanied the letter (see Appendix D). An observer (different from the one who conducted the first assessment and, consequently, without preconceived ideas of the child's status) again contacted the caregiver for a second two-hour appointment. The HOME and BSID were re-administered and the infant's weight and length re-measured.

RESULTS

The following scores were calculated twice for each infant, once for the six-month assessment and once for the twelve-month assessment:

IBQ scores. Six IBQ scale scores were calculated for each subject according to procedures outlined by Rothbart (1981): The total number of points received by a subject on a specific scale was divided by the number of items comprising the scale. Items marked does not apply or receiving no response were excluded both from the total number of points and from the number of items.

HOME scores. Each infant's home environment was assigned six HOME subscale scores plus a total HOME score. The subscale scores were the total number of affirmative responses in each subscale, while the total HOME score included the total number of yes responses in the inventory as a whole. Missing items were excluded from both total HOME score and the relevant subscale score. Scale and subscale scores were then calculated by a simple count.

BSID scores. On the Bayley Scales of Infant Development, each infant received two raw scores, one

based on the total number of successes achieved on the Mental Scale and the other comprising the total number of successes achieved on the Motor Scale. Then, according to procedures outlined in the BSID Manual (Bayley, 1969), each subject was assigned a standardized Mental Scale score or Mental Development Index (MDI) and a Motor Scale score or Psychomotor Development Index (PDI). The standardized scores were used in most of the analyses, while the raw scores (uncorrected for age) were used to analyze age-related changes.

Physical measures. Infants were weighed and measured on each home visit, once by the observer and once by the caregiver. The mean of the two weights and the mean of the two lengths yielded a single weight in grams and length in centimetres for each of the two assessments.

SES data. Information about parental occupations and education (number of years completed and post-secondary degrees or certificates obtained) was coded using Hollingshead's (1975) classification system. The coded information was used to calculate a family measure of socioeconomic status based on Hollingshead's formula of [5 x (mean of mother's and father's coded occupation)] + [3 x (mean of mother's and father's coded educational level)]. The occupations of parents who worked outside the home part-time were coded as if they worked full-time. If

information was available on a full-time homemaker's previous occupation, that information was used to calculate family socioeconomic status. If this information was unavailable, family SES was calculated on the basis of the employed parent's occupational and educational status. If an infant's family was headed by a single parent, that parent's occupational status and educational level were used in the calculation of family SES, and data obtained about a parent not residing with the infant was excluded.

Preliminary Data Analysis

Sample characteristics. At the 6-month assessment, the sample consisted of 95 infants (48 males and 47 females). Mean chronological age was 26.6 weeks (*SD* = .61). At the 12-month assessment, the sample comprised 91 infants (45 males and 46 females), and mean chronological age was 53.2 weeks (*SD* = .76).

Socioeconomic characteristics. Families of the infants were predominantly middle-class. On the Hollingshead (1975) scale, which classifies occupations on a scale from 1 to 9, average parental occupation (see Table 1) for the current sample occupied a position between a score of 5, representing "clerical and sales workers, small farm and business owners," and a score of

6, representing "technicians, semiprofessionals and small business owners." Also on the Hollingshead scale, which classifies educational level on a scale from 1 to 7, mean parental educational level occupied a position between a score of 4, representing high school graduation, and a score of 5, indicating partial college (at least one year) or specialized training. The mean family socioeconomic score was 43.02, which Hollingshead classifies as the social stratum of medium business, minor professional and technical occupations.

Table 1

Sample Socioeconomic Characteristics

Variables	M	SD
Father's Occupation (H)	5.57	1.91
Father's Education (H)	4.83	1.18
Education in Years	14.26	2.73
Mother's Occupation (H)	5.97	1.52
Mother's Education (H)	4.93	1.11
Education in Years	13.82	2.10
Family SES	43.02	9.93

Note: (H) = coded according to Hollingshead (1975). Education in Years = No. of years of education from Grade 1 to post-secondary.

Reliability. Reliability coefficients for the HOME and BSID are presented in Table 2. Per cent observer agreement correlation coefficients were all excellent, with kappas (taking into account chance observer agreement) ranging from good to excellent.

Table 2

Reliability Coefficients for HOME and BSID

	6-Month Assessment		12-Month Assessment	
	% Observer Agreement	Kappa	% Observer Agreement	Kappa
Bayley MDI	94.9	.90	98.9	.98
Bayley PDI	90.7	.81	97.0	.95
HOME	94.6	.68	95.5	.75

Summary statistics. Summary statistics (means and standard deviations) were calculated for both 6- and 12-month scores. Results are presented in Table 3.

Distributions. Most 6- and 12-month HOME subscale scores (with the exception of Acceptance of Child's Behavior) were positively skewed. Distributions of total HOME scores, all IBQ scales, Bayley MDI and PDI scores, and family socioeconomic status were approximately normal.

Internal reliability. To investigate internal reliabilities of individual subscales and total HOME scale

Table 3

Means and Standard Deviations of Major Variables

Variables	6-Month Assessment M	6-Month Assessment SD	12-Month Assessment M	12-Month Assessment SD
HOME				
Total	39.55	2.90	41.78	2.36
Responsivity	10.82	.65	10.96	.21
Acceptance	6.86	.77	6.74	.93
Organization	5.63	.57	5.81	.45
Play	7.77	1.27	8.26	1.01
Involvement	5.32	.91	5.53	.69
Variety	3.98	.91	4.48	.74
IBQ				
Activity Level	4.14	.79	4.45	.82
Smile & Laugh.	5.12	.71	5.21	.63
Distress to Novelty	2.45	.82	2.75	.71
Distress to Limitations	2.92	.74	3.25	.71
Soothability	5.06	.77	5.12	.89
Duration of Orienting	3.80	.98	3.82	.90
BSID				
MDI	123.72	12.12	124.38	10.99
PDI	110.45	11.97	107.25	15.23
Physical				
Weight (Gms)	8093.38	870.92	10605.01	998.09
Length (Cms)	66.86	2.60	75.50	2.89

scores, coefficient alphas were calculated for both 6- and 12-month HOME data (see Table 4). The size of coefficient alphas for both sets of data was moderate. Coefficient alphas were also calculated for 6- and 12-month IBQ

scales, and reliabilities ranged from moderate (6-month Distress at Novelty) to excellent (6-month Distress at Limitations).

Table 4

Coefficient Alphas for HOME and IBQ at 6- and 12-Months

Measure	6-Months Alpha	6-Months n	12-Months Alpha	12-Months n
HOME				
Total HOME	.68	91	.60	91
IBQ				
Activity Level	.79	80	.82	75
Distress to Novelty	.65	29	.77	59
Smiling & Laughter	.80	51	.75	71
Distress to Limitations	.85	46	.80	64
Duration of Orienting	.78	54	.77	77
Soothability	.79	29	.78	26

Note: As some items on the IBQ are designed for younger babies and some for older babies, parents are given the option of marking does not apply. Depending on the number of these items in addition to the number of missed items ns upon which alphas for IBQ scales were based varied considerably.

Stability. Longitudinal stability correlation coefficients were calculated (see Table 5). On the HOME, good stability was found for total HOME scores and the

Involvement subscale scores. The Acceptance subscale showed excellent stability, while the other HOME subscales showed poor stability. All the IBQ scales showed excellent stabilities that ranged from .49 for the Distress to Limitations scale to .66 for the Smiling and Laughter scale. On the Bayley Scales of Infant Development, MDI scores showed no evidence of stability over the observation period. On the other hand, the stability of the PDI was excellent. It will be recalled that different individuals completed the HOME and BSID scales when babies were 6- and 12-months while the same individual completed the IBQ on both occasions.

Table 5

Stability Coefficients for Major Variables

Measure	Stability Correlations 6- to 12-Months
HOME	
Total HOME	.27**
Responsivity	-.06
Acceptance	.46****
Organization	.00
Play	-.02
Involvement	.33**
Variety	.00
IBQ	
Activity Level	.50****
Distress to Novelty	.49****
Smiling & Laughter	.66****
Distress to Limitations	.45****
Duration of Orienting	.61****
Soothability	.46****
BSID	
MDI	-.11
PDI	.52****

** $p < .01$. **** $p < .0001$.

IBQ scale intercorrelations. IBQ scale intercorrelations are presented in Table 6. IBQ Activity Level and Distress to Limitations were significantly intercorrelated when infants were both 6- and 12-months of age, as were Distress to Limitations and Distress to Novelty. Duration of Orienting was positively related to Smiling and Laughter and to Soothability, and negatively related to Distress to Limitations when the infants were 6-months-old. Only the correlation between Smiling and Laughter and Duration of Orienting retained significance when the infants were 12-months-old. At the 12-months assessment only, Activity Level was positively associated with Smiling and Laughter.

Table 6

IBQ Scale Intercorrelations at 6- and 12-Months

		A	B	C	D	E	F
A.	Activity		.12	.06	.01	.26**	-.08
B.	Novelty	.16		.03	-.05	.21*	.00
C.	Orienting	.06	-.16		.28**	-.25*	.32**
D.	Smiling	.21*	-.16	.30**		-.06	.19
E.	Limits.	.31**	.44****	-.08	.02		-.17
F.	Sooth.	-.04	-.02	.20	.28**	-.02	

Note: Six-month assessment IBQ scale intercorrelations are above the diagonal, with N = 95; 12-month assessment IBQ scale intercorrelations are below the diagonal, with N = 91.

* p < .05. ** p <.01. **** p < .0001.

Hypothesis Tests

Results of specific hypothesis tests are presented in Table 7. In order to test the first two hypotheses, which predicted a relationship between extreme activity level and three HOME subscales, Activity Level scores from the IBQ were converted to standard z-scores. The absolute value of these z-scores represented a measure of AL extremity; for example, a baby with a very high or very low z-score (very active or very inactive) would have a high extremity score. AL extremity scores were correlated with scores from the Involvement, Responsivity and Organization subscale scores of the HOME.

Hypothesis 1, that extreme AL would correlate with Involvement and Responsivity proved to be unfounded for infants at both 6- and 12-months. In other words, parents were not more involved with and responsive to either active or inactive infants. Because the non-normality of the Responsivity and Involvement subscales may have affected the magnitude of the correlation with AL, attempts were made to normalize the distributions by combining and squaring them. There was comparatively little change in the distribution and, naturally, little change in the results (at 6-months: $r = .09$, n.s., and at 12-months: $r = .16$, n.s.).

Table 7

Results of Hypothesis Tests

No.	Hypothesized Relationship	6-Month *r*	12-Month *r*
1.	[*z*] AL & Involvement	.09	.17
	[*z*] AL & Responsivity	.04	.00
2.	[*z*] AL & Organization	.25*	.13
3.	*z* AL & Acceptance	.00	-.14
4.	For females: AL & Total HOME	-.01(F)	-.19(F)
		.03(M)	-.31(M)*
5.	AL & PDI	.03	-.17
6.	Weight in grams & AL	-.15	-.05
	Length in centimetres & AL	-.14	-.08
7.	AL & Distress to Limitations	.26**	.31**
8.	MDI & Total HOME	.32**	.15
9.	For females: MDI & Acceptance	.14(F)	-.18(F)
		.03(M)	-.05(M)
10.	Cross-lagged panel analyses	—	—

Note: Results of analyses of both 6- and 12-month assessment data were based on *N* = 91. M = Males; F = Females. [*z*] = absolute value of *z*-score. AL = IBQ Activity Level.

* *p* < .05. ** *p* < .01.

The second hypothesis, that extreme AL scores would be correlated with Organization, was true for the infants in this sample at 6-months, but not at 12-months of age. Apparently, parents structured the environment more for highly active and inactive infants at 6-months, but not at 12-months. Again, because Organization scores were not normally distributed, this hypothesis was retested, using squared Organization scores in an attempt to normalize the

distribution. Results were similar to those obtained using the unsquared scores (at 6-months: r = .25, p < .05, and at 12-months: r = .13, n.s.).

Hypothesis 3, that parents would be more restrictive with the more highly active infants in the sample, also proved to be unfounded. Activity Level scores were not significantly correlated with infants' HOME Acceptance scores at either age, although, as expected, the correlations were in the negative direction and increased over the 6-month assessment period.

To determine if sex had a significant effect on the relationship between activity level and home environment, as was predicted in Hypothesis 4, total HOME scores were correlated with Activity Level scores separately by sex. Results failed to confirm the hypothesis of a stronger association between AL scores and total HOME scores for females at either age. Differences between the male and female correlation coefficients were tested using the Fisher r to z transformation and the standard error of the difference between two zs term given by McNemar (1969, pp. 157-158).

Contrary to the prediction in Hypothesis 5, Activity Level scores were not correlated with PDI scores. The correlation between AL and PDI was larger when the infants were 12-months-old, but in a negative direction,

suggesting that, as the infants grew from 6- to 12-months, the more motorically advanced infants became less active.

It was also hypothesized, in Hypothesis 6, that larger (i.e. heavier and longer) infants would be more motorically advanced and therefore more active. Results failed to confirm this hypothesis as neither weight nor length measurements correlated with Activity Level scores.

The results were strongly supportive of Hypothesis 7: Children who had high Activity Level scores on the IBQ also had high scores on the Distress to Limitations scale. Parents in the sample indicated that very active children showed more anger and distress when waiting or refusing food, being in a confining place or position, being dressed or undressed, and being denied access to a wanted object.

The evidence for Hypothesis 8 was more equivocal. As hypothesized, infants' scores on the Bayley MDI were correlated with their total HOME scores at 6-months. Contrary to expectation, however, the same relationship was not sustained when the infants were 12-months of age.

The hypothesis that females' mental development would be more closely associated with their families' scores on the HOME Acceptance subscale (Hypothesis 9) was also not confirmed. MDI scores were not correlated with Acceptance

scores for either sex; differences between correlation coefficients were again tested for significance using the procedure described above (McNemar, 1969, pp. 157-158).

Although a sufficient number of subjects was obtained, cross-lagged panel analyses (Hypothesis 10) could not be performed because the basic assumptions of this type of analysis were not met by the data (Kenny, 1975). In a number of cases, dissimilar synchronous correlations indicated a violation of the stationarity assumption that the relationship between two variables remains unchanged over time. In other cases, negative synchronous correlations or autocorrelations made it impossible to rule out a common third variable as the spurious cause of a relationship between the original two variables.

Complicating Factors

Preliminary data analysis indicated several complicating factors which made it more difficult to interpret results of hypothesis tests in a straightforward fashion.

Correlations with family socioeconomic status.

Correlational analysis confirmed the suspicion that socioeconomic staus (SES) was indeed related to family HOME scores (see Table 8), with families of higher SES

obtaining higher HOME scores. At the 6-month assessment SES correlated with total HOME, Responsivity, Involvement, and Variety scores. At the 12-month assessment, SES correlated with total HOME, Acceptance and Play scores. Play was not as highly correlated with SES as expected: At the time of the 6-month assessment, there was no relationship between Play and SES; at the time of the 12-month assessment, the correlation between Play and SES was approximately the same magnitude as the correlations between SES and two other HOME scores (total HOME and Acceptance).

Correlations with tester. Multiple one-way analyses of variance with tester as the independent variable indicated a number of significant tester effects (see Table 9). In the 6-month assessment data, significant tester differences were discovered for the following measures: total HOME scores, Responsivity, Organization, Play and Variety subscale scores. On the BSID, Mental Development Index and Psychomotor Development Index scores were affected. In the 12-month assessment data, fewer tester effects were evident: HOME Responsivity and Acceptance scores, and, on the BSID, Mental Development Index scores.

Correlational analysis was employed to determine whether observer drift might have contributed to the

Table 8

Correlations between Family SES and Major Variables

Variables	r with SES 6-Months	12-Months
HOME		
Total HOME	.34**	.24*
Responsivity	.24*	-.04
Acceptance	.17	.30**
Organization	.07	-.06
Play	.07	.26*
Involvement	.29**	.10
Variety	.31**	-.02
IBQ		
Activity Level	.00	-.12
Smiling & Laughter	-.18	-.12
Distress to Novelty	-.02	.09
Distress to Limitations	-.12	-.05
Soothability	-.05	.03
Duration of Orienting	-.19	-.18
BSID		
MDI	.02	.06
PDI	.12	.08
Tester	.07	-.07

* $p < .05$. ** $p < .01$.

tester effects described above. For this analysis, the sample was first divided into two groups according to tester. Since subjects were assigned identification numbers (IDs) sequentially, subjects assessed later in the study generally had higher ID numbers. HOME and BSID scores of the subjects within each tester group were correlated with ID number to determine whether magnitude

Table 9

Tester Effects and Major Variables

Variable	F for Tester Effect	
	6-Months	12-Months
HOME		
Total HOME	10.69**	.01
Responsivity	8.10**	4.39*
Acceptance	1.27	4.41*
Organization	4.25*	.44
Play	33.70****	2.91
Involvement	.10	.69
Variety	9.32**	2.26
BSID		
MDI	36.96****	21.08****
PDI	33.06****	.76

Note: Degrees of freedom = 1, 89.

* $p < .05$. ** $p < .01$. **** $p < .0001$.

of score varied with sequential assessment order. A pair of large correlations in opposite directions on a particular variable would then indicate observer drift (i.e. observers' tendency to score differentially as the study progressed). The analysis indicated observer drift to be a probable cause of tester effects found in the 6-month MDI data (see Table 10). It was a possible cause of tester effects in 6- and 12-month PDI, 6-month Organization and 12-month Acceptance data.

Table 10

Correlations of Major Variables with Subject Sequence Number for Each Tester

Variable	r with ID			
	Tester 1		Tester 2	
	6-Month	12-Month	6-Month	12-Month
HOME				
Total HOME	.07	-.18	.12	.13
Responsivity	.22	--+	--+	-.25
Acceptance	.10	-.01	.03	.19
Organization	.16	-.24	-.01	-.21
Play	-.20	-.15	.03	.19
Variety	.15	-.28	.14	.12
BSID				
MDI	.48***	.01	-.28	.16
PDI	.28	.23	.36*	.37*

+ Because of a lack of variability in the Responsivity subscale scores at two points, correlations could not be calculated.

* $p < .05$. *** $p < .001$.

Management of tester effects. To counter the influence of tester effects, scores for the affected variables were first standardized by tester. Both testers' standardized scores were then merged and used to re-analyze major hypotheses (i.e. Hypotheses 1, 2, 3, 5, and 8) which would have been the most affected by systematic tester bias. Results from the second set of hypothesis tests remained insignificant, confirming previous conclusions. See Table 11 for results from this second set of hypothesis tests.

Table 11

Hypothesis Tests with Tester-Standardized Major Variables

No.	Hypothesized Relationship	6-Month *r*	12-Month *r*
1.	Activity Level & *z* Involvement	.20	-.11
	Activity Level & *z* Responsivity	.08	-.07
2.	Activity Level & *z* Organization	.10	-.17
3.	Activity Level & *z* Acceptance	.02	-.08
5.	Activity Level & *z* PDI	.19	-.16
8.	*z* Total HOME & *z* MDI	.15	.15

Note: Results of analyses of both 6- and 12-month assessment data were based on *N* = 91.

Other factors. Correlational analyses indicated an almost significant relationship between tester and IBQ Activity Level in both 6-month (*r* = .18, n.s.) and 12-month (*r* = -.20, n.s.) assessment data. It seems that, by chance, babies who were perceived by their parents to be highly active were assigned to the second tester for the 6-month assessment and to the first tester for the 12-month assessment. The tester effects described in the previous sections were probably as much related to the two test groups' differences in IBQ Activity Level (which could not have been influenced by tester) as to systematic tester bias. This would have been especially true in the case of the MDI scores: Twelve-month MDI was highly

correlated with 6-month Activity Level (r = .39, p < .001).

Simple Temperament-Environment Correlations

Pearson product-moment correlation coefficients for IBQ-HOME relationships are presented in Table 12. When infants were 6-months of age, there were three significant negative correlations between Duration of Orienting and total HOME, Play and Variety. These results suggest that infants with longer attention spans received less stimulating home environments overall (lower total HOME scores), received fewer appropriate play materials (lower Provision of Appropriate Play Materials scores), and less variety in daily routines (lower Opportunities for Variety in Daily Stimulation scores).

When the infants in the sample were 12-months of age, high IBQ Activity Level scores were correlated with low total HOME scores i.e. the most active infants at 12-months received less stimulating environments than low active 12-month-old infants.

Table 12

Simple Environment-Temperament Correlations at 6- and 12-Months

	IBQ Scores					
HOME Scores	AL	DL	DO	SL	DN	SO
			6-Months			
Total HOME	.00	-.04	-.25*	-.10	-.06	.03
Responsivity	.13	.06	-.03	.09	.05	.13
Acceptance	.00	.13	-.09	-.16	-.07	.04
Organization	.06	-.04	-.06	-.08	.07	-.15
Play	-.14	-.18	-.22*	-.06	.01	-.03
Involvement	.17	.07	-.15	-.11	-.15	.11
Variety	-.08	-.10	-.20*	.01	-.10	-.04
			12-Months			
Total HOME	-.25*	-.08	-.06	.02	-.18	.03
Responsivity	-.11	-.01	.02	.15	-.12	.14
Acceptance	-.14	-.01	-.14	-.08	-.01	-.05
Organization	-.15	-.12	.07	-.03	-.17	.01
Play	-.16	-.03	.07	-.04	-.12	.05
Involvement	-.12	-.06	-.08	.10	-.16	.08
Variety	-.17	-.09	-.08	.08	-.12	-.05

Note: For 6-month assessment, N = 95; for 12-month assessment, N = 91. AL = Activity Level; DL = Distress to Limitations; DO = Duration of Orienting; SL = Smiling and Laughter; DN = Distress to Novelty; SO = Soothability.

* $p < .05$.

Age Changes

Repeated measures analyses of variance using sex as the between-subjects variable and time as the within-subjects variable were conducted to determine whether the infants' scores on the MDI, PDI, HOME or IBQ had changed substantially over the six-month duration of the study (see Table 13). Raw MDI and PDI scores, rather than the age-corrected standard scores, which would have removed any changes brought about by infant maturation, were used in the analysis for age changes on the BSID. As might be expected, infants obtained significantly higher raw MDI scores at 12-months of age than at 6-months (see Table 14 for means and standard deviations of major 6- and 12-month variables). They also obtained significantly higher raw PDI scores at 12-months of age than at 6-months.

Using HOME total and subscale scores as within-subject variables, repeated measures analyses of variance also suggested that infants' home environments changed substantially from 6-months to 12-months of age. These changes were evident in total HOME, Responsivity, Organization, Play and Variety subscales. In other words, as their infants grew, parents became more responsive, reorganized the environment to better meet infants' needs, provided them with more developmentally appropriate play materials and stimulated them with more variable daily experience.

Table 13

Results of Age by Sex Repeated Measures Anovas

Variables	Within-Ss F (Age)	Between-Ss F (Sex)	Interaction F (S x A)
HOME			
Total HOME	44.05****	1.47	.66
Responsivity	4.03*	5.62*	2.78
Acceptance	1.37	.30	.21
Organization	5.93*	.05	.48
Play	7.84**	.84	.01
Involvement	3.69	.03	.02
Variety	17.01****	.94	.78
IBQ			
Activity Level	15.87****	2.59	.72
Smiling & Laughter	3.13	4.62*	.17
Distress to Novelty	14.09***	10.16**	1.82
Distress to Limitations	17.87****	.17	.02
Soothability	.44	1.86	.35
Duration of Orienting	.09	1.46	1.86
BSID			
MDI (Raw)	3398.65****	.38	.28
PDI (Raw)	3639.56****	1.80	3.15

Note: Degrees of freedom = 1, 89. At the 6-month assessment, Tester 1 assessed 21 males and 26 females; Tester 2 assessed 27 males and 21 females. At the 12-month assessment, Tester 1 assessed 20 males and 25 females; Tester 2 assessed 25 males and 21 females.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

Table 14

Means and Standard Deviations of Major Variables at 6- and 12-Months

Variable	6-Months		12-Months	
	M	SD	M	SD
HOME				
Total HOME	39.55	2.90	41.78	2.36
Responsivity	10.81	.65	10.96	.21
Acceptance	6.85	.77	6.73	.93
Organization	5.63	.57	5.81	.45
Play	7.78	1.27	8.26	1.01
Involvement	5.34	.91	5.53	.69
Variety	3.98	.91	4.83	.74
IBQ				
Activity Level	4.12	.79	4.45	.82
Distress to Novelty	2.44	.82	2.75	.71
Duration of Orienting	3.80	.98	3.82	.90
Smiling & Laughter	5.11	.71	5.21	.63
Distress to Limitations	2.91	.74	3.29	.71
Soothability	5.06	.77	5.12	.89
BSID				
MDI (raw score)	79.91	3.01	111.95	4.33
PDI (raw score)	29.77	3.13	47.45	2.54

Results of repeated measures analyses of variance using IBQ scale scores as within-subjects factors suggested that parents perceived their children as becoming more active from 6- to 12-months and also as being more likely to show distress at novel experiences. According to their parents, infants also displayed more distress to limitations (anger) at 12-months of age than at 6-months.

HOME as Predictor of BSID Scores

6-month HOME scores. Table 15 displays the correlations between 6-month HOME scores and both concurrent (6-months) and later (12-months) BSID scores. The correlation between 6-month total HOME scores and 6-month MDI scores was significant, but 6-month total HOME scores were unrelated to 12-month MDI. Total HOME scores of 6-month-olds, however, did predict both 6- and 12-month PDI scores. It must be noted that HOME scores were substantially but not totally independent of BSID scores.

Table 15

Correlations Between 6-Month HOME Scores and 6- and 12-Month BSID Scores

6-Month HOME	6-Month BSID		12-Month BSID	
	MDI	PDI	MDI	PDI
Total HOME	.32***	.36***	-.01	.22*
Responsivity	-.03	.07	.23*	.20
Acceptance	.09	.11	.07	.08
Organization	.12	.25*	.01	.15
Play	.31**	.27**	-.24*	.07
Involvement	.15	.24*	.18	.19
Variety	.31**	.27**	-.10	.13

* $p < .05$. ** $p < .01$. *** $p < .001$.

12-month HOME scores. Table 16 shows that the correlation between 12-month total HOME and 12-month MDI scores also did not achieve significance.

Table 16

Correlations Between 12-Month HOME Scores and 12-Month BSID Scores

12-Month HOME	r with 12-Month BSID MDI	PDI
Total HOME	.15	.14
Responsivity	-.18	-.05
Acceptance	-.11	.08
Organization	.17	.05
Play	.19	.17
Involvement	.15	.14
Variety	.16	-.04

Predicting MDI from specific HOME subscales. Results (see Table 15) indicated a significant correlation between 6-month Play and 6-month MDI, suggesting that, at this age, parents of infants with higher cognitive competence scores either provided them with more stimulating and developmentally appropriate toys or that brighter babies elicit more toys. When the more cognitively advanced infants were 6-months-old, parents also provided them with more opportunities for variety in daily stimulation.

Examination of correlations between 6-month HOME subscale scores and 12-month MDI scores, however, indicated that these significant relationships were not sustained. Six-month Play scores were significantly but negatively correlated with 12-month MDI; 6-month Variety scores were uncorrelated with 12-month MDI. Of the

6-month HOME subscale scores, only Responsivity was significantly correlated with 12-month MDI, suggesting that parents' responsivity to 6-month-old infants was related to the infants' cognitive competence at 12-months. None of the 12-month HOME subscale scores, moreover, were correlated with 12-month MDI scores.

Sex Differences in Environment

Results from a repeated measures analysis of variance (see Tables 13 and 17) indicate a significant sex effect on the HOME Responsivity subscale, suggesting that parents in the sample were more responsive to male infants than female infants.

Sex differences in HOME and MDI. Correlational analyses indicated few significant sex differences in the strength of the home environment-cognitive competence relationship at either 6- or 12-months (see Tables 18 and 19). For 6-month-old females, 6-month MDI scores were related only to parents' provision of stimulating play materials. Those 6-month-old female infants whose parents did not provide stimulating play materials, however, obtained higher MDI scores when the infants were 12-months-old. In addition, 6-month HOME Responsivity and Involvement scores were related to 12-month MDI scores in females. Nevertheless, no 12-month HOME scores were

correlated with 12-month MDI scores for either male or female samples.

Table 17

Means and Standard Deviations of Major Variables for Males and Females

Variable	Males		Females	
	M	SD	M	SD
HOME				
Total HOME	40.90	2.62	40.42	2.64
Responsivity	10.97	.18	10.80	.57
Acceptance	6.84	.79	6.76	.90
Organization	5.72	.55	5.72	.46
Play	8.07	1.09	7.96	1.22
Involvement	5.44	.82	5.41	.78
Variety	4.28	.82	4.19	.83
IBQ				
Activity Level	4.18	.74	4.41	.86
Distress to Novelty	2.39	.64	2.80	.83
Duration of Orienting	3.92	.99	3.70	.87
Smiling & Laughter	5.30	.57	5.03	.73
Distress to Limitations	3.06	.72	3.11	.74
Soothability	5.19	.86	4.99	.80
BSID				
MDI (raw score)	95.86	4.10	95.83	3.22
PDI (raw score)	38.87	2.86	38.25	2.79

For 6-month-old males, there were more significant correlations between HOME scores and 6-month MDI scores. Six-month total HOME, Play, Involvement and Variety were all significantly correlated with 6-month MDI scores.

Table 18

Correlations Between 6-Month HOME Scores and 6- and 12-Month MDI Scores by Sex

6-Month HOME Scores	6-Month MDI		12-Month MDI	
	Males	Females	Males	Females
Total HOME	.38**	.24	-.11	.11
Responsivity	.00	-.07	.26	.34*
Acceptance	.03	.14	.02	.13
Organization	.17	.07	-.02	.06
Play	.32*	.33*	-.21	-.30*
Involvement	.32*	-.06+	.11	.30*
Variety	.33*	.27	-.23	.07

Note: At 6-months, n of males = 48 and n of females = 47. At 12-months, n of males = 45 and n of females = 46.

+ indicates a significant difference, $p < .05$, between the correlations for males and females.

* $p < .05$.

Table 19

Correlations Between 12-Month HOME Scores and 12-Month MDI Scores by Sex

12-Month HOME Scores	12-Month MDI	
	Males	Females
Total HOME	.19	.10
Responsivity	-.25	-.16
Acceptance	-.05	-.18
Organization	.29	-.06
Play	.21	.19
Involvement	.12	.18
Variety	.14	.21

Note: N of males = 45; n of females = 46.

With only one exception, 6-month Involvement and 6-month MDI, the correlations for the male and female samples did not differ from each other. For 6-month-old males, the .32 Involvement-MDI correlation was significantly different from the female correlation of -.06.

Sex Differences in Temperament

A repeated measures analysis of variance (see Tables 13 and 17) also indicated that parents of female infants perceived their babies to be more distressed at novelty (i.e. fearful) than parents of male infants. On the other hand, parents of males believed their infants smiled and laughed more.

Sex differences in temperament and environment. When the infants were 6-months-old, there were two significant differences between male and female correlations in the temperament-environment relationship (see Tables 20 and 21). The first significant difference indicated that, for males, high activity level was associated with a more restrictive, less accepting home environment. The second significant difference suggested that, for females, high activity level is associated with lower scores in Provision of Appropriate Play Materials.

Table 20

Correlations of 6-Month Activity Level and 6-Month HOME Scores by Sex

6-Month HOME	6-Month IBQ Activity Level	
	Males	Females
Total HOME	.03	-.01
Responsivity	.05	.20
Acceptance	-.26	.23++
Organization	.17	-.03
Play	.05	-.29+
Involvement	.19	.15
Variety	-.07	-.07

Note: N of boys = 48; n of girls = 47.

\+ = difference between male and female correlations, $p < .05$.
++ = difference between male and female correlations, $p < .01$.

* $p < .05$. ** $p < .01$.

When the infants were 12-months of age, these two relationships failed to achieve significance, and two new significant correlations appeared. At 12-months, the Activity Level-Responsivity and the Activity Level-Involvement relationships were more negative for males than for females. Also, when the infants were 12-months-old, an overall pattern of a more highly negative Activity Level-HOME relationship for males, with a weaker, but still moderately negative relationship for females, emerged. Apparently, at 12-months of age, highly active

males did not have as developmentally rich home environments as their female counterparts.

Table 21

Correlations of 12-Month Activity Level and 12-Month HOME Scores by Sex

12-Month HOME	12-Month IBQ Activity Level	
	Males	Females
Total HOME	-.31*	-.19
Responsivity	-.39**	.05+
Acceptance	-.10	-.15
Organization	-.28	-.05
Play	-.14	-.16
Involvement	-.30*	.03+
Variety	-.19	-.17

Note: N of boys = 45; n of girls = 46.

+ = difference between male and female correlations, $p < .05$.

* $p < .05$. ** $p < .01$.

Birth Order

In a final supplementary analysis, correlations of birth order with major variables were considered and are presented in Table 22.

At the 6-month assessment, there were no significant differences between first- and later-borns on home environment, temperament or cognitive competence

Table 22

Correlations of Major Variables with Birth Order

Variables	Correlation with Birth Order	
	6-Months	12-Months
HOME		
Total HOME	-.19	-.08
Responsivity	-.06	-.16
Acceptance	-.20	.05
Organization	-.12	-.20*
Play	-.11	.15
Involvement	-.13	-.17
Variety	-.08	-.20*
IBQ		
Activity Level	.15	.11
Smiling & Laughter	.16	.06
Distress to Novelty	.04	.19
Distress to Limitations	-.06	.27**
Soothability	.09	.13
Duration of Orienting	-.07	-.07
BSID		
MDI	-.02	.04
PDI	-.16	-.02

Note: For 6-month assessment, n of first-borns = 46; n of second-borns = 34; n of third-borns = 15. For 12-month assessment, n of first-borns = 42; n of second-borns = 34; n of third-borns = 15.

* $p < .05$. ** $p < .01$.

variables. When the infants were 12-months-old, however, there were two significant negative birth order-HOME correlations, the first between birth order and Organization, and the second between birth order and

Variety. These results suggest that, when the infants were 1-year-old, later-borns received less developmental stimulation in terms of opportunities for variety in daily stimulation and a well-organized physical and temporal environment. At 12-months of age, later-borns showed more distress to limitations (anger) upon finding themselves in restrictive situations than did first-borns.

DISCUSSION

The present study examined the question of whether infant activity level (as measured by the IBQ Activity Level scale) was related to environmental variables (as measured by the HOME Inventory). Secondly, the study focussed on the relationship between infant cognitive development (measured by the BSID) and the home environment. Direction of effect and sex differences in the temperament-environment and mental development-environment relationships also constituted central concerns of the study.

Of the study's specific hypotheses, only the seventh, that children who had high IBQ Activity Level scores would also have high Distress to Limitations scores, was substantiated. A few problems clouded interpretation of this result. First, both the Activity Level and Distress to Limitations scales are parent perception measures and, as such, could have mutually influenced each other; i.e. parents could have placed additional limitations on their infant because they perceived their child to be more active than was actually the case. Second, the Distress to Limitations scale is quite influenced by parent practices. For example, item 2, which asks about whether

the baby fussed when kept waiting for food, could depend upon how long or how often the baby is kept waiting. The fact that this correlation is a replication of a pattern discovered by Rothbart (1981) contradicts the interpretation that current results represent an artifact of parent perceptions or practices.

Several measurement problems, including lack of variability in HOME subscale scores, the existence of tester effects and the young age of the subjects could account for the null results produced by other hypothesis tests.

Measurement Problems

Lack of variability in HOME subscales. A lack of variability in HOME subscale scores may well have been a factor in producing non-significant results. As previously discussed, preliminary analyses indicated positively skewed distributions for the Involvement, Responsivity and Organization HOME subscales, skewness which could not be normalized. Correlations between these subscales and other variables (IBQ Activity Level and BSID) were probably attenuated by the non-normal nature of the HOME subscale distributions.

The lack of variability in the HOME subscale scores was probably a result of a homogeneous, comparatively

well-educated middle-class sample. Participant families were selected from among those who could afford to advertise in the birth announcements in the newspaper. Also, those parents who agreed to participate in the study were not offered financial reward or any information about their children's developmental progress in exchange for their participation. Educated and aware parents such as these, motivated to participate by an interest in their children's development and an awareness of the benefits of scientific research, naturally would have obtained higher HOME scores than the low- to low-middle SES class upon which the HOME was standardized. Other researchers have reported a similar ceiling effect in using the HOME with middle-class samples (e.g. Stevenson & Lamb, 1979; Van Doornick et al., 1981; Zimmerman, 1981).

In a broader context, the middle-class nature of the sample could have affected the results in another way: It seems likely that more motivated and educated, higher SES mothers would be able to cope better with very active or inactive infants than lower SES mothers who have generally fewer environmental supports. Consequently, for this sample, extreme control behaviours might have been less apparent than would have been the case in a sample which would have included a broader spectrum from the general population.

Tester effects. An additional measurement problem which appeared to have affected hypothesis test results concerned the presence of significant tester effects, especially for the Bayley Scales of Infant Development and for the HOME. Despite excellent initial reliability estimates (inter-observer and kappa), 6-month Bayley MDI and PDI results were correlated with tester, and, in the 12-month data, MDI remained significantly correlated with tester. Of the HOME scores, 6-month total HOME, Responsivity, Organization, Play Materials and Variety were all significantly correlated with tester. In the 12-month data, only Responsivity and Acceptance retained significant correlations with the tester variable.

The tester effects problem was, however, remedied by conducting a separate set of hypothesis tests, using major variables that were standardized by tester. As no real changes in the outcome of the original hypothesis tests were produced, it was concluded that tester effects were not responsible for the lack of significance in the first set of tests.

Although the tester effect problems encountered in the course of this study were essentially circumvented, their occurrence suggests that even more stringent reliability procedures (e.g. checking reliability at either or both mid-points and ends of each data collection

period) should be implemented in future research. As the situation currently stands, the HOME, and even more so, the BSID, are such widely accepted and utilized tests that many researchers (e.g. King & Fullard, 1982; Crockenberg, 1983; Belsky et al., 1984; Peters-Martin & Wachs, 1984; Ramey et al., 1984) have accepted them uncritically, either neglecting to provide, or at least neglecting to report, reliability coefficients which pertain to the unique circmstances of their own research.

Age of subjects. An alternative explanation for the lack of significant results concerns the very young age of the subjects. Infants in the sample may have been too young to show much stability in mental development. Alternatively (or additionally), if environmental influences are cumulative, infants in the first year of life may have been too young to have demonstrated environmental effects.

McCall's (1981) theory of canalization supports this interpretation of the data. In brief, McCall theorized that there is a species-typical path (creod) along which all members of a species, given species-typical appropriate environments, tend to develop. According to McCall, early mental development is highly canalized during the first 18- to 24-months of life, but is thereafter less canalized. Canalization refers to the

individual's tendency to follow the species pattern under a wide range of diverse environments and to exhibit strong self-righting tendencies following exposure to severely atypical environments. After the age of 18- to 24-months, McCall's model suggests that mental development becomes progressively less canalized and individual differences become more stabilized. At this point, environment and heredity have both a greater impact on the individual and greater stability because of their cumulative character and because people tend to select environments that remain relatively stable. According to McCall, it is likely that ages 2 to 4 constitute the most sensitive period for mental development. McCall's model, then, would suggest that the mental development of the 6- to 12-month-old infants in the current study was still too canalized to display true stable individual differences or to demonstrate a measurable interaction with the environmental variables represented by the HOME.

Although the traditional approach has been to seek continuities in infant mental development (e.g. Siegel, 1981), a number of researchers have reported results which can be explained in terms of McCall's canalization theory. For example, from results of children's intellectual assessments (BSID at 6-, 12- and 18-months; Stanford-Binet at 24-, 36- and 48-months) and HOME assessments (at 6-, 18-, 30- and 42-months), Ramey et al. (1984) concluded

that both their control and experimental groups showed an increase in stability of individual differences from 6- to 48-months with these differences becoming increasingly predictable during the course of development. They noted that the effects of the HOME environment appeared to be cumulative. Similarly, in a factor-analytic study of HOME scores of low-income infants, Stevens and Bakeman (1985) discovered that HOME scores in infancy predicted later preschool (4-year-old) IQ somewhat better than earlier preschool IQ (3-year-old). Other researchers (e.g. Wilson & Matheny, 1983; Bradley & Caldwell, 1984a; Thompson et al., 1986) have reported similar findings: that HOME scores in infancy are more highly correlated with IQ scores at 2-years or older rather than with concurrent infant mental development scores.

In addition to arguing that instability in intellectual development contributed to the current study's failure to find significant home environment-cognitive competence relationships, it could also be argued that instability of temperament similarly affected the temperament-home environment relationship. Despite Rothbart's (1986) suggestion that periods of instability of temperament are to be expected during infancy because emotional systems comprising temperament are maturationally programmed, all IBQ scale scores in the present study demonstrated excellent stability. It

therefore becomes difficult to explain that a significant activity level-home environment relationship failed to emerge because infant activity level is unstable. Recent information about the IBQ's convergent validity with home observation measures (Rothbart, 1986) and actometers (McKeen, 1988) suggests that this stability does not exist solely in the minds of parents.

As McCall (1981) suggested was the case for the mental development-environment relationship, the lack of correlation between temperament and environment for very young infants may also be explained by the theory that temperament and environment have a slow, cumulative interaction. For example, Peters-Martin and Wachs (1984) found evidence of only a limited relationship between temperament and environment in the first year of life, with few temperament-environment correlations and little consistency in the relationship. As was the case with their subjects, babies in the present sample may simply have been too young for the expected temperament-environment interactions to be measurable.

Status of the IBQ

Overall, the pattern of results from the present study provides supportive evidence for the validity and reliability of the Infant Behavior Questionnaire.

Reliability for the Activity Level scale, as measured by Cronbach's alpha, was good (.79 at 6-months and .82 at 12-months) and consistent with coefficient alphas presented in other research (Rothbart, 1981; Rothbart, 1986). The stability of all IBQ scales was excellent and compares favorably with stability correlations reported by Rothbart (all scales in Rothbart, 1981; Activity Level, Smiling and Laughter, Fear and Distress to Limitations in Rothbart, 1986).

Although the current study provides no direct evidence of the IBQ's validity, the similarity of scale intercorrelations with intercorrelations provided by other researchers lends indirect support. Correlations between Activity Level and the other IBQ scales are similar to both the 6- and 12-month patterns of intercorrelations provided by Rothbart (1981). Activity Level intercorrelations with other IBQ scales are also quite similar to those presented by Eaton and Dureski (1986) and Crockenberg and Acredolo (1983) for samples of 3-month-olds.

Activity Level and Physical Measures

Hypothesis 6, that heavier and longer babies would be more active, proved to be unfounded. The correlations at both 6- and 12-months were small and negative. In fact,

these results show some consistency with the literature. A study by Walters (1965), discussed earlier, reported that, although at 24-weeks weight was positively related to motor development measures (including motor activity), as the infants aged, at 36-weeks, weight had an insignificant effect on development. Walters cautioned, however, that the variability in her infants' weights was not high.

Temperament and Environment

Although there were relatively fewer significant IBQ-HOME correlations than expected, it is intriguing to note that, in the 6-month data, all three significant negative correlations occur between total HOME scale and subscales (Play and Variety) and IBQ Duration of Orienting. A suggestion by Klein (1984) that mothers of 6-month-old males interpreted their sons' low distractibility (on Carey's Infant Temperament Questionnaire) as stubbornness may be pertinent. If parents in the current sample perceived less distractible infants as stubborn, then they might have been discouraged from providing their infants with high levels of developmentally stimulating interactions and experiences. The present results, however, do not correspond with Klein's findings (described in detail previously) in that, in the current study, less distractible children received less

environmental stimulation. In Klein's research, more distractible 6-month-olds received less stimulation.

The 12-month assessment data, which shows a significant negative correlation between Activity Level and total HOME scores, has possible clinical implications for management of parent-child interactions in cases of hyperactivity, especially if this pattern of results is replicated in samples of older children. The present research suggests that highly active 12-month-olds receive less developmentally stimulating environments and lower quantities of parent-child interaction than less active children. Perhaps parents of highly active 12-month-olds (who are becoming increasingly more mobile) are too tired to cope with their infants' activities or, in terms of Bell's control theory, they may be unknowingly attempting to control the infants by providing them with less stimulation. Alternatively, infants who are very active may be more exploratory and consequently more self-sufficient in terms of providing their own entertainment.

These findings are very consistent with those of Schroeder and Cooper (1983) who report a moderate negative correlation ($r = -.48$, $p < .01$) between Toddler Temperament Questionnaire Activity Level and total HOME scores for a very small ($N = 20$) sample of low birthweight infants. Significant negative correlations between two

other HOME scores (Involvement and Play) and Activity Level were not replicated in the current data.

Data from the present study indicating a generally negative pattern of parent-child interactions for highly active 12-month-olds were also consistent with findings of two other researchers. In samples of older hyperactive males, Buss (1981) and Cunningham and Barkley (1979) described generally conflicted, negative parent-child interactions.

In studies of adult temperament, Rothbart (1986) has found evidence for a pattern of dysphoria, characterized by significant correlations among susceptibility to fear, frustration, discomfort and sadness. In her studies of children, she has also identified a negative reactivity temperament cluster, characterized by high Distress to Limitations and Fear (Distress to Novelty). In the current research, the pattern of significant correlations amongst the Activity Level-Fear (Distress to Novelty)-Anger (Distress to Limitations) triad was especially prevalent in the 12-month-old data, and these scales' generally negative relationship with HOME variables tentatively suggests the existence of a highly active, intense and emotionally expressive temperament pattern which may be predictive of a poorer quality developmental environment.

On the other hand, Klein (1984), for her sample of 6-month-olds, reports that infants perceived to be more "active, intense, responsive and approaching" (p. 1214) received more sensory and social stimulation. In any case, results from Rothbart's, Klein's and the present study suggest that the exploration of such positive and negative reactivity patterns together with their relationship to environmental variables could be highly fruitful.

Age Changes in Environment

Results from the present study indicate significant increases in total HOME scores in the period from 6- to 12-months and also significant increases in Responsivity, Organization, Play and Variety HOME subscale scores. These results parallel those of Barrera, Cunningham and Rosenbaum (1986) who used the HOME Scale with a sample of prematures and found increases in Responsivity, Organization, Play and Variety scores as infants aged from 4- to 16-months.

Because stability coefficients for the above HOME subscale scores were low, it is difficult to know whether the age changes reported above are genuine or merely reflect instrument instability. Two factors, however, indirectly attest to the validity of the age changes.

First, two of the HOME subscales which show age changes (Organization and Play) were relatively immune to tester effects. Secondly, the replication of a pattern reported by Barrera et al. suggests that these changes are quite genuine. As Elardo and Bradley (1981a) contend, the HOME may be a dynamic environmental measure that changes as a function of child maturation.

Age changes in total HOME and MDI. In general, the literature suggests that the relationship between HOME scores and IQ strengthens as a child ages. For example, Elardo et al. (1975) found the HOME at 6-months to be weakly related to MDI scores at 6- and 12-months, but strongly related to Stanford-Binet IQ at 36-months. They concluded that the HOME measures environmental forces important to performance on cognitive tasks at a time in an infant's life before those forces have affected the infant's measured development. A follow-up study by Bradley and Caldwell (1976a) also produced strong multiple correlations between 6-month HOME scores and 54-month Stanford-Binet scores (R = .50) and between 24-month HOME and 54-month Stanford-Binet scores (R = .63). Bradley and Caldwell (1980) reported a substantial relationship between the HOME in the first year of life and Stanford-Binet IQ at age 3-years. Similarly, Elardo et al. (1977) have reported a stronger relationship between 24-month HOME scores and 37-month language development scores

(Illinois Test of Psycholinguistic Abilities) than between 6-month HOME scores and 37-month ITPA scores. Finally, Van Doornick et al. (1981) found 12-month HOME scores to be predictive of later school achievement in low-SES families.

Because of inconsistencies in the data and because the literature suggests that the infant subjects may have been too young to exhibit much stability of individual differences in either cognitive development or environmental influence, it is impossible to draw firm conclusions from the present study about the HOME-MDI relationship. For instance, the correlation between 6-month total HOME scores and 6-month MDI scores was significant and positive, but failed to retain significance at 12-months. Six-month total HOME scores failed to predict 12-month MDI scores, but they did predict psychomotor development as measured by PDI scores. Although the relationship between 6-month total HOME scores and 12-month MDI scores was not significant, 12-month MDI was correlated with 6-month Responsivity and negatively correlated with 6-month Play. Total HOME scores obtained at 6- and 12-months might have proven to be significant predictors of the infants' cognitive development, had their IQs been reassessed at 24- or 36-months.

Age changes in specific HOME subscales and IQ.

Findings from this study suggested a relationship between Provision of Appropriate Play Materials at 6-months and 6-month MDI. There were no 12-month HOME subscales which predicted 12-month MDI. As expected, 6-month Responsivity was significantly related to 12-month mental development, but, unexpectedly, 6-month Play was related negatively to 12-month MDI. It is difficult to speculate about why babies who were not provided with appropriate play materials at 6-months showed better 12-month cognitive abilities than those who were given stimulating toys. Perhaps those babies engaged in more interpersonal interactions with their caregivers or learned to amuse themselves with fewer toys, thereby improving their cognitive abilities.

These results diverge from results reported by other researchers, again, perhaps because subjects in the present study were too young to display stable individual differences or to show the cumulative effects of their environment. For example, Bradley, Elardo, Rosenthal and Friend (1984) found that 6-month Organization, Acceptance and Variety were significant predictors of 3-year-old Stanford-Binet IQ. Of the 24-month HOME scores, Play was most predictive of Stanford-Binet IQ at 3-years. Elardo et al. (1975) found that Organization and Variety were most critical for prediction of 6- and 12-month MDI

scores. Bradley (1981) reported that 6-month Organization and Play were significantly related to 36-month Stanford-Binet scores, and that, of the 12-month HOME scores, Play and Involvement had the strongest relationship with 36-month Stanford-Binet IQ.

Results from the present study also are not consistent with findings presented by Crockenberg (1983) who discovered a positive relationship between maternal response to child's distress at 3-months and child's performance on the MDI at 21-months. Instead, because 6-month Responsivity is a predictor of 12-month MDI scores, the current results give tentative support to Bradley's (1981) contention that Responsivity might be necessary for earlier cognitive development although he reports that it is not correlated with later (first grade) achievement scores. The present study's finding that 12-month Responsivity and 12-month MDI are negatively correlated remains somewhat puzzling; it is possible, however, that, in keeping with the earlier pattern of early Responsivity predicting later cognitive scores, the 12-month Responsivity score would be predictive of a later measure of cognitive development.

Age Changes in Temperament

In the literature to date, relatively little has been reported about developmental age changes in temperament. Findings from the present study indicate significant increases in Activity Level, Distress to Novelty (Fear) and Distress to Limitations (Anger) over the 6- to 12-month period of infancy. As these scales all showed excellent stability from the 6- to 12-month assessment, the developmental differences were probably not due to instability in individual differences. These three scales were intercorrelated, with significant correlations between Activity Level and Distress to Limitations and between Distress to Limitations and Distress to Novelty.

The finding of a significant age change in Activity Level is consistent with results presented by Rothbart (1986) in a study using both IBQ and home observation measures of temperament when infants were 3-, 6-, and 9-months of age. Rothbart also found age-related increases in Smiling and Laughter and Vocal Activity. Using the Toddler Temperament Questionnaire, Barrera et al. (1986) similarly discovered that infants in the first year of life became more active with age. Consistent with present findings, Rothbart (1986) also reported an increase in Fear (Distress to Novelty) over the 3- to 9-month period for IBQ data only and not for a home

observation measure. In Rothbart's study, Distress to Limitations showed a U-shaped function, with higher scores at 3- and 9-months than at 6-months for both measures, but significant only for the IBQ. This pattern is consistent with the present results, which show a lower 6-month score and a higher 12-month score.

Sex Differences in Environment

Findings from the present study depart from those of Moss (1967), who concluded that, after the first month, mothers tended to be more responsive to their daughters than to their sons. Parents in the present sample appeared to be more emotionally and verbally responsive to their sons than to their daughters.

Results from this study also diverge from those of Bradley and Caldwell (1984b) who found that females generally have higher HOME scores than males. In the present sample, there were few significant, consistent differences between the sexes. Unlike the present study, Bradley and Caldwell found significantly higher scores on the Acceptance subscale for girls at 6-months, but not at 12-months. As was the case with the present study, however, Bradley and Caldwell also noted that their study had produced a relatively small number of simple sex differences and no overall multivariate sex effect.

Other researchers have also reported few or no simple sex differences on the HOME. Allen et al. (1984) found no sex differences on the HOME in a sample of normal, high risk or developmentally delayed infants at 9- and 18-months. Similarly, Adams et al. (1984) found no significant differences between males and females on mental test scores, total HOME scores (obtained at 6- and 18-months) or HOME subscale scores (obtained at 6-months). At 18-months, boys' home environments were discovered to be lower than those of girls' in Acceptance and higher in Provision of Appropriate Play Materials.

Sex differences in HOME and MDI. In the literature, researchers have been inclined to support one of two theoretical perspectives regarding sex differences in the environment-cognitive competence relationship. The first perspective assumes that females are more amenable to environmental events than males. For example, in examining the relationship between 24-month HOME scores and 36-month IQ scores separately for males and females, Bradley et al. (1977) suggested that females might be more amenable to environmental events in the first three years and found a greater diversity of stimulation in the homes of females. Similarly, Yarrow et al. (1973) found many more significant relationships between social and inanimate stimulation (from the Yarrow scale) and clusters from the BSID for females.

On the other hand, Bayley and Schaefer (1964) concluded that the environment-cognitive competence relationship for the sexes changed with age, and that boys in the preschool years tended to be more affected by environmental variables such as maternal warmth and responsivity, the girls by heredity (e.g. parental IQ and education). Clarke-Stewart (1973) supported the notion that girls' cognitive abilities are more related to inheritance than to the environment.

Results from the present study which indicate a significant difference only on the Involvement subscale, are similar to those of other researchers who found few significant sex differences (Bradley & Caldwell, 1984b; Clarke-Stewart, 1973). Results also lend some support to the hypothesis that infant female cognitive competence may be more related to heredity than is male cognitive competence. Females' MDI scores were not more highly correlated with HOME scores at 6- or 12-months but, at 12-months, they were significantly more related to socioeconomic variables, notably family socioeconomic status (r for males = -.09, r for females = .28, z = -1.80, $p < .05$) and paternal occupation (r for males = -.10, r for females = .28, z = -1.68, $p < .05$). It is, of course, necessary to first make the plausible assumption that the Hollingshead (1975) family social status measure (based on occupation and education of parents) is related to parental IQ.

Bradley (1981) has pointed out that, although the total HOME shows the same general level of relationship with IQ for both sexes, there are some important differences on the individual subscales. From research published by Bradley and Caldwell (1980), Bradley concluded that cognitive development for boys is facilitated by an organized environment, with plenty of appropriate play materials, and encouragement for development. He believed the environment-cognitive competence relationship for girls to be more diffuse, with girls needing parenting that was more fine-tuned to their unique needs. In the present study, no such clear-cut or consistent pattern of correlations between HOME scores and MDI scores emerged. The results were quite inconsistent, with the few significant 6-month MDI/6-month HOME correlations disappearing by the 12-month assessment.

Sex Differences in Temperament

The finding that parents perceived their female infants to be more fearful (distressed by novel situations and by strangers) than male infants of the same age is quite consistent with the cultural stereotype of females as being more timid. It is also not inconsistent with results from other studies: In children not old enough to read and write, Maccoby and Jacklin (1974) have interpreted the literature to mean that certain specific

elicitors may arouse fear more readily in girls than in boys. For older children, teacher ratings and self-reports, according to Maccoby and Jacklin, suggest that girls are more timid and anxious.

A more unexpected finding was that parents perceived their little boys to smile and laugh more frequently than little girls. This contradicts the prevailing picture in the literature (e.g. Moss, 1967) and in popular culture of the male infant as being a generally fussier, less soothable, more immature organism than the female infant. Of course, the present sample of babies was not newborn and the finding of a sex difference in smiling and laughter may reflect the results of 6-month-olds' maturation from the newborn level. In a sample of 243 firstborn infants, Vaughn et al. (1982) found that male newborns were rated significantly less fussy and easier to soothe by their nurses. Recently, Thompson and Lamb (1983) reported that, for a sample of 43 one-year-olds, males received higher scores on the Smiling and Laughter scale of the IBQ.

On the other hand, other researchers have failed to replicate these two sex differences. Rothbart (1986) reports finding no sex differences on either home observations of temperament or on IBQs filled out by parents for a sample of 52 infants assessed at 3-, 6-, and

9-months of age. In previous research, Rothbart, Furby, Kelly and Hamilton (1977, March, cited in Rothbart, 1986) also failed to find sex differences in three cohorts of infants whose parents completed IBQs.

The excellent stability of the IBQ scores strengthens the conclusion that the sex differences apparent in the present sample are not artifactual, as does the observation that a tendency for the male infant to smile and laugh more frequently probably does not fit the cultural stereotype. It is impossible to ignore, however, the fact that these sex differences occurred in a measure of parental perceptions which may have been biassed by popular cultural stereotypes. Stability in IBQ scores may reflect stability of parental perceptions as much as it reflects reality.

Sex differences in temperament and environment. Few studies have investigated the relationship between specific temperament dimensions and environmental variables, let alone sex differences in this relationship. A significant exception is a study by Bradley and Caldwell (1981) which examined the interaction between temperament (as measured by the IBR) and HOME environmental variables by sex in a sample of one-year-olds. Bradley and Caldwell found that, for females, an IBR activity level factor was significantly and positively related to Responsivity,

Organization, Play, Involvement and total HOME scores. For males, the IBR activity level factor was related only to total HOME scores. Bradley and Caldwell also noted a stronger relationship between environment and temperament for females. On the other hand, Simpson and Stevenson-Hinde (1985) did not find mother-infant interaction to be more related to characteristics of girls than characteristics of boys.

Results from the present study do not replicate those of Bradley and Caldwell (1981), described above. When the infant subjects were 6-months-old, there were two significant sex differences in the activity level-environment relationship: Parents were significantly more restrictive with and less accepting of active males. As both Activity Level and Distress to Limitations are parent measures (and Distress to Limitations is particularly influenced by parent practices), it is difficult to say whether or not parents were influenced by social stereotypes of males as being more active and more angry. When the infants were 6-months-old, parents also provided active females with fewer stimulating play materials. These results are consistent with Bell's control theory to the extent that parents seem to be attempting to control infants they may perceive to be excessively active, using different techniques for the sexes, a more direct one for males and a subtler one for females. At this age, the

strength of the temperament-environment relationship seems about equal for males and females, with a similar overall magnitude and pattern of correlations.

By 12-months of age, the results indicate a change in the temperament-environment relationship, with neither of the two previous sex differences (on Acceptance and Play) remaining significant. At this point, however, parents perceived themselves to be significantly more responsive to and involved with active females than active males (although the correlations for females were low). Using Bell's control theory, the results can be interpreted to suggest that parents try to control highly active one-year-old males by giving them less attention (or those parents are too worn out by their children's activity to respond to very motorically active male toddlers). Again, unlike the results presented by Bradley and Caldwell (1981), results from the present study show a stronger, more highly negative activity level-environment relationship for males, with a weaker, although still moderately negative, relationship for females.

An explanation for the discrepant results from the two studies may be found in the differences between the two activity level measures. IBR Activity Level represents an observer activity level measure of infant behaviour in a slightly stressful, test-taking situation,

while IBQ Activity Level is a parent report measure based on a much longer sample of infant behaviour in diverse everyday situations.

The finding of significant sex differences in the activity level-environment relationship is especially interesting in light of other research which suggests that mothers may match their behaviour to perceived temperament of child differentially by sex. For example, Klein (1984) found that positive affect towards 6-month-old boys was related to maternally rated activity level, although this relationship was non-significant when the infants were 12-months of age. Klein also found that intensity for girls was related to more auditory stimulation and responsivity contingent on positive vocalization, whereas intensity of boys was related to physical contact (tactile stimulation and body play).

Findings of differential parental treatment according to sex and perceived temperament of child may have important implications for the socialization experience. This is a subtle interaction which is easily missed in many investigations which examine temperament-environnment interactions alone and at a single point in time. Furthermore, Klein's (1984) study emphasizes the need for more sensitive measures of parent-child or environment-child interaction variables, such as different kinds of responsivity.

Birth Order Effects

Results from the 12-month assessment showed two significant negative correlations between birth order and the Organization and Variety HOME subscales. The data suggest that, at 12-months, later-borns have less organized environments with a lesser variety of stimulating experiences than first-borns.

Bradley and Caldwell (1984b) have also reported a relationship between birth order and HOME scores with overall multivariate effects in a sample of 79 infants assessed at 12- and 24-months of age. Bradley and Caldwell found birth order to be among the significant predictors of three 24-month-old subscales, with first-borns receiving higher Organization, Play Materials and Involvement scores. In the present study, the significant correlation between birth order and Organization reported by Bradley and Caldwell was replicated in the 12-month-old data. There was no relationship between birth order and Organization in the 6-month-old data. At neither age were correlations of birth order with Play Materials and Involvement significant.

In Bradley and Caldwell's correlational analysis, correlations between birth order and other HOME variables were generally stronger and more negative than analagous correlations in the present study. Also, in the Bradley

and Caldwell study, correlations between birth order and Variety were positive at both 12- and 24-month assessments; that is, later-borns received more opportunity for variety in daily stimulation than first-borns at both ages. In the current study, the reverse was true: First-borns received more opportunity for variety in daily stimulation. Reasons for this discrepancy between the two sets of results was unclear, although it may be because the two samples were quite different: Bradley and Caldwell's sample was predominantly lower- to lower-middle class, racially mixed, and paid, whereas families in the current sample were predominantly middle-class, Caucasian and unpaid.

From HOME scores obtained from a sample of 30 infants with development-threatening perinatal medical complications or genetic disorders, Allen et al. (1983) found that mothers were less restrictive and punishing of later-born children at 9-months. In the current study, no such relationship was found, although the correlation for 6-month-olds just missed significance.

In the present study, the only significant difference between first- and later-borns on the IBQ occurred on the Distress to Limitations scale. According to their parents, at 12-months of age, later-borns showed significantly more distress (anger) at being in

restrictive situations. To date, this result has not been replicated in the literature. Crockenberg and Acredolo (1983) have, however, reported that their second-borns scored higher on the Distress to Novelty scale. Eaton and Dureski (1986) reported that, for their sample of 3-month-olds, first-borns tended to be more active.

Summary and Conclusions

Of the study's specific predictions, only one, that IBQ Distress to Limitations (Anger) would be positively correlated with Activity Level, was confirmed. Results from the current study suggest there is little support for an interactionist perspective (or, more specifically, for Bell's control theory) in investigating the temperament-environment relationship for infants below the age of one-year.

Two factors which may have contributed to the generally non-significant results were discussed. The first factor was the lack of variability in a number of HOME subscales, due to the nature of the sample which was homogeneous, well-educated and middle-class. A second factor concerned age of the infant subjects: In light of McCall's (1981) canalization theory, infants who participated in the study may simply have been too young to exhibit stable individual differences in temperament or

cognitive development and this could have attenuated some of the hypothesized correlations. Also, assuming environmental effects are cumulative, infants may have been too young to exhibit much environmental influence. It is very possible that the interactionist position would be more effective in predicting temperament-environment and cognitive competence-environment relationships in a sample of older children.

The pattern of the current results, including IBQ scale intercorrelations, provides indirect positive evidence concerning the validity and reliability of the IBQ. The results suggest that IBQ-measured infant temperament is stable, although the possibility of parental biases influencing infant temperament ratings cannot be entirely eradicated.

Results concerning the relationship between physical measures (weight and length) were found to be consistent with results from several other studies which suggest that the relationship between weight and activity level weakens as infants age.

Fewer than expected simple temperament-environment correlations were found, again perhaps because of the extreme youth of the subjects acting to attenuate correlations. The data, however, did suggest that parents of highly active 12-month-old infants provide them with

overall less developmentally stimulating home environments than they provide for less active infants.

Age changes in the HOME environment indicated in the present study approximate those reported by other researchers (Barrera et al., 1986) and appear valid despite some evidence of instrument instability. An increase over the 6- to 12-month period in parent-rated IBQ Activity Level corresponds with infants' increasing mobility and is also consistent with previous reports (Rothbart, 1986). The literature also suggests that the home environment-cognitive competence relationship increases in magnitude as the child ages; the extreme youth of subjects may again explain why results from this study depart from those of other studies which examine the HOME-MDI correlation over broader age ranges.

In contrast with sex differences reported by other studies, results from the present study suggest that parents are more emotionally and verbally responsive to their sons than their daughters up to the age of one. These findings differ from those of Bradley and Caldwell (1984b) who found generally higher HOME scores for females, but are consistent with results of other researchers who report few or no simple sex differences on the HOME. Analysis of the home environment-cognitive competence relationship for the present sample suggests

that, at 6-months only, HOME Parental Involvement was more related to cognitive competence for boys. The present results suggest that infant female cognitive competence may be more related to SES variables or to heredity; this interpretation is consistent with the conclusions of Bayley and Schaefer's classic (1964) study.

Concerning the issue of sex differences in temperament, results from the present study suggest that parents viewed their infant girls as more fearful than infant boys, a view that is consistent with popular male-female stereotypes and one that has tentative support in the literature for older children (e.g. Maccoby & Jacklin, 1974). The finding, however, that infant boys, according to their parents, smile and laugh more, although consistent with other studies, contrasts with the popular picture of the male infant as a fussy, less soothable, somewhat immature organism.

In examining the temperament-environment relationship for sex differences, the current results suggest that, when infants are 6-months, parents are significantly more restrictive with and less accepting of active males, but also provide active male 6-month-olds with more stimulating play materials than their active female counterparts. By the time the infants were 12-months, the previous relationship did not hold, and parents appeared

to be more responsive to and more involved with active females. These results were inconsistent with a major study by Bradley and Caldwell (1981) in that they indicate a more highly negative activity level-environment relationship for 12-month-old males, with a similar weaker relationship for females. The finding of significant sex differences in the activity level-environment relationship could have important implications for the socialization experience if, as Klein (1984) suggests, mothers interact differentially with their children according to the child's sex and perceived temperament.

Results of the analysis for birth order effects tentatively suggest that later-borns generally receive less developmentally stimulating home environments than first-borns, with the effect being stronger when children are 12-months-old than when they are 6-months-old. In general, these findings are consistent with the literature, although the correlations between specific HOME subscales and birth order deviate somewhat from those reported by other researchers (Bradley & Caldwell, 1984b). The present results also suggest that, at 12-months of age, later-borns display more distress to limitations (anger) than do first-borns. To date this result has not been replicated.

Suggestions for Future Research

Results of the current study suggest the following guidelines for future temperament-environment and cognitive development-environment research:

1. To accurately assess the interaction of temperament and environment, infant subjects should be assessed either at older ages or over a broader age range than were the 6- to 12-month-old infants in the present sample. The work of McCall (1981) suggests that, before the age of 18-months to 2-years, infants display few stable individual differences in cognitive development or temperament that can interact with environmental forces. Also, if environment has a cumulative impact on development, then normal infants below the age of 2-years will be too young to exhibit its influence.
2. The lack of variability apparent on several of the HOME subscales (especially Responsivity) in the current study suggests that the HOME (although a valid screening instrument for developmental disorders in low SES groups) may not be the instrument of choice for exploratory research with better-educated, homogeneous middle-class samples. Klein's (1984) study, for example, underlines the value of an environmental measure which assesses

many different kinds of parental responsivity. A measure of such sensitivity, however, which also possesses the practical advantages of the HOME has yet to be developed.

3. The unexpected problem with tester effects encountered in the current study highlights the importance of building adequate reliability checks into studies which use even such well-validated and reliable measures as the BSID and the HOME Inventory. Ideally, reliability checks should be implemented at beginning, middle and end of each assessment phase. A survey of the literature points out how, when using well-accepted measures like the BSID and HOME, researchers frequently fail to calculate reliability for their particular sample, calculate reliability only at the beginning of the study, or, at the best, fail to report their reliability calculations.

4. Other studies comparing parent rating scale measures of infant temperament with other types of temperament measures (e.g. home observations, or, for activity level, mechanical measures) are needed. Ideally and if practical, two or more of these types of temperament measures should be used with the same sample of infants.

5. The present research suggests that the study of well-validated, intercorrelated temperament dimensions (such as Activity Level, Distress to Novelty and Distress to Limitations on the IBQ) could prove to be a fruitful line of research. Rothbart's (1986) delineation of positive and negative temperament patterns already has provided some interesting preliminary results.

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Appendix A

INFANT BEHAVIOR QUESTIONNAIRE

Infant Behavior Questionnaire

Baby's Name: _____ Date of Baby's Birth ____ ____ ____
mon. day year

Today's Date _____

Sex of Child _____

INSTRUCTIONS: Please read carefully before starting:

As you read each description of the baby's behavior below, please indicate how often the baby did this during the LAST WEEK (the past seven days) by circling one of the numbers in the left column. These numbers indicate how often you observed the behavior described during the last week.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Never	Very Rarely	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	Always	Does Not Apply

The "Does Not Apply" (X) column is used when you did not see the baby in the situation described during the last week. For example, if the situation mentions the baby having to wait for food or liquids and there was no time during the last week when the baby had to wait, circle the (X) column. "Does Not Apply" is different from "Never" (1). "Never" is used when you saw the baby in the situation but the baby never engaged in the behavior listed during the last week. For example, if the baby did have to wait for food or liquids at least once but never cried loudly while waiting, circle the (1) column.

Please be sure to circle a number for every item.

Feeding

When having to wait for food or liquids during the last week, how often did the baby:

1 2 3 4 5 6 7 X . . . . (1) seem not bothered?

1 2 3 4 5 6 7 X . . . . (2) show mild fussing?

1 2 3 4 5 6 7 X . . . . (3) cry loudly?

During feeding, how often did the baby:

1 2 3 4 5 6 7 X . . . . (4) lie or sit quietly?

1 2 3 4 5 6 7 X . . . . (5) squirm or kick?

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Never	Very Rarely	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	Always	Does Not Apply

During feeding, how often did the baby:

1 2 3 4 5 6 7 X . . . . (6) wave arms?

1 2 3 4 5 6 7 X . . . . (7) fuss or cry when s/he had enough to eat?

1 2 3 4 5 6 7 X . . . . (8) fuss or cry when given a disliked food?

When given a new food or liquid, how often did the baby:

1 2 3 4 5 6 7 X . . . . (9) accept it immediately?

1 2 3 4 5 6 7 X . . . . (10) reject it by spitting out, closing mouth, etc.?

1 2 3 4 5 6 7 X . . . . (11) not accept it no matter how many times offered?

Sleeping

Before falling asleep at night during the last week, how often did the baby:

1 2 3 4 5 6 7 X . . . . (12) show no fussing or crying?

During sleep, how often did the baby:

1 2 3 4 5 6 7 X . . . . (13) toss about in the crib?

1 2 3 4 5 6 7 X . . . . (14) move from the middle to the end of the crib?

1 2 3 4 5 6 7 X . . . . (15) sleep in one position only?

After sleeping, how often did the baby:

1 2 3 4 5 6 7 X . . . . (16) fuss or cry immediately?

1 2 3 4 5 6 7 X . . . . (17) play quietly in crib?

1 2 3 4 5 6 7 X . . . . (18) coo and vocalize for periods of 5 minutes or longe

1 2 3 4 5 6 7 X . . . . (19) cry if someone doesn't come within a few minutes?

How often did the baby:

1 2 3 4 5 6 7 X . . . . (20) seem angry (crying and fussing) when you left her/him in the crib?

1 2 3 4 5 6 7 X . . . . (21) seem contented when left in the crib?

1 2 3 4 5 6 7 X . . . . (22) cry or fuss before going to sleep for naps?

(1) Never	(2) Very Rarely	(3) Less Than Half The Time	(4) About Half The Time	(5) More Than Half The Time	(6) Almost Always	(7) Always	(X) Does Not Apply

Bathing and Dressing

When being dressed or undressed during the last week, how often did the baby:

1 2 3 4 5 6 7 X . . . . (23) wave his/her arms and kick?
1 2 3 4 5 6 7 X . . . . (24) squirm and/or try to roll away?
1 2 3 4 5 6 7 X . . . . (25) smile or laugh?

When put into the bath water, how often did the baby:

1 2 3 4 5 6 7 X . . . . (26) startle (gasp, throw out arms; stiffen body, etc.
1 2 3 4 5 6 7 X . . . . (27) smile?
1 2 3 4 5 6 7 X . . . . (28) laugh?
1 2 3 4 5 6 7 X . . . . (29) have a surprised expression?
1 2 3 4 5 6 7 X . . . . (30) splash or kick?
1 2 3 4 5 6 7 X . . . . (31) turn body and/or squirm?

When face was washed, how often did the baby:

1 2 3 4 5 6 7 X . . . . (32) smile or laugh?
1 2 3 4 5 6 7 X . . . . (33) fuss or cry?

When hair was washed, how often did the baby:

1 2 3 4 5 6 7 X . . . . (34) smile or laugh?
1 2 3 4 5 6 7 X . . . . (35) fuss or cry?

Play

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . . (36) look at pictures in books and/or magazines for 2-5 minutes at a time?
1 2 3 4 5 6 7 X . . . . (37) look at pictures in books and/or magazines for 5 minutes or longer at a time?
1 2 3 4 5 6 7 X . . . . (38) stare at a mobile, crib bumper or picture for 5 minutes or longer?
1 2 3 4 5 6 7 X . . . . (39) play with one toy or object for 5-10 minutes?

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Never	Very Rarely	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	Always	Does Not Apply

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . . (40) play with one toy or object for 10 minutes or longer?

1 2 3 4 5 6 7 X . . . . (41) spend time just looking at playthings?

1 2 3 4 5 6 7 X . . . . (42) repeat the same sounds over and over again?

1 2 3 4 5 6 7 X . . . . (43) laugh aloud in play?

1 2 3 4 5 6 7 X . . . . (44) smile or laugh when tickled?

1 2 3 4 5 6 7 X . . . . (45) cry or show distress when tickled?

1 2 3 4 5 6 7 X . . . . (46) repeat the same movement with an object for 2 minutes or longer (e.g., putting a block in a cup, kicking or hitting a mobile)?

When something the baby was playing with had to be removed, how often did s/he:

1 2 3 4 5 6 7 X . . . . (47) cry or show distress for a time?

1 2 3 4 5 6 7 X . . . . (48) cry or show distress for several minutes or longer?

1 2 3 4 5 6 7 X . . . . (49) seem not bothered?

When tossed around playfully, how often did the baby:

1 2 3 4 5 6 7 X . . . . (50) smile?

1 2 3 4 5 6 7 X . . . . (51) laugh?

During a peekaboo game, how often did the baby:

1 2 3 4 5 6 7 X . . . . (52) smile?

1 2 3 4 5 6 7 X . . . . (53) laugh?

Daily Activities

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . . (54) cry or show distress at a loud sound (blender, vacuum cleaner, etc)?

1 2 3 4 5 6 7 X . . . . (55) cry or show distress at a change in parents' appearance (glasses off, shower cap on, etc.)?

(1) Never	(2) Very Rarely	(3) Less Than Half The Time	(4) About Half The Time	(5) More Than Half The Time	(6) Almost Always	(7) Always	(X) Does Not Apply

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . .(56) when in a position to see the television set, look at it for 2-5 minutes at a time?

1 2 3 4 5 6 7 X . . . .(57) when in a position to see the television set, look at it for 5 minutes or longer?

1 2 3 4 5 6 7 X . . . .(58) protest being put in a confining place (infant seat, play pen, car seat, etc)?

1 2 3 4 5 6 7 X . . . .(59) startle at a sudden change in body position (for example, when moved suddenly)?

1 2 3 4 5 6 7 X . . . .(60) startle to a loud or sudden noise?

1 2 3 4 5 6 7 X . . . .(61) cry after startling?

When being held, how often did the baby:

1 2 3 4 5 6 7 X . . . .(62) squirm, pull away or kick?

When placed on his/her back, how often did the baby:

1 2 3 4 5 6 7 X . . . .(63) fuss or protest?

1 2 3 4 5 6 7 X . . . .(64) smile or laugh?

1 2 3 4 5 6 7 X . . . .(65) lie quietly?

1 2 3 4 5 6 7 X . . . .(66) wave arms and kick?

1 2 3 4 5 6 7 X . . . .(67) squirm and/or turn body?

When the baby wanted something, how often did s/he:

1 2 3 4 5 6 7 X . . . .(68) become upset when s/he could not get what s/he wanted?

1 2 3 4 5 6 7 X . . . .(69) have tantrums (crying, screaming, face red, etc.) when s/he did not get what s/he wanted?

When placed in an infant seat or car seat, how often did the baby:

1 2 3 4 5 6 7 X . . . .(70) wave arms and kick?

1 2 3 4 5 6 7 X . . . .(71) squirm and turn body?

1 2 3 4 5 6 7 X . . . .(72) lie or sit quietly?

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Never	Very Rarely	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	Always	Does Not Apply

When placed in an infant seat or car seat, how often did the baby:

1 2 3 4 5 6 7 X . . . .(73) show distress at first; then quiet down?

When you returned from having been away and the baby was awake, how often did s/he:

1 2 3 4 5 6 7 X . . . .(74) smile or laugh?

When introduced to a strange person, how often did the baby:

1 2 3 4 5 6 7 X . . . .(75) cling to a parent?
1 2 3 4 5 6 7 X . . . .(76) refuse to go to the stranger?
1 2 3 4 5 6 7 X . . . .(77) hang back from the stranger?
1 2 3 4 5 6 7 X . . . .(78) never "warm up" to the stranger?
1 2 3 4 5 6 7 X . . . .(79) approach the stranger at once?
1 2 3 4 5 6 7 X . . . .(80) smile or laugh?

When introduced to a dog or cat, how often did the baby:

1 2 3 4 5 6 7 X . . . .(81) cry or show distress?
1 2 3 4 5 6 7 X . . . .(82) smile or laugh?
1 2 3 4 5 6 7 X . . . .(83) approach at once?

Soothing Techniques

Have you tried any of the following soothing techniques in the last two weeks? If so, how often did the method soothe the baby? Circle (X) if you did not try the technique during the LAST TWO WEEKS.

1 2 3 4 5 6 7 X . . . .(84) rocking
1 2 3 4 5 6 7 X . . . .(85) holding
1 2 3 4 5 6 7 X . . . .(86) singing or talking
1 2 3 4 5 6 7 X . . . .(87) walking with the baby
1 2 3 4 5 6 7 X . . . .(88) giving the baby a toy
1 2 3 4 5 6 7 X . . . .(89) showing the baby something to look at
1 2 3 4 5 6 7 X . . . .(90) patting or gently rubbing some part of the baby's body
1 2 3 4 5 6 7 X . . . .(91) offering food or liquid

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(X)
Never	Very Rarely	Less Than Half The Time	About Half The Time	More Than Half The Time	Almost Always	Always	Does Not Apply

Soothing techniques:

1 2 3 4 5 6 7 X . . . .(92) offering baby his/her security object

1 2 3 4 5 6 7 X . . . .(93) changing baby's position

1 2 3 4 5 6 7 X . . . .(94) other (please specify) _____

IBQ Scoring Procedure

Scale scores for the Infant Behavior Questionnaire represent the mean score of all scale items applicable to the child during the last week or two weeks, as judged by the caretaker. Scales scores are to be computed by the following method:

1. Sum all numerical item responses for a given scale. Note that:
   a) If caretaker omitted an item, that item receives no numerical score;
   b) If caretaker checked the "does not apply" response option for an item, that item receives no numerical score;
   c) Items indicated with an R are reverse items and must be scored in the following way:

7 becomes 1	3 becomes 5
6 becomes 2	2 becomes 6
5 becomes 3	1 becomes 7
4 remains 4	

2. Divide the total by the number of items receiving a numerical response. Do not include items marked "does not apply" or items receiving no response in determining the number of items. For example, given a sum of 40 for a scale of 17 items, with one item receiving no response, two items marked "does not apply", and 14 items receiving a numerical response, the sum of 40 would be divided by 14 to yield a mean of 2.85 for the scale score.

TEMPERAMENT DIMENSION DEFINITIONS
8/25/78

Activity Level. Child's gross motor activity, including movement of arms and legs, squirming and locomotor activity.

Smiling and Laughter. Smiling or laughter from the child in any situation.

Distress and Latency to Approach Sudden or Novel Stimuli. The child's distress to sudden changes in stimulation and the child's distress and latency of movement toward a novel social or physical object.

Distress to Limitations. Child's fussing, crying or showing distress while a) waiting for food, b) refusing a food, c) being in a confining place or position, d) being dressed or undressed, 4) being prevented access to an object toward which the child is directing her/his attention.

Soothability. Child's reduction of fussing, crying, or distress when soothing techniques are used by the caretaker of child.

Duration of Orienting. The child's vocalization, looking at and/or interaction wit a single object for extended periods of time when there has been no sudden change in stimulation.

Calculation of IBQ Scale Scores

Activity Level (17 items)

6-months: 4R 5 6 13 14 15R 23 24 30 31 62 65R 66 67 70 71 72R

12-months: same as above

Distress to Limitations (20 items)

6-months: 1 2 3 7 8 12R 16 17R 19 20 21R 22 47 48 49R 58 63 68 69 73

12-months: same as above

Distress to Novelty (16 items)

6-months: 9R 10 11 33 35 54 61 75 76 77 78 79R 83R

12-months: same as above and 45 55 81

Duration of Orienting (11 items)

6-months: 18 36 37 38 39 40 41 42 46 56 57

12-months: same as above

Smiling and Laughter (15 items)

6-months: 25 27 28 32 34 43 44 50 51 52 53 64 74 80 82

12-months: same as above

Soothability (11 items)

6-months: 84 85 86 87 88 89 90 91 92 93 94

12-months: same as above

R - indicates a reverse item.

Appendix B

HOME OBSERVATION FOR MEASUREMENT OF THE ENVIRONMENT

APPENDIX B - APPENDICE B:
(pp. 210 - 211)

Home Inventory for Families
of Infants and Toddlers
by
Betty M. Cladwell
and
Robert H. Bradley

Home Observation for Measurement of the Environment

HOME Inventory for Families of Infants and Toddlers

Bettye M. Caldwell and Robert H. Bradley

Family Name_____ Date_____ Visitor_____

Child's Name_____ Birthdate_____ Age_____ Sex_____

Caregiver for visit_____ Relationship to child_____

Family Composition_____
(Persons living in household, including sex and age of children)

Family Ethnicity_____ Language Spoken_____ Maternal Education_____ Paternal Education_____

Is Mother Employed?_____ Type of work when employed_____ Is Father Employed?_____ Type of work when employed_____

Address_____ Phone_____

Current child care arrangements_____

Summarize past year's arrangements_____

Caregiver for visit_____ Other persons present_____

Comments_____

SUMMARY

Subscale		Score	Lowest Middle	Middle Half	Upper Fourth
I.	Emotional and Verbal RESPONSIVITY of Parent		0-6	7-9	10-11
II.	ACCEPTANCE of Child's Behavior		0-4	5-6	7-8
III.	ORGANIZATION of Physical and Temporal Environment		0-3	4-5	6
IV.	Provision of Appropriate PLAY MATERIALS		0-4	5-7	8-9
V.	Parent INVOLVEMENT with Child		0-2	3-4	5-6
VI.	Opportunities for VARIETY in Daily Stimulation		0-1	2-3	4-5
	TOTAL SCORE		0-25	26-36	37-45

For rapid profiling of a family, place an X in the box that corresponds to the raw score on each subscale and the total score.

Place a plus (+) or minus (-) in the box alongside each item if the behavior is observed during the visit or if the parent reports that the conditions or events are characteristic of the home environment. Enter the subtotal and the total on the front side of the Record Sheet.

I. Emotional and Verbal RESPONSIVITY

1. Parent spontaneously vocalized to child twice.	
2. Parent responds verbally to child's verbalizations.	
3. Parent tells child name of object or person during visit.	
4. Parent's speech is distinct and audible.	
5. Parent initiates verbal exchanges with visitor.	
6. Parent converses freely and easily.	
7. Parent permits child to engage in "messy" play.	
8. Parent spontaneously praises child at least twice.	
9. Parent's voice conveys positive feelings toward child.	
10. Parent caresses or kisses child at least once.	
11. Parent responds positively to praise of child offered by visitor.	
Subtotal	

II. ACCEPTANCE of Child's Behavior

12. Parent does not shout at child.	
13. Parent does not express annoyance with or hostility to child.	
14. Parent neither slaps nor spanks child during visit.	
15. No more than one instance of physical punishment during past week.	
16. Parent does not scold or criticize child during visit.	
17. Parent does not interfere or restrict child more than 3 times.	
18. At least ten books are present and visible.	
19. Family has a pet.	
Subtotal	

III. ORGANIZATION of Environment

20. Substitute care is provided by one of three regular substitutes.	
21. Child is taken to grocery store at least once/week.	
22. Child gets out of house at least four times/week.	
23. Child is taken regularly to doctor's office or clinic.	
24. Child has a special place for toys and treasures.	
25. Child's play environment is safe.	
Subtotal	

IV. Provision of PLAY MATERIALS

26. Muscle activity toys or equipment.	
27. Push or pull toy.	
28. Stroller or walker, kiddie car, scooter, or tricycle.	
29. Parent provides toys for child during visit.	
30. Learning equipment appropriate to age--cuddly toys or role-playing toys.	
31. Learning facilitators--mobile, table and chairs, high chair, play pen.	
32. Simple eye-hand coordination toys.	
33. Complex eye-hand coordination toys (those permitting combination).	
34. Toys for literature and music.	
Subtotal	

V. Parental INVOLVEMENT with Child

35. Parent keeps child in visual range, looks at often.	
36. Parent talks to child while doing household work.	
37. Parent consciously encourages developmental advance.	
38. Parent invests maturing toys with value via personal attention.	
39. Parent structures child's play periods.	
40. Parent provides toys that challenge child to develop new skills.	
Subtotal	

VI. Opportunities for VARIETY

41. Father provides some care daily.	
42. Parent reads stories to child at least 3 times weekly.	
43. Child eats at least one meal per day with mother and father.	
44. Family visits relatives or receives visits once a month or so.	
45. Child has 3 or more books of his/her own.	
Subtotal	

TOTAL SCORE	

*For complete wording of items, please refer to the Administration Manual.

Appendix C

SOCIOECONOMIC DATA

Socioeconomic Questionnaire

1A. What kind of work were you doing?

_____

(For example: electrical engineer, stock clerk, farmer.)

1B. What were your most important activities or duties?

_____

(For example: kept account books, filed, sold cars, operated printing press, finished concrete.)

1C. What kind of business or industry was this?

_____

(For example: TV and radio mfg., retail shoe store, provincial government, farm.)

1D. Were you: (Mark one.)

an employee of a PRIVATE company, business or individual for wages, salary, or commissions?..... ☐ PR

a GOVERNMENT employee (federal, provincial, or municipal government)?..... ☐ GOV

self-employed in OWN business, professional practice, or farm?

own business not incorporated (or farm)..... ☐ OWN

own business incorporated..... ☐ INC

working WITHOUT PAY in a family business or farm..... ☐ WP

[1]Adapted from the U.S. Census Bureau, cited in Mueller & Parcel (1981).

Appendix D

LETTERS TO PARENTS

Letter to Parents I

THE UNIVERSITY OF MANITOBA DEPARTMENT OF PSYCHOLOGY Winnipeg, Manitoba Canada R3T 2N2

March 25, 1986

Dear

We are involved in a research project on infant behaviour. We are studying how babies behave and develop in their home environments. As parents of growing young children we have become increasingly interested in how our homes changed to accommodate our children's developing abilities. We are writing to briefly describe our project to you. We will call you within the next few days to see if you are interested in participating and to answer any questions that you might have.

Enclosed is a questionnaire about your baby's behaviour in everyday situations. If, after talking to us on the telephone, you are interested in participating, we would like you (or the person who spends the greatest number of hours caring for your baby) to complete this questionnaire. Then we (or one of our assistants) will call to arrange a convenient time when we can pick up the questionnaire. During the visit, we would ask more questions about your baby's behaviour in daily situations, and with your assistance we would measure your baby's weight and height. We would also have your baby do some simple tasks such as holding a rattle or listening to a bell so we have an estimate of his or her state of development. Then, with your permission, we will repeat the procedure (questionnaire and home visit) again just before your child's first birthday.

This project should provide valuable information about how children grow and develop as well as assist parents in encouraging their children's development. If they wish, parents who agree to participate will receive a summary of our results when the research is completed.

We will be happy to answer any questions you may have when we call. If you wish to contact us before then, please leave a message for one of us with the Psychology Department secretary, at 474-9338 between 8:30 a.m. and 4:30 p.m.

If you are interested in participating, please remember: do <u>not</u> fill out the enclosed questionnaire before receiving our telephone call.

Sincerely,

Warren O. Eaton, Ph.D.
Associate Professor

Lesley Enns, M.A.
Ph.D. Student

WOE/LE/sal

Enclosure

Letter to Parents II

THE UNIVERSITY OF MANITOBA DEPARTMENT OF PSYCHOLOGY Winnipeg, Manitoba Canada R3T 2N2

August 27, 1986

Dear parent:

Now that your baby is approaching his or her first birthday, we are writing to briefly describe the second phase of our infant development project and to request your permission for a second home visit.

Enclosed is a second behaviour questionnaire identical to the first one which you completed when your baby was six-months old. In the coming weeks, one of our research assistants, Robin Adkins or Connie Dureski, will contact you to arrange a mutually convenient time for a second home visit. We would ask the same parent who completed the second questionnaire no earlier than one week before this second visit. Obtaining the two questionnaires completed at two different ages should show how much your baby's behaviour has changed over the previous six months.

The second home visit will be very similar to the first. Once again, Robin or Connie will ask questions concerning your child's behaviour in everyday situations and, with your assistance, will measure your baby's weight and height. She will again ask your baby to do some simple tasks so that we will have an estimate of his or her state of development. These tasks will be similar to those from the previous visit except that they will be more appropriate to a twelve-month-old.

This research is currently slated for completion by summer, 1987. At that time, we'll mail you a summary of our results, which we hope you will find interesting and informative. Again, if you have any questions or wish to contact us, please feel free to leave message for one of us with the Psychology Department secretary at 474-9338 between 8:30 a.m.and 4:30 p.m. weekdays.

Also enclosed is a "diploma" certifying your child's graduation from our university as a "Baby of Science." Perhaps some day you will be able to explain how you assisted him or her to acquire a "B.S." degree at such a young age. We would like to extend to you our sincere appreciation for your support of this research.

Sincerely,

Warren O. Eaton, Ph.D.
Associate Professor

Lesley Enns, M.A.
Ph.D. Student

WOE/LE/sal
Enclosure

Diploma

In Appreciation for
Great Contributions to Knowledge

is hereby awarded the

Baby of Science (B.S.) Degree

University of Manitoba
Winnipeg, Canada
1986

Feedback Letter to Parents

September 25, 1987

Dear Parent:

As promised, we are writing to give you a summary of findings from the research study in which you and your child participated last year. Ninety-six infants and their parents were involved.

Now that we have collected our data, we can explain to you more fully what we hoped we would find. We were interested in studying infant temperament, by which we mean individual differences in children which appear at birth, have a constitutional basis, and persist in later life. The questionnaire which we twice asked you to complete was designed to give us an idea of how you perceived your baby's temperament or "personality." Among the temperament characteristics measured by this questionnaire (activity level, smiling and laughter, distress at sudden or novel stimuli, distress to limitations, soothability and duration of orienting or persistence), the one which most interested us was activity level, an infant's customary level of gross motor (large muscle) activity, including movement of arms and legs, squirming, etc.

More specifically, we wanted to know whether there was a relationship between an infant's activity level and certain social and physical aspects of his or her home environment. For example, we wondered whether parents had to be more physically restrictive with a highly active child and whether they structured the physical environment differently for an active child as opposed to an inactive one. We were also interested in the relationship between activity level and developmental level, theorizing, for example, that more active children would be more physically mature. We had expected that very active or very inactive infants would be treated differently by parents than infants with average activity levels. This hypothesis was not confirmed.

As you know, we were also interested in the changes that occurred in your baby and in your home over the crucial 6- to 12-month period. As we expected, the babies in the sample were much better able to perform more complex mental and physical tasks at 12 months than at 6 months. During this time period, the infants' home environments also changed, probably in response to their developing needs. Generally, as the infants aged, their homes became more stimulating. When the babies were 12 months, parents appeared to be more emotionally and verbally responsive (perhaps because their children were practicing their own "communication skills"). At this age, parents also structured their infant's environment more

(e.g. took them to the grocery store, etc.), provided them with more stimulating playthings and incorporated a greater variety of experience into their daily routines.

Over the course of the study, parents also perceived changes in their infants' personalities: they believed that their 12-month-olds were more active, more fearful in unusual situations or with strangers, and more angry when restricted by their parents or kept waiting for food, being dressed, etc.

We were also interested in sex differences: whether parents treated male infants differently than females. In this sample, parents of male babies appeared more verbally and emotionally responsive. Parents perceived the little boys as smiling and laughing more frequently than little girls. They also indicated that the girls showed more fearfulness when confronted with a novel situation or a stranger.

We hope that these results have been of interest to you. Of course, we still have considerable work ahead making more sense of the findings by relating them to theories of child development and comparing them to findings from other studies.

If you have further questions about the research, please leave a message for us at 261-1251, and we will return your call.

Again, thank you for your participation in the study.

Sincerely,

Warren O. Eaton, Ph.D.
Associate Professor

Lesley Enns, M.A.
Ph.D. Student

WE/hw

Appendix E

RESEARCH FORMS

Telephone Protocol

Birth Date _____

Name_____ ID_____

Date Letter Sent_____Phone No._____Date_____

Name _____ U of M Psych. Dept._____Research project_____

Receive letter?_____ (if no, check address _____)

Interested in hearing more? _____ (If no, thanks_____)

Are you person who spends most no. of hours with baby? _____

If interested, will make 2 visits to home when baby is awake and rested and with you (or other caregiver) there _____.

Visit 1: Within week or 10 days _____

Visit 2: When baby is 12-months-old _____

Each visit takes about 2 hours. Questions asked about baby's routine & some simple tasks to check developmental progress (e.g. listening to bell, looking at picture book, sitting, etc.). _____

Will also check weight and length _____

No chance of harm _____ Free to withdraw at any time, for any reason _____

At end (in a year's time), will send out a summary of results from whole study _____ & diploma for baby book _____

Still interested in participating? Yes _____ No _____

One of two assistants will call soon to make an appointment ___.

When would it be convenient to call? AM ___ PM ___ Eve.___

Is this best phone number to reach you? _____

Before assistant's visit, please fill out behaviour questionnaire enclosed with letter _____

Questions?

Correct address? _____ Directions? _____ (write on back).

Thanks.

Examiner's Checklist I

Baby's Name _____

ID No. _____

Examiner's Checklist I

Consent form signed (copy left with caregiver). _____

Behaviour Questionnaire checked. _____

Identifying data (front page of Bayley). _____

Occupational data (for both parents). _____

Bayley Scales: Mental Scale _____

Motor Scale _____

HOME _____

Baby's Weight (Gms) 1. _____

2. _____

Baby's Length (Cms) 1. _____

2. _____

Infant Behaviour Record _____

Contact Sheet _____

Caregiver reminded about next visit and telephone call _____

Parental Consent Form

Consent to Participate

I agree to my child's participation in a study on infant behaviour conducted by Ms. Lesley Enns, Ph.D. Candidate, Psychology Department, University of Manitoba. I understand that I am under no obligation to have my child participate and that we may withdraw from the study at any time.

_____ _____

Date Signature

I would/would not like to receive summary information on the results of the study.

Address to which summary of results should be sent:

Additional Contact Form

Name _____

ID# _____

Contact

It is sometimes helpful to have a name and phone number of a close family member or friend who would be sure to know your new address if you were to move. Would you be willing to give us a name and number in case we wanted to contact you for a follow-up?

Name: _____

Relationship: _____

Phone: _____

Examiner's Checklist II

Baby's Name _____

I.D. No. _____

Examiner Checklist II

Behaviour Questionnaire checked (all questions completed) _____

Identifying data (front page of Bayley) _____

Bayley Scales - Mental Scale _____

- Motor Scale _____

HOME _____

Baby's weight (lbs.) 1. _____

2. _____

Baby's length (cms.) 1. _____

2. _____

Infant Behaviour Record _____

Baby's Due Date (I.D.'s 1-50, 52, 55, 57, 76, 95) _____

Follow-up letter _____

Data Checklist

ID	Check-list	IBO	HOME	Bayley Mental	Bayley Motor	IBR	Due Date	Sibs. B.D.	Relative's Phone No.

Future Participation Form

Department of Psychology
University of Manitoba
Winnipeg, Manitoba R3T 2N2
August 29, 1986

Dear Parent,

Thank you for participating in this research project. In several months, we should have some results to report to you. At that time we will send you a letter describing what we have learned, and you can contact us with any questions you might have.

Although information about infants in their homes has proven extremely valuable in the scientific study of child development, it is very difficult and expensive to obtain such information. Consequently, it is always tempting to a researcher to obtain additional information about children who have already been studied. Although we currently have no research plans involving you or your child, we may well wish to do additional research which would build upon what we have already learned. We would like to know if you would consider participation in a future research project. Please indicate your preference below and give the form to the research assistant.

Yours truly,

Warren Eaton, PhD. Lesley Enns, M.A.

August 29, 1986

Name_____

I would consider participation in a future project: Yes____ No____