

Topic Review

Connections between Temperament and Social Development: A Review

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Abstract

This paper critically reviews the literature on the links between temperament and social development in children and adolescents. Social development is broadly defined to include externalizing and internalizing behaviour problems, prosocial behaviour and social competence. It concludes that there are clear links between specific dimensions of temperament and particular aspects of social development. Examples include the association of negative reactivity with externalizing behaviour problems, inhibition with internalizing behaviour problems, and attention regulation with school functioning. Theoretical and methodological issues to be confronted in future research are identified, including the need to investigate further the interactions between temperament and social context. Analysis of patterns of change in temperament, in relation to physiological changes and to such factors as parenting and socio-cultural expectations of children, promise to refine our understanding of how temperament works in context. Some practical implications which can be drawn from the research are also discussed.

Keywords: temperament; behaviour problems; social competence; socio-cultural context

While ideas about temperament go back to ancient Greco-Roman times, the first major publication on child temperament in modern times was the report by Thomas, Chess and colleagues on the New York Longitudinal Study (Thomas, Chess, Birch, Hertzig, & Korn, 1963). It constituted part of the paradigm shift from a predominantly environmentalistic, unidirectional perspective on child development, to one which acknowledged the child's own active part in the developmental process. Thomas *et al.*'s focus on temperament led to the recognition that differences between children in such qualities as their responsiveness to stimulation and capacity to regulate their emotions and attention impacted upon the process of social development. This review seeks to provide an overview of where and how the research has progressed since that time

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in terms of our understanding of the role of temperament in social development over childhood and adolescence, and to give some pointers towards future research directions.

Given that recent authoritative reviews have addressed theoretical and methodological issues in temperament research more generally (e.g. Rothbart & Bates, 1998; Sanson & Prior, 1999), the conceptualization and measurement of temperament is only briefly discussed here in order to provide a framework for the research which is reviewed. We outline theoretical perspectives on how temperament may impact on social development, before proceeding to review the research in selected areas of social development.

1. The Structure, Stability and Measurement of Temperament

Despite long-standing controversy over the definition of temperament, a consensus is emerging that the term 'temperament' refers to constitutionally based differences in behavioural style that are visible from the child's earliest years. Specifically, the definition adopted here is of individual differences in emotional, motor and attentional reactivity to stimulation, and in patterns of behavioural and attentional self-regulation (Sanson, Smart, & Hemphill, 2002).

In their pioneering work, Thomas, Chess and colleagues identified nine dimensions of temperament on which infants and young children could be seen to differ, which described their characteristic style of response across contexts, and which impacted on their subsequent psychosocial development (Thomas *et al.*, 1963). These were approach-withdrawal, adaptability, quality of mood, intensity of reaction, distractibility, persistence or attention span, rhythmicity, threshold of responsiveness, and activity level.

These nine dimensions have been widely used in research. However, concerns about conceptual overlap among scales and low internal consistency have led to empirically and theoretically based conceptual refinements (Rothbart & Bates, 1998; Sanson & Rothbart, 1995). Three broad aspects of temperament are gaining wide acceptance: *Reactivity* or *Negative Emotionality*, which refers to irritability, negative mood and high-intensity negative reactions, and can be differentiated into distress to limitations (irritability, anger) and distress to novelty (fearfulness); *Self-Regulation*, which has two subcomponents, the effortful control of attention (e.g. persistence, non-distractibility) and of emotions (e.g. self-soothing); and a dimension variously labelled *Approach-Withdrawal*, *Inhibition* or *Sociability*, which describes the tendency to approach novel situations and people or conversely to withdraw and be wary. Factor analyses also often reveal narrower band factors such as *Rhythmicity and Activity* level (McClowry, 1995; Sanson, Smart, Prior, Oberklaid, & Pedlow, 1994). In this review, we focus on the three broad-band temperament dimensions described above, but also include some research on narrower band factors.

A number of researchers have used the 'easy-difficult' categorization system developed by Thomas and Chess (Thomas *et al.*, 1963), which groups children on the basis of their temperament profiles. 'Difficult' children are typically negative in mood, withdrawing, unadaptable, highly intense and arrhythmic. Failure to replicate these temperament clusters has led researchers to form their own 'difficult' categorizations, making comparisons across studies problematic. Nevertheless, we include in this review some influential studies which have used a variant of the 'difficult' conceptualization.

Definitions of temperament generally emphasize the biological underpinnings of individual differences in behavioural style (see Rothbart & Bates (1998) for review). Twin and adoption studies suggest that heritability is generally in the range of .4 to .6 (Braungart, Plomin, DeFries, & Fulker, 1992; Cyphers, Phillips, Fulker, & Mrazek, 1990). Some aspects of temperament, e.g. activity, appear to be more strongly influenced by heredity than others, e.g. attention span (Schmitz, Saudino, Plomin, Fulker, & DeFries, 1996). More recently, researchers have also begun to investigate linkages between DNA profiles and temperament traits (e.g. Jorm *et al.*, 2000).

The incorporation of models from neuroscience and the application of psychobiological variables to temperament research is expanding with recent technological advances. These models (e.g., Gray, 1982) have been reviewed in detail elsewhere (see Rothbart & Bates, 1998). For example, Kagan and colleagues postulate that threshold to arousal in the amygdala is related to motor activity, reactivity, and inhibition, with low threshold linked to high levels of these temperament traits and high threshold to low levels (Kagan, 1998; Kagan & Snidman, 1999). Another line of physiological research suggests that greater right than left frontal brain activity is associated with withdrawal tendencies and the expression of negative affect (e.g. fear, sadness), while greater left than right frontal brain activity is associated with approach tendencies and the expression of positive affect (Fox & Davidson, 1988).

While elucidation of the biological bases of temperament is still at an early stage, a range of approaches are promising further advances. Given the complexity of the human brain and bodily systems, it is likely that interconnections between a range of systems underlie particular temperament characteristics. The effect of the environment on developing biological systems and how this impacts on temperament is an important direction for future research.

Temperament traits are typically moderately stable over time, with correlations in the range of .2 to .4 (see Slabach, Morrow, & Wachs, 1991), although stability may be as high as .7 to .8 when measurement error is taken into account (Pedlow, Sanson, Prior, & Oberklaid, 1993). Even these relatively high stability coefficients imply a considerable amount of change in children's temperament over time. At present, the bases for changes in temperament are poorly understood (Putnam, Sanson, & Rothbart, 2002).

Temperament has generally been measured via parent-rated questionnaires. While some have questioned the validity of parental reports, citing the effect on ratings of characteristics such as depression and stress (Mednick, Hocevar, Schulsinger, & Baker, 1996), others argue that there is a strong objective component in parental ratings (Bates & McFayden-Ketchum, 2000), and convergence has been found between parental ratings and observational assessments of temperament (Allen & Prior, 1995; Kochanska, Murray, & Coy, 1997). More studies are now adopting naturalistic or structured observational measures (e.g. Kagan & Snidman, 1999; Rubin, Hastings, Stewart, Henderson, & Chen, 1997). While the optimal solution appears to be to use multiple methods of assessing temperament (Rothbart & Bates, 1998), relatively few studies currently adopt this procedure.

2. Models of the Role of Temperament in Social Development

While traditional socialization research focused on environmental effects on the child and assumed a unidirectional transmission from parent to child (see Schaffer (1999) for discussion), temperament research from the outset has been unusual in that its

focus is explicitly on the child's own contribution to his/her development. This has redressed the historical underemphasis on the significance of the child's individuality, but ironically temperament research has often erred on the other side and ignored the influence of the environment. Hence the research literature is dominated by studies adopting a basically correlational methodology, and implicitly or explicitly interpreting associations found between child temperament and social development outcomes as evidence of the unidirectional influence of temperament on outcome.

Various models have been posited to explain the developmental processes through which temperament exerts its effects on social development. A unidirectional view is that temperament has direct linear effects on social development (e.g. very high inhibition is related to social withdrawal). Most research to date has been framed so as to detect only such direct effects. A second model posits indirect effects, either mediated effects (a variable impact on outcome through the influence of a third interacting variable), or moderated effects (the impact of a variable on outcome is affected by the presence of a third variable).

A third model is interactional. Thomas and Chess (1977) argued that temperament affects development primarily through its 'goodness of fit', or match, with the child's environment. Thus, high compatibility between temperament capacities and contextual requirements facilitates healthy development, whereas a mismatch compromises development. Interactional influences imply multiplicative effects (i.e., the co-occurrence of particular temperamental and environmental variables exert an effect beyond their separate contributions). Temperament-by-temperament interactions may also occur (Rothbart & Bates, 1998); for example, high self-regulatory capacities might control the expression of problematic traits such as negative reactivity, facilitating more positive outcomes. Despite the attractiveness of the interactional model, this review will document that findings of interactional effects are still relatively scant.

A fourth type of model is a more elaborated, transactional model (e.g. Cicchetti & Cohen, 1995), which argues that understanding the process of development requires analysis of the ongoing interaction among intrinsic child characteristics and aspects of the environment. Thus, children's temperament, health status and cognitive capacities, together with parent and family circumstances and the wider sociocultural context, all interconnect to explain and predict developmental pathways. In this model, temperament is often seen as a risk or protective factor.

3. Social Development

Many aspects of child functioning and development fall under the mantle of 'social development'. Schaffer (1996) has defined social development as 'the behaviour patterns, feelings, attitudes, and concepts children manifest in relation to other people and the way that these various aspects change over age' (p. 1). In this review, we examine the aspects of children's functioning in social contexts that have most drawn the attention of temperament researchers. These include connections between temperament and the broad domains of social, behavioural and emotional adjustment that comprise social competence, internalizing and externalizing behaviour problems, and more specific aspects of social development such as withdrawal from peers and others, parent-child relations, and school adjustment. As an organizational device, we make distinctions between these different types of social development, but acknowledge that the lines between them are often blurred. Similarly, as will be seen, the lines between temperament as a predictor, and behaviour as an outcome, are also sometimes fuzzy.

Studies which have been concerned with general social functioning, measured most often by rating scales (e.g. overall levels of social competence or behaviour problems) with little emphasis on context, are reviewed first in Section 4. This is followed by a review of studies of social behaviour in specific contexts. The contribution of temperament to peer relationships, particularly the development of social withdrawal in early childhood, will be reviewed in Section 5. Section 6 reviews studies investigating relationships between temperament and parenting, with most attention given to social development in early to middle childhood. This set of studies includes the majority of those attempting to find more complex (mediated, moderated and interactive) relationships between the constructs. Studies examining the contribution of temperament to aspects of social behaviour in the school context, from school entry to late secondary school, are reviewed in Section 7. Temperament contributions in broader environmental contexts, and cultural variations in the expression of temperament and their relationship to social development outcomes are reviewed in Section 8. In a concluding section, we pinpoint some critical methodological and theoretical issues currently facing this field of research, and point to some particularly promising lines for future research. The review is not intended to be exhaustive but rather illustrative of important trends and findings in recent research.

4. Relationships between Temperament and General Social Developmental Outcomes

Many studies have shown direct relationships between temperament and broad domains of social development such as internalizing and externalizing behaviour problems (IBPs and EBPs), and social competence. The reader should note that what appear to be direct effects in much of this work may in fact be more complex, but this possibility has rarely been examined.

4.1 Temperament and Internalizing Behaviour Problems (IBPs)

Most studies investigating connections between temperament and IBPs have focused on temperamental inhibition, where associations are frequently reported. For example, Schwartz, Snidman, and Kagan (1999) followed toddlers who were identified as inhibited or uninhibited into adolescence and found that 61% of adolescents who had been classified as inhibited toddlers displayed social anxiety symptoms, whereas only 27% of adolescents who were uninhibited toddlers showed social anxiety.

There is some evidence to suggest that infant negative reactivity predicts toddler and preschool inhibition, which subsequently predicts childhood IBPs. Kagan and colleagues (whose studies are outlined in more detail in Section 4.2) followed a sample of over 400 4-month-old infants to 7.5 years of age. Infants were classified as high or low reactive according to levels of distress and activity in response to visual, auditory and olfactory stimuli. High reactive infants showed distress (crying and fretting) and vigorous motor activity in response to stimuli, whereas low reactive infants were minimally distressed and low in motor activity (Kagan & Snidman, 1999). As toddlers, high reactive infants showed more fear and inhibition to unfamiliar events than low reactive infants (e.g., entry into the laboratory of an unfamiliar adult); were more likely to be inhibited and withdrawn at 4 years; and more had developed anxiety symptoms at 7 years (45% versus 15%). The results of Kagan's studies suggest that temperament (especially reactivity and inhibition) is associated with IBPs, although many children

who are inhibited in early life do not show later IBPs. One limitation of research in this area is the overlap between the indicators of inhibition and the indicators of IBPs (e.g., temperamental fearfulness in new situations overlaps with anxiety, an indicator of IBPs). This overlap may partly account for the associations between the two, and remains an area in need of further theoretical and methodological refinement.

Following children from infancy to adolescence, other researchers have found only modest associations between early reactivity and inhibition and later anxiety. For example, data from the Australian Temperament Project, a longitudinal multi-wave study of over 2,000 infants, found that early high reactivity did not increase the risk for anxiety in adolescence (Prior, Smart, Sanson, & Oberklaid, 2000). Shyness in infancy and toddlerhood were modest risk factors for later anxiety. Stronger associations were found when shyness persisted over time, with 42% of children who were rated shy on multiple time points between infancy and late childhood exhibiting anxiety problems in adolescence. Looking back in time, only one-fifth of adolescents with anxiety problems had been persistently shy, suggesting that temperamental shyness or inhibition was only one of a number of risk factors for the development of anxiety in adolescence. Kagan and colleagues also report that only some inhibited children (about one-third) show evidence of 'serious' social anxiety in adolescence (Kagan & Snidman, 1999). Little work has been done to identify the characteristics distinguishing those inhibited children who do and do not continue to show difficulties in adolescence, an essential task if at-risk children are to be targeted for early intervention.

Relatively few studies have investigated links between temperament and depression, another aspect of IBPs. Katainen, R  iekk  enen, and Keltikangas-J  rvinen (1999) investigated pathways from 15-year-old temperament and perceived social support to depressive tendencies at 20 years of age. Pathways to depression differed for males and females. After controlling for the effects of depression at 15 years, low sociability predicted depression for boys, whereas for girls the pathway from low sociability to later depression was indirect and mediated by social support. These findings emphasize the importance of investigating both direct and indirect effects of temperament on social functioning, as well as examining gender differences.

4.2 Temperament and Externalizing Behaviour Problems (EBPs)

A considerable body of research has documented associations between EBPs and a range of temperamental characteristics. Illustrative examples are presented here (fuller reviews can be found in Rothbart & Bates, 1998 and Sanson & Prior, 1999). Negative emotionality has been widely studied for its role in the development of EBPs, with some authors (e.g., Cairns & Cairns, 1991; Ledingham, 1991) postulating that negative emotionality represents a predisposition for angry and aggressive behaviour. Toddlerhood negative emotionality, impulsivity, and activity predicted 4-year-old EBPs in a study by Hagekull (1994). Eisenberg, Guthrie *et al.* (2000) reported that behavioural dysregulation predicted EBPs for children both high and low in negative emotionality, whereas attentional control was a significant predictor of EBPs only for children high in negative emotionality. These results suggest temperament-by-temperament interactions, and also indicate the importance of differentiating between behavioural and attentional regulation for the prediction of externalizing outcomes.

Several studies have reported associations between a global measure of 'difficult' temperament and EBPs. Maziade *et al.* (1990) used a longitudinal design to investigate the influence of temperament on the development of EBPs and found that children with clinically significant EBPs scored higher on 'difficult' temperament (low adaptability, distractibility, negative mood, high intensity, and approach). These findings held for both younger (3- to 7-year-old) and older (8- to 12-year-old) children. In this study, difficult temperament was more strongly related to EBPs than to IBPs. Similar findings were obtained in a study of the same age group by Guerin, Gottfried, and Thomas (1997).

Wills and colleagues have investigated the connections between temperament and adolescent substance use in several large cohort studies (Wills, DuHamel, & Vaccaro, 1995; Wills, Windle, & Cleary, 1998). Findings consistently indicate indirect linkages, with temperament dimensions such as activity, mood, negative emotionality and sociability being mediated by other aspects of functioning such as self-control (conceptually similar to emotion regulation), maladaptive coping styles, novelty seeking, and academic competence; and by environmental factors such as negative life events and deviant peer affiliations. Somewhat similarly, examination of the earlier histories of 15- to 16-year-old participants in the Australian Temperament Project showed that high negative reactivity, high sociability, low persistence (as well as aggression, school difficulties and deviant peer affiliations) were significant risk factors for later substance use (Williams, Sanson, Toumbourou, & Smart, 2000).

Temperamental inhibition may be a protective factor against the development of EBPs. Australian Temperament Project data showed that boys with EBPs at 11 to 12 years were less likely to have been inhibited at 3 to 4 years than boys without later EBPs (for girls, the relationship was reversed and small; Sanson, Oberklaid, Prior, Amos, & Smart, 1996). Early childhood inhibition has also been found to be protective against the development of EBPs in adolescence (e.g., Schwartz, Snidman, & Kagan, 1996). Other temperamental characteristics which may be protective, leading to resilience, are low emotional reactivity and high social engagement in childhood (Smith & Prior, 1995), as well as being affectionate, responsive, and moderately active as an infant (Werner & Smith, 1982).

Some aspects of temperament seem to be general risk factors for maladjustment. Rubin, Coplan, Fox, and Calkins (1995) found that a group of poorly regulated, low sociable preschoolers had more IBPs than children in highly regulated, low sociable and average groups. Poorly regulated, highly sociable children had more EBPs than the other groups. These findings suggest that emotional dysregulation may be a nonspecific risk factor for both IBPs and EBPs, and the type of adjustment difficulty exhibited may be influenced by other temperament factors, such as sociability.

Some researchers have investigated the associations between temperament (categorized as problematic or not) and both IBPs and EBPs (categorized as the presence or absence of disorder). For example, in a sample of adolescents, Windle (1992) categorized high activity, low rhythmicity, poor task orientation, low approach, negative mood and inflexibility as problematic. Temperamental risks for depression were similar for boys and girls and included inflexibility and negative mood (i.e. negative emotionality), as well as low approach. The most notable risks for delinquency were high activity and low task orientation (or persistence) for boys and girls, and, for girls only, inflexibility. As the number of problematic temperament styles increased so did the incidence of disorder, particularly for depression. Moderational and mediational models were also investigated and some support for a mediational model was found,

in that temperament difficulty contributed to depression and delinquency both directly, and indirectly through support from family and friends.

4.3 Temperament and Positive Social Functioning

Among research on the contribution of temperament to positive social functioning, the series of studies by Eisenberg and colleagues has highlighted the importance of emotionality and self-regulation for prosocial behaviours and capacities, as well as gender differences in these relationships. For example, Eisenberg *et al.* (1993) showed that self-regulation capacities and negative emotionality were powerfully related to a composite measure of social skills derived from parent, teacher and observer report, with self-regulation appearing more salient. High negative emotionality was found to be a risk factor for low social skills for both boys and girls, while low negative emotionality was protective, but only for boys. The presence of temperament-by-temperament interactions was suggested by the finding that children who were both highly emotional and poorly regulated had the lowest levels of social skills and peer sociometric status.

The moderating effect of context on connections between temperament and social competence was revealed by Fabes *et al.* (1999), using naturalistic observations of preschoolers. Individual differences in temperament characteristics were more influential in stressful or intense contexts, with well-regulated children better able to maintain socially competent behaviour. In more low-key, relaxed contexts, most children responded in socially competent ways, regardless of their temperament.

The direct contributions of temperament to children's capacity for sympathy were investigated by Murphy, Shepard, Eisenberg, Fabes, and Guthrie (1999). High negative emotionality assessed concurrently and 2 and 4 years previously was related to low teacher-reported sympathy in preadolescence and concurrently to low parent-reported sympathy. High regulation was related to high teacher- and parent-reported sympathy. Here, as in Eisenberg *et al.* (1993), self-regulation capacities appeared more salient than negative emotionality. Consistent with the North American studies reviewed above, Australian Temperament Project data have identified attentional self-regulation, sociability and reactivity as predictors of social skills at 11 to 12 years assessed concurrently by parent, teacher and child report, explaining almost half of the variance. Longitudinal predictors of this social skills measure were task orientation and flexibility (attentional and emotional self-regulation) at 5 to 6 and 7 to 8 years, with 16 to 20% of the variance explained (Prior, Sanson, Smart, & Oberklaid, 2000).

Girls are consistently found to have higher levels of empathy, sympathy and conscience development than boys, and numerous sex differences are apparent in the connections between temperament and these aspects of functioning. In a sample of toddlers and preschoolers, Kochanska, DeVet, Goldman, Murray, and Putnam (1994) identified two higher order components of conscience: Affective Discomfort (e.g., anxiety, guilt, remorse about wrongdoing) and Moral Regulation/Vigilance (e.g., confession, reparation following wrongdoing). Consistent with other research, Affective Discomfort was higher for girls than for boys. For girls, it was predicted by higher reactivity and focus/effortful control (i.e., attentional regulation), whereas no temperament dimensions were predictive for boys. High focus/effortful control was associated with higher Moral Regulation/Vigilance for both boys and girls. Different temperament dimensions were related to lower levels of Moral Regulation/Vigilance, with reactivity being prominent for girls, and impulsivity and sensation seeking for

boys. Gender differences in the temperamental predictors of empathy were also found by Bryant (1987), with emotional intensity and low soothability associated with higher empathy only for girls. More systematic investigation of gender-specific pathways to positive outcomes is clearly required.

In summary, there is widespread evidence of the direct effects of child temperament on a range of social development outcomes. Inhibition and negative reactivity have links with IBPs; while high reactivity and poor self-regulation are typically predictive of EBPs, with self-regulation perhaps more salient than negative reactivity. Positive aspects of temperament (i.e., low reactivity, high self-regulation) tend to be associated with prosocial behaviour and social competence. Relatively few studies have explored gender differences in the relationships between temperament and social development, but when they have done so they have revealed evidence of differential pathways and predictors and a need for more research in this area. Similarly, the majority of studies under-represent children from lower socioeconomic status families, although the observational study of preschoolers from homeless families, conducted in a childcare setting by Youngblade and Mulvihill (1998), reported findings consistent with those described above.

The research reviewed so far has generally looked at broad positive and negative social developmental outcomes—IBPs, EBPs and positive social functioning have been seen as cross-situational behaviours, with little regard for the context of their expression. Other studies have more explicitly addressed the question of the influence of temperament on particular types of social developmental outcomes as displayed in specific contexts, such as peer relationships, relationships with parents and school adjustment. These at times allow more insight into how temperament fits into the complex interplay of factors which drive development than do the studies investigating acontextual main effects. These three areas of research are now reviewed in turn.

5. Relationships between Temperament and Peer Relationships

A large body of research shows that temperament directly affects peer relationships, the most common finding being that temperamental inhibition predicts withdrawal from peers (as well as anxiety and depression as reviewed above). Studies on the associations between temperament and peer relationships have extended across a wide age range, beginning in infancy and continuing into adolescence.

Two influential sets of studies on social withdrawal in early childhood have been conducted by Kagan and colleagues, and Rubin and colleagues, respectively. For these authors, social withdrawal (or reticence) refers to consistent displays of solitary, onlooking and unoccupied behaviours when with familiar or unfamiliar peers (Burgess, Rubin, Cheah, & Nelson, 2001). This work is characterized by careful laboratory observations (in particular the use of the 'behavioural inhibition paradigm'). Typically, children encounter novel events such as entry into the laboratory of a clown, and their reactions are coded for indicators of inhibition (e.g. proximity to mother, latency to approach clown). The studies by Kagan and colleagues have largely focused on 'high reactive' infants (high motor activity, fretting and crying) (e.g. Kagan & Snidman, 1999). As noted above, it is sometimes difficult in these studies to make clear conceptual and methodological distinctions between the purported temperament factor (e.g. inhibition) and the outcome measure (e.g. social withdrawal, IBPs), since some of the indicators of inhibition overlap with those ascribed to social withdrawal and anxiety.

In attempting to explain the links between temperament and peer relations, some authors (e.g. Kagan, Rothbart) have referred to the physiological theories described earlier in Section 1. Others (e.g. Rubin and colleagues) argue that inhibition gives the child fewer opportunities to interact with others (i.e., peers, adults), particularly if they receive overprotective parenting. Due to their limited interactions with others, these children are less likely to learn how to interact effectively with peers. This may lead to rejection from the peer group and further isolation.

In contrast to inhibited children, temperamentally sociable children tend to have more positive relationships with friends and are more popular with peers (e.g. Skarppness & Carson, 1986). Stocker and Dunn (1990) investigated concurrent relationships between temperament and peer relationships (as well as children's friendships) in 5- to 10-year-old children. Children who were rated by their mothers and teachers as temperamentally more sociable were also rated as more popular with peers and higher on peer leadership. These results are in contrast to some emerging from non-Western cultures and described in more detail in Section 6; for example, shy children in China scored higher on peer leadership than their more sociable counterparts (Chen, Rubin, & Li, 1995).

Associations between peer relationships and other aspects of temperament (e.g. emotionality and self-regulation) have also been studied. Dunn and Cutting (1999), using a sample of preschoolers, investigated concurrent relationships between temperament and the quality of interactions with a friend. Negative emotionality was positively correlated with several aspects of the interaction, such as 'coordinated play' (e.g. agreeing with the other child's suggestion) and 'bids' (unsuccessful attempts to gain attention). While the latter is clearly a negative outcome, the surprising association between high reactivity and coordinated play suggests that this type of play may reflect dependency rather than peer competence.

Using sociometric data and assessing a range of temperament dimensions, Walker (2001) found that preschoolers who were rejected by their peers scored higher on concurrent teacher ratings of activity and distractibility and lower on persistence than popular children. Compared with popular children, preschoolers in both rejected and neglected groups showed more negative mood and less adaptability at school. Preschoolers classified as controversial (highly liked by some peers but highly disliked by others) were less inhibited than rejected, neglected and popular children. Overall, the more 'difficult' temperament characteristics were associated with more negative sociometric status.

Gender differences in the associations between temperament and peer relationships have been somewhat under-examined. For example, Sanson, Smart, Prior, and Oberklaid (1996) examined the preschool temperament characteristics that differentiated children classified (on the basis of parent, teacher and self-report) as having problematic, competent or average peer relationships at 11 to 12 years. Low persistence and poor task orientation (low self-regulation), assessed from 1 to 3 years onwards, differentiated between problem boys and average or socially skilled boys, but not girls. Higher irritability and inflexibility (aspects of reactivity) between 1 to 3 and 9 to 10 years discriminated between the problem group and other groups for both sexes, but more powerfully for boys than for girls.

To summarize this section, the main focus of research in this area has been on the connections between temperament and social withdrawal. Findings from several research groups show links between inhibition and later withdrawal from peers. While several theoretical models have been advanced to explain these links, some measurement

issues remain to be resolved, including clearer differentiation between variables and constructs. There is also some evidence of links between negative emotionality and poor peer relationships. Non-inhibited children, on the other hand, tend to have positive relationships with peers, although there may be some cultural differences in this association. Gender differences are again under-explored in this area.

6. Temperament and Parenting

In recent decades, it has been increasingly recognized that the child is not a passive participant in parent–child interactions and that what the child brings to the interaction, particularly in terms of his/her temperament, may influence parenting and parent–child interactions (e.g. Bell, 1968; Lytton, 1990). Many models of development also emphasize the potential influence of parenting on child temperament. In this section, the impact of temperament on parenting, and of parenting on temperament, along with some of the pivotal research investigating the interactive effects of child temperament and parenting on social developmental outcomes, are reviewed. Given that the family context is highly relevant to social development in young children, studies reviewed in this section focus on this age group. It is evident that, although empirical data are increasing, temperament-by-parenting interactions are currently not well understood, even though they are frequently described in theories of development.

6.1 Impact of Temperament on Parenting and of Parenting on Temperament

While it is frequently postulated that child temperament and parenting are linked (e.g. Rubin & Stewart, 1996), the exact nature of these associations is often difficult to specify. In addition, the small amount of empirical evidence of such links which is available is often difficult to interpret because of four methodological problems. First, connections between temperament and parenting may be explained by the genetic and biological similarity of parent and child (likely to be reflected to some extent in the child's temperament), rather than the direct influence of temperament on parenting, or vice versa (Scarr, 1992). Second, the extensive use of parent report data to assess both child temperament and parenting means that underlying parental characteristics may influence both sets of data. Third, given that child temperament is likely to be influenced by parenting from very early in the child's life, associations between concurrent parenting and child temperament could be the result of earlier parenting history. Finally, conclusions about the causal relations between temperament and parenting often cannot be drawn because studies have used only correlational data. Hence, the results of studies reporting links between temperament and parenting need to be interpreted with care (see Putnam *et al.*, 2002, for further discussion).

In general, the focus of studies of links between temperament and parenting has been on distress-related temperament attributes (e.g., irritability, 'difficultness', negative reactivity), which tend to covary with parental punishment/power assertion, low levels of positive parenting and general unresponsiveness, and are related to EBPs (e.g. Hemphill & Sanson, 2000; Hinde, 1989; van den Boom & Hoeksma, 1994). Associations between the child's positive affect and self-regulation and parental responsiveness, social interaction and use of rewards have also been reported (e.g. Hinde, 1989; Kyrios & Prior, 1990). For example, Spangler (1990) found that low levels of 'difficult temperament' at 12 months of age (the sum of approach, adaptability, intensity, mood and rhythmicity dimensions) were associated with observed

maternal responsiveness at home during the child's second year, which in turn was related to high levels of observed social competence at 2 years of age (e.g., positive interactions with mother and stranger). Recent investigations have also shown that child inhibition tends to be associated with parental overcontrol and overprotectiveness (e.g. Rubin *et al.*, 1997), which is thought to reinforce social wariness, fostering the development of peer withdrawal (e.g. Rubin & Stewart, 1996).

In contrast to findings that parents withdraw from temperamentally irritable and demanding children, others have found that parents invest *more* positive efforts with their irritable and demanding children. For example, Rubin, Hastings, Chen, Stewart, and McNichol (1998) reported that very young boys with poor behavioural and emotional regulation (i.e., low anger/frustration tolerance and low self-control) received higher levels of both maternal warmth and negative dominance (negative control and hostile affect). Sanson and Rothbart (1995) argued that age of child and parental attributions may be critical factors in determining whether parents invest in more or less positive parenting with their 'difficult' children. Initially enhanced parenting may be difficult to sustain over time, and parents may come to perceive 'difficultness' as intentional rather than intrinsic. The differing ways in which parents respond to their child's 'difficult' temperament are likely in turn to impact on the child's social developmental outcomes.

6.2 Temperament-by-Parenting Interactions

While a number of researchers have identified additive effects in which both temperament and parenting make independent contributions to social development (e.g. Bates & Bayles, 1988; Sanson, Oberklaid, Pedlow, & Prior, 1991), fewer studies have looked at how temperament and parenting may interact with one another to affect social developmental outcomes. Such multiplicative effects are regularly postulated but not so frequently detected empirically. An elegant example of both theoretical and empirical work on temperament-by-parenting interactions is that of Kochanska and colleagues in the development of conscience. They emphasized the importance of the interaction between child temperament (especially reactivity and self-regulation) and parenting (e.g. Kochanska, 1993). For example, Kochanska (1997) found that for fearful toddlers, a gentle style of maternal discipline facilitated conscience development at preschool age. For fearless toddlers, the experience of higher attachment security and higher maternal responsiveness in toddlerhood predicted later conscience.

In a study of multiple social development outcomes (EBPs, IBPs and social skills), Paterson and Sanson (1999) investigated temperament-by-parenting interactions, as well as the 'goodness of fit' between the characteristics of 5- to 6-year-old children and their environments. 'Good fit' was conceptualized as a child possessing characteristics which matched the demands of his/her environment (e.g. parental expectations). Fit was assessed by seeking parent reports of social, behavioural and cognitive child characteristics that they would find 'bothersome', as well as ratings of their own child on these characteristics. 'Poor fit' occurred when a child displayed a high frequency of behaviours rated as 'bothersome' by the parent. Both additive and interactive effects were found for EBPs, with temperamental inflexibility (including negative reactivity) and punitive parenting directly predicting EBPs, as did the interaction between these two variables (i.e., the combination of high inflexibility and high punitive parenting). For combined parent and teacher reports of social skills, greater attention regulation (or persistence), higher levels of parental warmth, and better 'fit'

predicted higher levels of social skills. For aggregated parent–teacher report of IBPs, only inhibition was predictive.

Two studies used a categorical approach to investigate interactions between temperament, family environment and child functioning. Groups were formed on the basis of presence or absence of a problematic temperament characteristic (e.g. reactivity) and/or a problematic parenting style (e.g. low warmth) or poor parent–child fit. Using ATP data, Smart and Sanson (2001) investigated children's social competence at 11 to 12 years, assessed via a composite of parent, child and teacher ratings. While competence was related to both temperamental difficulty (e.g. high reactivity, low attention or emotion regulation) and poor parent–child fit from toddlerhood through 7 to 8 years, there were also interaction effects. The group with both problematic temperament and poor fit had significantly lower social skills at 11 to 12 years than the groups with only one of these problems, who in turn had lower social skills than the group with neither problem.

Hemphill and Sanson (2001) followed a group of 112 children from 2 to 4 years in a study that included detailed laboratory observations as well as parent ratings. High reactive children who showed significantly higher rates of EBPs at 4 years had experienced poorer parenting (low parental warmth, high punishment or low inductive reasoning) at 2 years of age than similarly reactive children who did not show later behaviour problems. Children who scored low on inhibition (i.e., were highly sociable) and who exhibited EBPs at 4 years had received higher levels of punishment as toddlers than highly sociable children who did not show later EBPs. Similar findings emerged from a study of two cohorts of children (infants followed to 10 years of age and 5-year-olds followed through mid- to late childhood by Bates, Pettit, Dodge, and Ridge (1998). They found that temperamental resistance (e.g. continues to play when told to leave objects alone) was more strongly associated with EBPs in children receiving low restrictive control from their parents than children who received high restrictive control from their parents.

Lengua, Wolchik, Sandler, and West (2000) also found both direct and interactive effects of temperament and parenting in a study of children who had experienced parental divorce. Low positive emotionality and high impulsivity, together with high parental rejection and high inconsistency, predicted conduct problems, all assessed by composites of parent and child ratings. For depression, high negative emotionality and low positive emotionality, as well as parental rejection and inconsistency, were predictive. There was a stronger relationship between parental rejection and adjustment difficulties (both conduct problems and depression) for children low in positive emotionality than for children moderate or high in positive emotionality. Inconsistent parental discipline had a stronger association with both types of adjustment problems for children high in impulsivity than for children moderate or low in impulsivity.

Other researchers (e.g., Werner & Smith, 1982) have studied temperament as a potential resilience factor in an environment characterized by high psychosocial stress and poor parenting. Positive child temperament characteristics, such as sociability and adaptability, appeared to protect children from later difficulties by attracting warmth and responsiveness from adults who guided the children's development. Thus, the influence of temperament was mediated through the mentor relationship. Support for a mediational model was also found by Katainen, Rääkkönen, Keskivaara, and Keltikangas-Järvinen (1999) in a study of almost 400 6- to 15-year-olds. Using structural equation modelling, low maternal role satisfaction and ratings of the child as difficult (i.e., high on activity, low on sociability and high on negative emotionality) at

6 years of age predicted hostile maternal child-rearing attitudes (emotional rejection, strict discipline and feeling that the child is a burden) at 9 years, which in turn were significantly related to adolescent-reported depression at 15 years. Although the fact that mothers provided both the temperament and parenting data limits the confidence with which mediated effects can be inferred, it appears that temperament affected parenting which led directly to the social development outcome of depression. Such mediational models deserve further research attention.

Moderational effects may also be important. Maziade *et al.* (1990) found evidence that parenting moderated the relationship between temperament and adolescent adjustment. They reported that difficult temperament at 7 years of age was associated with an increased risk of developing a psychiatric disorder at 12 and 16 years of age, but only when parenting was dysfunctional, with inadequate behavioural control featuring most prominently. This is one of few studies to examine moderator effects, suggesting a need for more systematic investigation.

One approach to overcoming some of the methodological difficulties outlined in Section 6.1 is to use experimental manipulation of parenting to investigate links between temperament and parenting (clearly child temperament is not open to experimental manipulation). This approach has been attempted in only a few studies. The brief, individualized intervention developed by van den Boom (1994) targeted low SES mothers of 6-month-old irritable infants (classified as such within a few weeks of birth), and aimed to promote maternal responsiveness and decrease intrusiveness and uninvolvedness. Results of the first year of the intervention showed improved maternal behaviour (e.g. responsiveness, stimulation), child functioning (e.g. sociability, sophistication during exploration), and quality of attachment in treated, compared with control group participants, and follow-up data indicated ongoing effects to 42 months (van den Boom, 1995). In other words, the change in parenting appeared to improve the social development outcomes of the irritable children in the treatment group in comparison to the control group, indicating a moderational role for parenting. Since irritability in neonates may be rather unstable, replication of these findings is desirable.

In summary, evidence is accumulating which supports the theorized associations between temperament and parenting, and their interactive effects on social development outcomes. Temperamental irritability and difficultness are typically associated with negative parenting, whereas child positivity and self-regulation are associated with parental responsiveness. Research on interactive effects of temperament and parenting suggests that the combination of irritable, difficult child temperament with poor, especially punitive, parenting adds to the prediction of EBPs beyond their independent effects. Studies on conscience development suggest that fearful children respond best to gentle maternal discipline and fearless children do best with maternal responsiveness. However, few studies have fully disentangled the methodological difficulties noted in Section 6.1, and these should provide a focus for further research. Intervention studies appear to be one promising avenue for such research.

7. Connections between Temperament and Social Functioning at School

Temperament has been found to contribute to many facets of children's lives at school. In the main, researchers have investigated direct effects, although some evidence is emerging of interactive and mediated effects. There has also been a concerted effort to examine goodness of fit in the school context (e.g. Lerner *et al.*, 1986).

The commencement of formal schooling and the move from elementary to secondary school are important life transition points requiring substantial adaptations by the child. Temperament characteristics can influence the ease with which these pivotal points of change are negotiated, although few studies as yet have provided directly relevant data, with the measurement of temperament prior to the developmental transition and the assessment of functioning following it. From available research, it appears that attention regulation capacities are important; for example, persistence measured at the start of the first year of school was a strong predictor of school achievement at the end of the year, after controlling for intelligence (Schoen & Nagle, 1994; see also Paterson & Sanson, 1999).

A number of researchers have investigated the contribution of temperament to children's academic achievement, which is outside the purview of this review. In brief, poor achievement has been found to be related to higher activity, distractibility and lower persistence, all of which are aspects of self-regulation, and lower adaptability (Guerin, Gottfried, Oliver, & Thomas, 1994; Martin, 1989), as well as negative reactivity (Lerner, Lerner, & Zabski, 1985). These relationships held after intelligence was controlled.

Temperament characteristics may also moderate the effectiveness of different instructional approaches. Barclay's (1983) meta-analysis suggested that structured, traditional classrooms helped children with lower task orientation (attention regulation) or lower sociability to develop self-control and become more outgoing, whereas less structured or free classroom environments appeared to be beneficial for children who were already competent, adaptable and well regulated. These findings suggest the importance of the 'fit' between child and classroom. Similarly, Keogh and Burstein (1988) showed that temperament characteristics such as high task orientation, high flexibility (sociability) and low reactivity were significantly related to children's interactions with teachers and peers when classroom activities were less structured. It seemed that these temperament characteristics helped children to stay focused and on-task in environments where interruptions and distractions were more frequent. An interesting interaction between temperament and type of instructional method was reported by Orth and Martin (1994). For children high on task orientation, off-task behaviour was not affected by mode of instruction (teacher versus computer), whereas children with lower task orientation displayed more off-task behaviours when receiving teacher instruction. Thus attention regulation capacities appear to moderate the effectiveness of different modes of instruction.

Although findings are somewhat mixed, attention regulation capacities appear important for social functioning at school. For example, the temperament dimension of persistence, reported by parents at child age of 3 to 4 years and in the year prior to the start of formal schooling, was strongly related to combined parent-teacher ratings of social skills during the first year at school (Paterson & Sanson, 1999). The type and quality of children's interactions with teachers may also be influenced by temperament. (Connections between temperament and peer group interactions were reviewed in Section 5.) Paget, Nagle, and Martin (1984) found that adaptability and task attention were related to specific aspects of observed teacher-student classroom interactions. Although children's responses to teachers were not related to temperament style, teachers' propensity to praise or criticize was related to their students' task attention capacities, with teachers more likely to criticize low-attention, distractible children. Preschoolers with high task orientation and low reactivity have been found to display positive socialization towards teachers, while flexibility (sociability) was related to

peer socialization (Mobley & Pullis, 1991). Using detailed observations of handicapped and non-handicapped preschoolers' interactions with teachers and peers, Keogh and Burstein (1988) found that frequency of teacher-child interactions was related to positive temperament profiles among the non-handicapped group, but to negative temperament profiles for the handicapped group, perhaps pointing to the salience of other aspects of child functioning, such as ability or behaviour problems, for teacher-child relationships. A consistent theme throughout these studies is the relevance of attention regulation to teacher-child social relationships. Inhibition (or its obverse, sociability), which is a strong contributor to peer relationships (as described above), appears to have much less relevance for teacher-child relationships.

Adaptive and problematic classroom behaviours have been linked to temperament style. Martin, Nagle, and Paget (1983) showed that activity, persistence and distractibility were related in expectable ways to observations of constructive and non-constructive classroom behaviour. Guerin *et al.* (1994) found that between 25% and 30% of variance in classroom behaviour, assessed by teacher ratings of ability to work hard and appropriateness of behaviour, was explained by temperament style, with persistence being the most powerful contributor and adaptability and approach also featuring. Negative emotionality has also been linked to children's behaviour in the school context. Teacher-reported EBPs at 8 years of age were strongly predicted by parent-reported negative emotionality at 5 years of age, as were positive social behaviours, although much less powerfully (Nelson, Martin, Hodge, Havill, & Kamphaus, 1999).

Connections between temperament and school adjustment and achievement have been viewed as an example of goodness of fit. In this view, children's functioning at school is influenced by the congruence between temperament characteristics and contextual requirements, rather than temperament style by itself. In a series of studies investigating this issue, Lerner and colleagues found that when there is good fit, achievement and adjustment are enhanced (Lerner *et al.*, 1986). As one example of this research, children with high correspondence between self-ratings of temperament and teacher ratings of desirable temperament characteristics, especially reactivity, were found to have higher achievement levels and were rated as of higher ability than children with poorer fit (Lerner *et al.*, 1985). In another study, low fit adolescents, assessed by comparing self-ratings of actual temperament with parents' and peers' ratings of ideal temperament, had poorer teacher-rated academic competence and more parent-rated externalizing and school problems than high fit adolescents (Talwar, Nitz, & Lerner, 1990). The fit between self- and ideal ratings on the mood and approach-withdrawal dimensions was particularly important.

However, methodological difficulties have plagued this area of research, with the measurement of fit proving to be especially challenging (Windle & Lerner, 1986). When 'fit' is seen as the discrepancy between ideal and actual temperament ratings, there is commonly little variation in the ratings of ideal temperament characteristics. Hence the ideal score becomes close to a constant, and the fit, or discrepancy, score may be almost identical to the actual temperament score. Attempts to define fit by reference to undesirable behaviours which are conceptually distinct from temperament or behaviour problem measures are promising. This strategy was used by Feagans, Merriwether, and Haldane (1991), who showed that lower achievement and fewer positive classroom behaviours were evident among 6- to 7-year-old children with poor home fit. As noted earlier, Paterson and Sanson (1999) used a similar measure and reported that poor fit with parental expectations contributed independently of temperament to combined parent-teacher ratings of behaviour problems.

In summary, temperament has been shown to play a major role in children's school functioning, in their responses to the learning environment, in their behaviour in the classroom and playground, and in the social relationships they develop with teachers and peers. The fit between a child's temperament style and the school environment has also been found to be influential. Attention regulation capacities appear to be of key importance in the school context, emerging with great consistency as a significant influence on functioning. Emotionality and negative reactivity also feature, while inhibition-sociability is an important contributor to peer relationships but not to teacher relationships.

8. Temperament and the Broader Social Context

While temperament may be biologically based, its expression, social acceptance and impact on individual functioning and development may be moderated by societal and cultural conditions and expectations. There has been little research on this topic, but if bi-directional or interactive models are to be taken seriously, greater attention to this issue will be necessary. As Wachs (1999) points out, the interweaving of culture, temperament and social development is likely to be complex and difficult to untangle, with potentially non-linear linkages.

The research on social class differences in temperament style suggests that children from lower SES families are over-represented at the 'problematic' end of temperament dimensions, especially those relating to child difficulty (Fullard, Simeonsson, & Huntington, 1989). Infants in a noisy and crowded home environment (which may be more typical of lower SES families) have also been found to be less approaching, less adaptable and more negative in mood (Wachs, 1988). Understanding the processes by which the family's socioeconomic circumstances influence temperament is crucial, and may involve variations between groups in conceptions of what constitutes positive and difficult behaviour, differing child-rearing values and practices, variations in economic and social resources, or a combination of these factors (Prior, Sanson, & Oberklaid, 1989). Given the well-established connections between difficult temperament and behaviour problems, the independent and interactive contributions of SES and temperament to social development outcomes merit further attention.

Cultural differences may influence the nature and stability of the connections between temperament and social development. One of the most often-quoted findings in the temperament field is the unexpected relationship between difficult temperament and lower infant mortality among the Masai of East Africa during a famine (DeVries, 1984). Difficult temperament was thought to increase chances of survival in this extreme environment because higher levels of fussing and crying increased the likelihood of being fed. These findings, although on a small number of children, serve as a dramatic reminder of the importance of goodness of fit. Similarly, Korn and Gannon's (1983) finding that difficult temperament did not lead to the development of behaviour problems for a sub-sample of children from Puerto Rican families in New York, unlike the main white American sample, was interpreted as support for the notion of goodness of fit. It was postulated that the more flexible and relaxed Puerto Rican home environment facilitated a more accommodating parental response to child difficulty, and lessened the likelihood of coercive exchanges and processes developing. However, behaviour problems began to develop among this subgroup once they encountered the mainstream environment of school.

Further confirmation of the impact of culture on temperament and social development relationships comes from evidence that temperamental inhibition is associated with positive developmental outcomes in China, in direct contrast to North American findings (Chen *et al.*, 1995). Children aged 8 to 10 years who were identified by peers as inhibited, were also more accepted by peers and rated more positively by teachers and peers on 'honourship' and leadership than were average or aggressive children. Differing connections between inhibition and parenting style have also emerged in studies of Chinese and Canadian samples (Chen *et al.*, 1998). Toddler inhibition was positively related to maternal acceptance and encouragement of achievement in the Chinese sample, whereas the correlations were negative for the Canadian sample. Together, these results suggest a higher valuing of inhibition in the Chinese culture by comparison with the Canadian culture. These findings require replication and are somewhat inconsistent with more recent work concerning social withdrawal using a younger sample of Chinese children (Hart *et al.*, 2000). However, they do point to the cultural relativity of the impact of temperament on social development.

In summary, while there is limited research on this topic as yet, sociocultural context has been shown to exert a clear effect on the connections between temperament and social functioning. Cultural variations provide a timely reminder of the complex mix of factors which combine to impact on social development outcomes. Our understanding of how temperament works in a broader social context will be enhanced by closer examination of the role of culture-specific attitudes, expectations and beliefs about temperament and parenting practices.

Attention to the temperamental characteristics that are valued in particular cultural settings may reveal differential connections to social development outcomes. For example, if temperamental shyness is seen as a valued trait, it may elicit parental warmth rather than overprotectiveness and disapproval, and may lead to later self-confidence and social competence. If volatility is seen as a sign of alertness or intelligence, it may be socially sanctioned and not elicit the parental rejection and punitiveness found in Anglo-dominated samples. Similarly, cultures may vary in their beliefs about the extent to which a child can control or moderate the expression of their temperament proclivities (distractibility, negative mood, etc.), and hence influence responses to and strategies for managing the child.

Additionally, cross-cultural comparisons may help shed light on the universality and timing of developmental processes. The question of whether particular temperament dimensions have greater salience at different ages or stages of development could be addressed via cross-cultural comparisons. For example, it could be argued that in the preschool years, attention regulation capacities are less central to social functioning than traits such as negative reactivity, emotion regulation and inhibition, but that once children encounter school, attention regulation becomes critical. Comparing cultures with differing ages of school entry might shed light on this issue.

9. Conclusions

This paper has provided an overview of the sizeable body of research investigating connections between temperament and social development. There are clear linkages between temperament and a range of internalizing and externalizing behaviour problems, socially competent functioning, and the development of prosocial capacities such as conscience, sympathy and empathy. Furthermore, temperament has been

shown to influence children's behaviour in specific social contexts such as with parents, peers and in the school environment.

Considerable consistency and specificity has been revealed in the connections between temperament dimensions and behavioural outcomes. For example, inhibition and negative reactivity are important contributors to anxiety. Negative reactivity and poor self-regulation (particularly of emotions but also of attention) are of prime importance for the development of EBPs; while inhibition/shyness appears to be protective against EBPs. High self-regulation and low negative reactivity/emotionality are associated with the development of good social skills and prosocial capacities, with self-regulation perhaps of greater salience.

The approach-inhibition temperament dimension appears the most powerful temperamental contributor to children's functioning in the peer context. Irritability, an aspect of negative reactivity, and 'difficultness' (usually comprising negative reactivity, self-regulation especially of emotions, and inhibition) are important contributors to children's functioning in the family context. Attention regulation is the most powerful predictor of children's functioning in the school context, with smaller roles for emotionality and negative reactivity. Perhaps more than in any other context, the goodness of fit between the school environment and temperament style has emerged as a significant contributor to functioning in that context.

The majority of studies report direct connections from temperament to developmental outcome. It is noteworthy that most studies only seek and test such direct associations, hence what appear to be direct links may mask more complex relationships. The culture-specific findings reviewed are reminders that temperament also operates indirectly and in interaction with other factors. Only in relation to parenting has there been a concerted attempt to investigate indirect and interactional pathways between temperament and social development outcomes, and the evidence emerging is not clearcut. Nevertheless, a number of studies have found that the interaction of parenting and temperament does contribute to social developmental outcomes, and intervention studies also suggest a mediational or moderational role for parenting in the association between temperament and social development. These findings emphasize the potential of future research in this area to inform parent-focused prevention and early intervention efforts.

This review suggests that it is time to move from investigating direct effects, to examining more complex pathways including indirect, interactive, or transactional effects. For example, an area worthy of future study is the way in which temperament contributes to social development through its impact on and interaction with the parenting styles of both mothers and fathers. Temperament works in large part through how it is 'received' by others. Thus it is likely to vary by sex (for as long as gender-based cultural expectations prevail), by culture, and by the demands of the situation (e.g. home or school). Refining designs to illuminate these differential relationships will lead to a greater understanding of the complex roles of temperament in social development.

Although we have made the case that it is more the match or mismatch of temperament characteristics with the social environment, rather than those characteristics in themselves, which can create difficulties for children's social development, it is nevertheless the case that modification of some temperament characteristics such as high reactivity and inhibition is likely to facilitate social development. Hence, understanding the processes involved in changes in temperament is clearly an important research goal. These changes might be stimulated by changes in the child's environment. For

example, van den Boom's research (1994, 1995) showed that changes in parenting led to changes in child temperament. An alternative mechanism might be through the child's moderation of his/her own temperament characteristics; for example, self-regulation capacities may over time enable children to modify high levels of reactivity. At the moment, our understanding of both extrinsic and intrinsic mechanisms by which temperament changes over time is very sketchy and much work remains to be done.

Sex differences emerge in a number of studies, suggesting the possibility of sex-specific connections between temperament and social development outcomes. There has been surprisingly little research addressing this issue, and it provides a clear avenue for future research. In most of the sections of the review, we note suggestive evidence of gender differences but with no clear picture emerging. As discussed in more detail below, investigation of gender differences which goes beyond mere documenting of differences might be able to shed light on the extent to which temperament is biologically embedded, culturally defined, and/or shaped through environmental transactions.

There are other obvious gaps in the existing literature—families from non-English speaking cultures, ethnic minorities within English-speaking countries, lower SES and disadvantaged families have received little attention. In the literature on temperament and parenting, there has been virtually no investigation of the role of fathers. Hence generalization from existing studies needs to be cautious at best. Further, it is notable that temperament's contribution to problematic social development outcomes has received far greater attention than its contribution to positive outcomes. The role of temperament in facilitating healthy, competent development warrants closer study. Similarly, there has been much focus on negative emotionality, while the role of positive emotionality has been relatively neglected. Positive emotionality (comprising positive affect, adaptability, agreeableness) may be particularly important in the development of prosocial behaviours and capacities.

One of the most important and challenging conceptual and methodological issues in temperament research at this point is the overlap between temperament and social development constructs. While it is generally assumed that empirical associations between temperament and social development are due to the contribution of temperament to developmental outcomes (through direct or indirect developmental processes), they may also be due to developmental continuity between early temperament and later child characteristics (i.e., they are in essence the same construct as manifested at different ages), conceptual fuzziness (the concept of social development includes aspects of temperament), and/or methodological overlap (measures of temperament blur over into measures of social development). Apparent methodological overlap between the indicators used for temperament dimensions and social development outcomes may be found in many of the studies reviewed here. For example, fearfulness is commonly used as an indicator of inhibition, and excessive fear as a symptom of anxiety. Similarly, temperamental traits such as resistance to control may include indicators of noncompliance, a facet of EBPs.

Sanson, Prior, and Kyrios (1990) investigated the degree of overlap between temperament and behaviour problems at a measurement level by asking child development experts to define items taken from standard temperament and behaviour problem questionnaires as indicators of each of these domains. The study revealed a significant amount of overlap, especially between temperament and IBPs, with items designed to assess behaviour problems often being thought to be better measures of

temperament. Overlap between a temperament factor labelled cooperation manageability and EBPs was also evident.

Several more recent studies have suggested that the effects of such confounding do not invalidate conclusions regarding the influence of temperament on social development. For example, when confounding items are removed from temperament and behaviour problem questionnaires, temperament-adjustment relationships are still evident (Lemery, Essex, & Smider, 2002; Lengua, Sandler, & West, 1998). Sheeber's (1995) intervention study found that parental ratings of child temperament remained stable after treatment whereas their ratings of behaviour problems improved, suggesting a significant differentiation between temperament attributes and behaviour problems. Clearly, the issue of overlap between temperament and social development indicators is a complex one which should be considered when interpreting data from any of the studies reviewed here. Some careful theoretical and empirical unpacking remains to be done in future studies to better understand this issue.

There is a need for greater attention to a number of other measurement issues. One such issue is the need for independent, multi-source assessments. Reliance on single-source data (frequently maternal report) is likely to inflate any associations found due to shared method variance. The trend for studies to include multiple sources and to use multi-method modes of assessment is an encouraging recent development. However, given potentially powerful contextual influences, strong associations between measures obtained across different situations and by different reporters may not be found, and should not be simply interpreted as indicating low validity or reliability. An important consideration in future research will be how to make sense of these different types of data, both within and across studies.

A further challenge is to develop and refine statistical analysis techniques capable of detecting complex interrelations between influences on children's development. To date, many studies have simply reported correlational data, which do not allow causal inferences to be drawn. Further, there has been little attempt to investigate nonlinear associations, although recent models postulate such relationships (e.g. Eisenberg *et al.*, 2000). Structural equation modelling, latent growth curve modelling and trajectory analysis are some of the more sophisticated tools which are beginning to be used. Investigations of interaction effects have generally relied on hierarchical regression analysis, in which interaction effects are extremely difficult to detect (McClelland & Judd, 1993). Person-oriented approaches, which cluster participants according to various attributes, have recently proved very useful in detecting interactions between temperament, parenting and social development outcomes. Intervention studies can also identify interaction effects (e.g. by observing the effects of changes in parenting style for children with similar temperament profiles). Thus, a number of statistical techniques and creative research methodologies are being employed which offer promise in attempting to delineate the more complex developmental relationships between temperament and social development.

This review has documented the importance of self-regulation capacities to social development. However, more attention needs to be given to deconstructing self-regulation into sub-components of emotional and attentional self regulation (Miller & Keating, 1999). It is possible that these two facets of self-regulation contribute differently to developmental outcomes. Conceptual fuzziness and operational overlap currently characterize research on self-regulation, with numerous variants of constructs in use (e.g. effortful control, persistence, attention regulation; positive and negative emotionality, negativity, reactivity). A further imperative is to disentangle

negative reactivity/emotionality and emotional self-regulation. This may prove to be quite complex; for example, emotional regulation may be a more crucial attribute for highly reactive children for whom there is more to 'self-regulate'. Devising clearly differentiated measures of emotional self-regulation and negative reactivity presents a challenge for the future.

The complex question of biology–environment interactions is a critical one for future research on the impact of temperament on social development. While it is widely accepted that there is some underlying biological predisposition towards particular temperamental characteristics, the strength of associations between physiological systems and temperament traits remains uncertain (see e.g. Quas, Hong, Alkon, & Boyce, 2000). Of course, to postulate that temperament has a biological basis does not imply that temperament is immutable. It is yet to be established whether changes in observed temperament represent change also in their biological substrates, or change in the expression of temperament without accompanying biological changes. The complexity of the relationships between temperament and physiology is suggested by the findings of Burgess, Marshall, Rubin, and Fox (2002) that, while physiological measures at 14 months did not predict later temperament (at 2 years), attachment status at infancy did predict later cardiac measures. The recent research in neuroscience which documents the effect of the environment on the growing brain (e.g. Cynader & Frost, 1999) opens avenues for research on how temperamental predispositions may be potentiated or blocked by the social and/or physical environment.

A basic question impacting on the interpretation of all the research reviewed here is the nature of temperament itself. The conception of temperament which has guided this review is of temperament as a relatively stable, biologically based, intrinsic characteristic, which is nevertheless modifiable through environmental influences. Others might regard it simply as a social construction whose meaning is derived from the social context, or as an epiphenomenon generated in the context of interactions between the child and his/her environment. These alternatives should not be taken to be mutually exclusive; for example, a child's initial tendencies towards withdrawal might lead to the child being labelled as 'shy', and this social label can then impact on the stability of the withdrawal tendencies and on the subsequent response of the social environment to the child (Caspi, Elder, & Bemm, 1988).

Research which would shed light on the relative weighting of the 'intrinsic', 'learned' and 'constructed' elements in temperament could include close investigation of changes in temperament across development and across social and cultural settings. If changes are biologically governed, generally similar changes might be expected across all children, despite individual differences (e.g. all children may become better regulated, or less inhibited, over time); if environmentally influenced, changes would vary according to environmental demands and expectations, for example, across differing socioeconomic groups and cultures. A close examination of the sex differences in temperament might also prove informative. As has been noted, boys tend to be more reactive and more poorly self-regulated than girls. Research could indicate whether this difference is related to differential social acceptability and expectations regarding temperament traits for boys and girls, suggesting a role for social construction. Of particular relevance here might be whether gender differences are similar across cultures which have different sex stereotypes. Alternatively, gender-specific developmental patterns might indicate differences in the speed with which the capacity for self-regulation develops among boys and girls.

A further conceptual issue is the relationship between temperament and personality, both of which clearly refer to basic facets of individual differences. Temperament has been seen as the biologically based foundation stone for later-developing personality which emerges through the complex interplay of a person's learning and experiences, his/her cognitive development and emerging sense of self (Hagekull & Bohlin, 1998). There is growing interest in the nature and strength of the developmental connections between temperament dimensions and personality factors, and in the determinants of continuities and discontinuities.

Several studies have mapped associations between temperament and the five-factor model of personality (comprising Extraversion, Neuroticism or Emotional Stability, Agreeableness, Conscientiousness and Intellect or Openness to Experience). Despite difficulties comparing studies due to the differing temperament dimensions and scales used, some consistent trends are emerging. Extraversion and agreeableness have each been linked to activity and inhibition/approach, conscientiousness to persistence, neuroticism to emotionality/negative reactivity, and intellect/openness to inhibition/approach (Angleitner & Ostendorf, 1994; Hagekull & Bohlin, 1998; Torgersen, 1999). While generalizations about specific temperament–personality links are clearly premature at the present time, the existence of paths from temperament to personality may be regarded, first, as indicating a direct impact of temperament on social development (if personality is considered a social developmental outcome in itself), and second, as evidence of the continuing indirect influence of temperament, through the associations of personality with numerous aspects of social development over the lifespan.

The research literature reviewed here provides some guidance for how we raise children with differing temperament styles. This review has documented the importance of context, has shown that certain temperament attributes 'matter' more in some contexts than others, and that the same environmental characteristics can have differential impact depending on the child's temperament. For example, the same parenting can have differential effects on fearful and bold children, and different modes of school instruction appear optimal for children with different attention regulation capacities. This knowledge can guide the way environments are structured so that differences between children can be accommodated. It is also a reminder that universal prescriptions are unlikely to be appropriate. 'Recipe book' or 'one size fits all' approaches to parenting, for example, which do not take children's temperamental style into account, may be counter-productive. As well as furthering our theoretical understanding, intervention studies have potential for enhancing children's social development by tailoring their environments to 'fit' their temperament style, potentially most critical at transition points such as entry into childcare and school.

In sum, understanding of links between temperament and social development has come a long way and it can be clearly concluded that specific temperament traits impact on particular aspects of social development, either directly or indirectly. Some conceptual and methodological limitations will need to be addressed to allow more confident conclusions about the mechanisms and processes involved. Unexamined facets of temperament, such as positive emotionality, deserve more research attention, and more diverse populations need to be foci of research. Future research will also need to be more sophisticated in examining how temperament interconnects with other influences to affect social development in different contexts, guided by ecological and transactional models of development and supported by appropriate statistical approaches to the data. Studies of change offer particular potential—both research

examining biological and environmental influences on change in temperament, and intervention studies which intentionally attempt to induce change. Such research will not only advance our understanding of developmental processes, but will also strengthen the evidence base to guide efforts to better provide for each child's unique individuality.

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