

## Evolution and Development

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### I. Theoretical basics

The thesis of this chapter is that evolutionary theory can make a major contribution to conceptualizing children's social development. However, at the outset it is useful to begin with a few definitions and general ideas.

Evolutionists accept as a fundamental postulate that the process of natural selection over the course of evolutionary time has shaped every aspect of the human mind. Humans, like other animals, evolved a set of adaptations that functioned to solve particular adaptive problems occurring in the environment of evolutionary adaptedness (EEA)—the environment that humans evolved in and which presented the set of problems whose solutions constitute the set of human adaptations. Thus, for example, Bowlby (1969) proposed that a recurrent problem of our evolutionary past was that altricial human infants were helpless in the face of danger from predators. This problem was solved by the evolution of the human attachment system as a mechanism that reliably results in infants staying close to their mothers.

The general principle that natural selection sculpted the human mind, by itself, tells us little about the structure of the human mind and even less about development. Basic evolutionary logic, however, requires that at least some evolved systems be domain-specific (Cosmides & Tooby 1987). Domain-specific mechanisms have two important characteristics: they evolved in order to solve a specific recurrent problem in the human EEA; the mechanisms are content-specific in the sense that they take in only a very delimited set of stimuli and, via a decision rule, produce only a limited set of outcomes which solve a highly discrete adaptive problem (Buss 1995: 6). Domain-specific psychological adaptations evolved in specific environments and responded to the recurrent properties of that environment. For example, the eye evolved to respond to the properties of light and the structure of surfaces as enduring and recurrent features of the environment, and children's cognitive abilities reflect adaptations to recurrent features of specific problem domains, including object construal, physical causality, motion, etc. (Gelman & Carey 1991).

Within this perspective, then, domain-specific mechanisms are construed as species-typical universals which evolved to solve recurrent adaptive problems posed by recurrent

features of the environment. However, there is every reason to suppose that domain-general mechanisms are also an important feature of human evolution. Domain-general mechanisms did not evolve to solve a specific recurrent problem in the human EEA, but rather can be utilized to solve a wide range of non-recurrent problems. Moreover, domain-general devices would be able to take in a wide range of stimuli and produce a wide range of responses which could solve these non-recurrent problems. Examples would be mechanisms of social learning (Boyd & Richerson 1985, 1988) and the *g* factor of intelligence tests (MacDonald 1991, 1997). For example, whatever the precise nature of *g* at the level of proximal (neurophysiological) mechanisms, there is no reason whatever to suppose *g* is a domain-specific mechanism. Individuals with high intelligence perform better in complex, relatively unpredictable environments and succeed at a very wide range of tasks and occupations, so that there is no reason to construe the *g* factor as having evolved to solve a specific, highly circumscribed recurrent problem in the human EEA. Moreover, given the very wide range of test items involved in IQ tests and the very wide range of occupations that individuals of high IQ excel in, it is extremely unlikely that the underlying psychological mechanisms take in only a very delimited set of stimuli and produce only a limited set of outcomes which solve a highly discrete adaptive problem. From an adaptationist perspective, therefore, an essential feature of human intelligence is that intelligence facilitates the attainment of evolutionary goals (e.g., acquiring economic resources, obtaining mates, etc.), but that the nature of human intelligence is to be able to attain evolutionary goals in a very flexible manner by, e.g., constructing novel solutions to non-recurrent problems presented by an ever-changing and incredibly complex human environment. The activities that men engage in to attract mates or vanquish their adversaries may be very different now than in the remote past, but there is every reason to suppose that in both environments men, using domain-general abilities, were able to devise highly flexible strategies to attain their evolutionary goals.

Thus stated, however, an evolutionary approach must seem to be a weak theory in the sense that it makes no specific predictions about the contours of human development. In a sense this is true because it is inevitably an empirical question to ask what kind of species humans are. If humans evolved to be obligately monogamous like many bird species one would not expect to find important sex differences in behavior resulting from males needing to compete with other

males in order to obtain multiple mates. And if humans had evolved the haplo-diploid genetic system of the hymenopterans (ants, bees and wasps), we might expect to find societies centered around sterile females cooperating to rear their sister's offspring.

Nevertheless, it is not really so hopeless as these considerations might suggest. The basic theorem of modern evolutionary biology might be phrased as "Thou shalt not construct a theory which implies that organisms are truly altruistic". A fundamental result of modern evolutionary logic is that true altruism can evolve only under very stringent conditions, and that even if it were to evolve it would tend to lose out in competition with non-altruistic individuals within any group where it occurs (e.g., Alexander 1987). (This is not to imply that human groups cannot impose altruism on their members, by, e.g., penalizing non-altruists in the interests of establishing cohesive groups (MacDonald 1994; Wilson & Sober 1994); however, this type of social regulation is not likely to be an aspect of children's evolved psychological adaptations.) The result is that an evolutionary perspective predicts that children's behavior will be self-interested rather than truly self-sacrificing, and that children's moral reasoning, moral behavior, and their relationships with parents and peers will reflect this generalization.

Moreover, the enterprise of reconstructing the past can be accomplished in a principled manner. For example, there is considerable evidence that there are universal patterns of sexual dimorphism (e.g., sex differences in size) among humans that conform to patterns expected in a moderately polygynous species (Alexander 1979). This in turn implies that an important aspect of human evolution is the development of sex-differentiated patterns of parental investment, with the implication that the human mind will reflect a human ancestral environment where females devoted more effort to parenting than males and males devoted more effort to mating than females.

This has very broad implications for the contours of children's development. At a conceptual level, organisms need to perform two very broad types of functions. They must approach the world and obtain resources related to adaptive functioning (e.g., food and mating opportunities) and they must have mechanisms for avoiding threats (e.g., predators, environmental dangers). Evolutionary theory predicts that in species with sex-differentiated patterns of parental investment, the sex with the lower level of parental investment (in this case,

males) will pursue a more high risk strategy compared to females, including being more inclined to have their behavioral approach and behavioral avoidance mechanisms balanced in favor of behavioral approach (e.g., being more prone to risk taking, neophilia, and exploratory behavior). This follows because the high investment sex (in this case, females) is expected to be able to mate relatively easily and is highly limited in the number of offspring she can rear (Buss & Schmitt 1993; Symons 1979; MacDonald 1988; Trivers 1972). However, mating is expected to be problematic for the low investment sex, with the result that males must often compete with other males for access to females and there will be large differences among males in reproductive success.

Mating for males is thus expected to be much more of a high stakes enterprise, with much more to gain and much more to lose than is the case with females. Risk-taking directed at resource acquisition can therefore have very high payoffs for males compared to females, and, as a result, the evolutionary theory of sex makes predictions of sex-differentiated behavior which go well beyond expected differences in mating strategies to encompass a wide range of behaviors which influence resource acquisition. In terms of the following discussion, males in general are expected to be higher than females on behavioral approach systems (including sensation seeking, risk-taking, and impulsivity) and lower on behavioral withdrawal systems (including caution and fear).

In addition, evolutionary theory predicts that in species with sex-differentiated patterns of parental investment, males, as the low investment sex, would gain more from aggression and social dominance—both of which are costly and dangerous—because engaging in these behaviors would be more likely to lead to increased mating opportunities. Females, on the other hand, are expected to adopt a more conservative strategy, benefiting less from aggression and social dominance. Females also benefit more from long term mating relationships characterized by romantic involvement, trust, and empathy because these features of relationships are signals of a male's willingness to invest in the female and her children.

To conclude this introductory section, the foregoing implies that evolutionary biology constitutes a supra-paradigm for human development. A very common practice in textbooks in developmental psychology is to begin with several different theoretical approaches, including

cognitive-developmental theory, social learning theory, biological and evolutionary approaches, and, perhaps, psychoanalysis (the latter, alas, not always included only for its historical interest). The relationships among these theories are typically not discussed, but it was not very long ago that it was common to argue that different theories constituted fundamentally incompatible world views and that scientists were forced to choose among them, ultimately for irrational reasons (e.g., Lerner & Kauffman 1986; Overton 1984).

An evolutionary perspective, however, begins with the proposition that all aspects of the phenotype are open to natural selection. The evolutionary perspective is highly compatible with the view that the phenotype is influenced not only by the highly dedicated, domain-specific mechanisms of development revealed by biological, cognitive-developmental, and information processing research, but also by the domain-general mechanisms of social learning, developmental plasticity, and the *g* factor of intelligence tests. This does not imply that all aspects of the phenotype are genetically determined, but it does imply that one should not be looking for alternatives to evolutionary theory. Instead, one should attempt to understand how evolution has orchestrated a complex interplay among highly dedicated, domain-specific systems that evolved to solve particular adaptive problems in the EEA as well as domain-general processes such as social learning which facilitate adaptive behavior even in the very novel set of environments that children and their parents confront in the contemporary world.

## II. Sex Differences in Some Domain-Specific Mechanisms

Discussions of adaptive systems among children inevitably raise the difficult question of specifying the adaptive niche of childhood and the relationship between adult systems and their precursors in children. From an evolutionary engineering standpoint, if a particular set of systems (e.g., those related to aggression) are important in adulthood then they must emerge full blown at some point during development. They need not, of course, develop at birth or during early childhood (e.g., the reproductive organs are not competent until adolescence). Nevertheless, there are at least three reasons to suppose that systems important in adulthood will often emerge much earlier at least in truncated form.

(1) Advanced animals are characterized by a prolonged period of plasticity in which learning takes place, typically during play (Fagen 1983; MacDonald 1988, 1993; Smith 1982). Important behavioral systems are not genetically "hard-wired" units which suddenly emerge full blown in adulthood. There is a prolonged training period during which skills are honed and lessons learned. Thus the fact that boys are more aggressive than girls during nursery school quite possibly has nothing whatever to do with their obtaining more resources at this age which in turn leads to greater success as an adult. Nevertheless, the presence of this system allows the child to develop skills related to being effectively aggressive when it really counts. Consistent with this, Pellegrini (1988) notes a shift in rough and tumble (r & t) play from a cooperative, playful style in younger children to a rougher style associated with dominance interactions and aggression in early adolescence.

(2) Secondly, evolved systems may be adaptive in childhood. In the following, I will discuss three biological systems which show sex differences during childhood. Two of these systems can be reasonably viewed as having an adaptive function during childhood (MacDonald 1988, 1995). Thus the behavioral approach systems are associated with curiosity, exploratory behavior, creativity (see MacDonald 1988; 1993), and holistic, synthetic thought processes (Tucker & Williamson 1984). This trait is thus associated with interest in and responsiveness to the environment (whether social or non-social), and is thus presumably an important aspect of play (and certainly r & t play [see below]) as a general Piagetian environment—engagement device. Evolutionary analyses of play emphasize the function of play as involving intrinsic motivators which facilitate interaction with the environment (e.g., Fagen 1981; MacDonald 1988, 1993; Smith 1982). Similarly, systems underlying behavioral avoidance are functional beginning early in life as systems that responds to external threats with behavioral inhibition and emotions such as fear and anxiety (Gray 1982; Kagan, Reznick, & Snidman 1987, 1989).

(3) Another reason for discussing evolved systems during childhood is that if a biological system is important in adulthood, then a non-functional version of the system may be present during earlier development because of what one might term the opportunistic nature of evolution itself. The evolutionary function of the human affectional system has been proposed to be that of producing close affectional relationships during adulthood in order to facilitate high investment

parenting (MacDonald 1992). Given such a function, there would be no evolutionary necessity for the tendency for pair bonding to develop out of relationships that occur during infancy. It is quite conceivable that intimate relationships, like reproductive competence, would develop *de novo* at puberty so that early affectional relationships would be irrelevant. However, natural selection appears to have opportunistically taken advantage of a pre-existing system involving maternal nurturance of the young, with the result that the tendency for affectional relationships in humans occurs at a very early age. Natural selection must work with what is available, and it is often much easier to modify existing systems rather than create a system *de novo*. In the absence of natural selection against such a trait occurring in childhood, the most efficient path for developing an adult trait may be to develop the trait (or a rudimentary version of it) during childhood even if it has no adaptive function during childhood.

The purpose of the following is to show that the mean sex differences in three important personality systems related to the Five-Factor Model (FFM) of personality conform to the evolutionary logic described above. Within this framework, the FFM is conceptualized as set of universal human adaptations, and individual differences in these systems constitute a set of viable alternative strategies (see below). John et al (1994) have found the FFM factors replicate for children, and there are clear conceptual linkages between the FFM and early-developing temperament systems (see below). While the FFM is derived from semantic information, the evolutionary perspective is strengthened by the following types of evidence: 1.) Evidence for similar systems in animals which meet obvious adaptive needs; 2.) Evidence for a structural basis for these systems in the brain; 3.) Developmental evidence that recognizable precursors of the FFM exist during infancy or early childhood when there is little *a priori* reason to suppose that such dimensions of individual variation would answer to adult interests in describing individual variation. Here I will briefly summarize data related to the last type of evidence only. (See MacDonald [1995] for details.)

*Behavioral Approach Systems.* Sex differences within the FFM factor space conform to evolutionary expectations. Particularly relevant are the dimensions of Dominance and Nurturance/Love which cover the same domain as Extraversion and Agreeableness on some FFM measures (Briggs, 1992; Trapnell & Wiggins, 1990). As Trapnell and Wiggins (1990) point

out, the difference amounts to a rotational difference between two different ways of conceptualizing the same interpersonal space. Nevertheless, an evolutionary perspective is better conceptualized with Dominance and Nurture as the primary axes of interpersonal space, since this conceptualization maximizes theoretically important sex differences and is thus likely to have been the focus of natural selection. Men score significantly higher on the IAS-R-B5 DOM (Dominance) scale and significantly lower (by .88 Standard Deviations) on the IAS-R-B5 LOV (Love) scale (Trapnell & Wiggins 1990). Theoretically expected sex differences are also pronounced on the Sensation Seeking Scale in studies performed in America, England, Scotland, Thailand, and Japan (Zuckerman 1979, 1991). These scales tap variation in attraction to physically dangerous activities and lack of fear of physical harm, promiscuous sexual activity, disinhibition, and susceptibility to boredom.

Developmentally there appears to be a pattern in which the most sexually-differentiated aspects of behavioral approach are maximized during late childhood and early adulthood while the least sex-differentiated aspects of behavioral approach appear early in infancy and are highly associated with positive emotionality. However, boys are higher on behavioral approach even during infancy in cross cultural samples (see Rothbart 1989a for a review), and sex differences in aggression (Eagly & Steffan 1986), externalizing psychiatric disorders (conduct disorder, oppositional/defiant disorder), risk-taking, and rough and tumble play (which is often associated with aggression) (DiPietro 1981; MacDonald & Parke 1986; Humphreys & Smith 1987; O'Brien & Huston 1985) can be seen beginning in early childhood. The social interactions of boys are also more characterized by dominance interactions and forceful, demanding interpersonal styles (Charlesworth & Dzur 1987; Cowan & Avants 1988; LaFrenière & Charlesworth 1983; Leaper 1991; Savin-Williams 1987; Sheldon 1990).

*Conscientiousness and Behavioral Avoidance Systems.* The trait of Conscientiousness subsumes variation in the ability to defer gratification, persevere in unpleasant tasks, pay close attention to detail, and behave in a responsible, dependable manner. Widiger and Trull (1992) find that the psychiatric disorder most associated with conscientiousness is obsessive-compulsive disorder, a disorder which tends to co-occur with a variety of phobic states and other anxiety disorders (e.g., Marks 1987; Öhman 1993). The evolutionary theory of sex outlined above

suggests that females would tend to adopt a more conservative strategy and thus be higher on measures of conscientiousness and more prone to anxiety disorders and behavioral inhibition.

Females are indeed significantly higher on IAS-R-B5 Conscientiousness (Trapnell and Wiggins 1990). Females are also more prone to most anxiety disorders, including agoraphobia and panic disorder (e.g., Weissman 1985; DSM IV). It is also noteworthy that girls report being more fearful and timid in uncertain situations than boys and are more cautious and take fewer risks than boys (Christopherson 1989; Ginsburg & Miller 1982). Girls are also more compliant than boys beginning in the toddler period and throughout childhood (Kochanska & Aksan 1995; Minton, Kagan & Levine 1971; Pederson & Bell 1970; Smith & Dagiiesh 1977), and girls are more prone to anxiety disorders (Weissman 1985).

On the other hand, ADHD is overwhelmingly found among boys. ADHD is conceptualized by Tucker and Derryberry (1992) as involving a diffuse, extraverted attentional style which is the antithesis of the redundancy bias characteristic of the attentional style of obsessive-compulsive disorder. The characteristics of ADHD children clearly place them low on all of the typical descriptors of conscientiousness: undisciplined, unplanful, unreliable, non-compliant, disorderly, impulsive, incautious, non-persistent in the face of difficulty, interested in immediate gratification, and lacking in neatness and tidiness (e.g., Shaywitz & Shaywitz 1988).

*Nurturance/Love as an Adaptation.* As indicated above, the circumplex model of interpersonal descriptors (Kiesler 1983; Trapnell & Wiggins 1990; Wiggins et al 1988) results in a highly sex-differentiated dimension of Nurturance/Love. Nurturance/Love is proposed to be a reward system that evolved to underlie adaptive relationships of intimacy and other long term relationships, especially family relationships, involving reciprocity and transfer of resources to others (e.g., maternal and paternal investment in children). This trait is not considered as a temperament dimension of childhood, but individual differences in warmth and affection observable in early parent-child relationships, including secure attachments, are conceptually linked with this dimension later in life (MacDonald 1992, 1997). Secure attachments and warm, affectionate parent-child relationships have been found to be associated with a high investment

style of parenting characterized by later sexual maturation, stable pair bonding, and warm, reciprocally rewarding, non-exploitative interpersonal relationships (Belsky et al 1991).

If the main evolutionary impetus for the development of the human affectional system is the need for high investment parenting, females are expected to have a greater elaboration of mechanisms related to parental investment than males. Females, because of their very high, morphologically imposed investments in pregnancy and lactation are expected to be highly discriminating mothers compared to males (e.g., Buss & Schmitt 1993; Symons 1979; Trivers 1972). It was noted above that females score higher on the IAS-R-B5 LOV scale by a very robust 0.88 standard deviations (Trapnell & Wiggins 1990). Moreover, IAS Nurturance is conceptualized as involving the tendency to provide aid for those needing help, including children and people who are ill (Wiggins & Broughton 1985), and would therefore be expected to be associated with ideal child-nurturing behaviors. This dimension is strongly associated with measures of femininity, and is associated with warm, empathic personal relationships and dependence (Wiggins & Broughton 1985).

The tendency for females to be more strongly attracted to intimate relationships and pair bonding has empirical support. Girls are more prone to engage in intimate, confiding relationships than boys throughout development (e. g., Berndt 1986; Buhrmester & Furman 1987). Females also tend generally to place greater emphasis on love and personal intimacy in sexual relationships (e. g., Buss & Schmitt 1993; Hinde 1984; Kenrick & Trost 1989). Females are more empathic and desire higher intimacy in relationships (Lang-Takoc & Osterweil 1992), and both sexes perceive friendships with women as closer, richer, more intimate, more empathic, and more therapeutic (Aukett et al 1988; Wright & Scanlon 1991). Developmentally, sex differences related to intimacy peak during the reproductive years (Gutmann 1977; Turner 1981), a finding that is compatible with the present perspective that sex differences in intimacy are related to reproductive behavior.

#### IV. Do the Phenotypic Contours of Human Development Meet Evolutionary Expectations?

*Peer Relationships.* I noted above that an evolutionary perspective predicts that children's behavior will be self-interested rather than self-sacrificing, and that their relationships with their

peers will reflect this generalization. Within this perspective, peer relationships may be viewed as a continuum ranging from high levels of commonality of interest to high levels of conflict of interest. (See Figure 1.) Empirical research has focused on three points of this continuum. At one extreme is exploitation, defined as asymmetrical relationships in which one individual receives no benefit. Because the interests of the exploited child are compromised, such relationships are not voluntarily entered into, and the relationship is maximally prone to defection. Examples would be the bullying relationships studied by Smith (1991), and, in the following section, the relationship between aggression and peer rejection is considered in this framework.

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(Place Figure 1 about here.)

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At a second level are structured group settings in which there are limited resources. The empirical findings indicate that there is a tendency toward uneven access to resources among groups of children, a result highly compatible with the evolutionary expectation of conflict of interest among individuals regarding access to valued resources (Charlesworth 1995). Paradigmatic of such group phenomena are relationships of dominance and subordination in naturally occurring groups of children. Unlike relationships of exploitation, relationships of dominance/subordination are voluntarily entered into and, indeed, dominance/subordination is a basic principle of social organization among many species of animals. Dominance relationships are asymmetrical, with dominant children having priority of access to resources (Charlesworth & LaFrenière 1983; Savin-Williams 1987). The evolutionary expectation that dominance/subordination, as a voluntary relationship, contains benefits for subordinate individuals is borne out in the animal literature (McGuire 1974; Wilson 1975), and Savin-Williams (1987) has noted that subordinate adolescent boys highly value membership in hierarchical peer groups. As indicated above, an evolutionary perspective predicts that boys' relationships are more likely to be characterized by dominance and subordination, and this is indeed the case.

On the other extreme of the continuum of commonality of interest are relationships of friendship. As is the case with relationships of dominance/subordination in naturally occurring

groups of children, friendship is characterized by repeated interactions which are voluntarily entered into and from which neither party defects. However, unlike dominance/subordination, there is the implicit assumption that the individual can choose friends from a set of individuals who vary along a variety of dimensions. The choice of a friend is thus essentially a choice of a resource which, from the present perspective, is theoretically constrained by the requirement that the friendship satisfy the interests of both partners. As a result, it is expected that such relationships are more nearly symmetrical and based on reciprocity than are relationships based on dominance or exploitation.

The empirical research indicates that symmetry and reciprocity are central to friendship. Youniss (1986), taking an evolutionary perspective, summarizes evidence that indeed children's positive social interactions tend to involve reciprocity. Infants exhibit toy sharing, turn-taking, and mutual imitation, and older children regard acts of symmetrical reciprocity as the hallmark of friendship. Friends share a variety of resources, help each other in times of emotional stress, and develop mutual dependence (Asher 1990). Resources need not be exchanged immediately, but only over the long term. Friendship implies reciprocity, because, as Parker and Gottman (1989) note, "If play is to be coordinated, it is simply not always possible to get one's own way. In service of the overall adventure, children must inhibit some actions [and] accept influence at times" (p. 112). Because reciprocity is lacking, children who always try to get their way are thus not likely candidates for friends. This is presumably the reason why theorists since Piaget have emphasized the importance of peer interactions as influences on social cognition and perspective taking: Becoming a successful social actor entails understanding others' interests.

Interestingly, Morgan and Sawyer (1967) found that friends prefer equality in division of rewards but would sometimes consent to unequal division. However, children who disliked each other insisted on absolute equality. LaFrenière (1995) and Hartup (1989) show that friends are more likely to engage in equitable exchanges and are more likely to cooperate rather than compete even in situations with limited resources (see also Rabbie (1991) for similar data on adults). Nevertheless, Hartup makes the point that although reciprocity and equality are the hallmarks of friendship, one of the friends may be less favored in the relationship and therefore be more willing to accept some imbalance in distributing rewards.

These findings are consistent with Charlesworth's (1995) findings: In a limited resource situation, there is a strong tendency for non-equal division of resources even among children who are friends, and this is the case cross-culturally. In such a situation one can conceptualize reciprocity as being achieved despite the lack of equal division of resources: The less favored partner in the relationship must give up more in some tangible resource in order to maintain the relationship. For example, in the following section, sociometric popularity is conceptualized in terms of possessing a set of traits which are valued by peers. Thus, if a very popular child were friends with a somewhat less popular child, it is expected that the less popular child would have to allow the more popular child to obtain more tangible resources in a resource-competitive situation in order to maintain an overall reciprocity in the relationship.

A perhaps not so obvious result of this is that similarity is expected to be a basic feature of peer relations of friendship. From an evolutionary perspective, a child may be considered to be a concatenation of resource potentials for other children. If indeed reciprocity is the fundamental rule of peer relations, then a very likely outcome is simply a phenotypic matching process in which children aggregate on the basis of phenotypic similarity. Similarity ensures reciprocity because the resource value of a wide range of phenotypic attributes is matched within the dyad. Thus if physical attractiveness is a resource, children of similar physical attractiveness are expected to be more likely to become friends because reciprocity in this resource attribute has been achieved. In addition, children's interests and abilities would be expected to be resources for other children who have similar interests and abilities: Sharing an interest in, e.g., baseball, provides both children with psychological rewards, so that reciprocity is maintained.

There is overwhelming evidence for the importance of similarity as a principle of assortment in children's friendships. In terms of the present theoretical perspective, the set of similar attributes constitutes a set of resources which are relevant to particular friendships. Humphreys and Smith (1987) found that children who engaged in r & t play tended to have similar rank in the dominance hierarchy, and Pellegrini (1988) found that this was the case not only for r & t, but also for engaging in games-with-rules and other types of social interactions (e.g., talking with a peer, comfort contact). Similarly among primates, cooperation and other

types of association are much more likely among animals who are near to each other in the dominance hierarchy (Harcourt 1991).

Cairns, Cairns, Neckerman, Gest, and Gariépy (1988) found that aggressive children formed groups with other aggressive children and were often nominated as best friends by other aggressive children. Panduit, the talking robot, used by Parker and Gottman (1985) to explore children's friendship formation, was rated much more likable when it attempted to establish common ground with the child. Epstein (1989) found that similarity among friends occurs on a wide range of attitudes, behaviors, and interests, as well as personality and academic success. Moreover, the similarity of friends increases linearly with age (quite possibly because there tends to be a wider range of possible friends as one gets older), and closer friends tended to be more similar than casual friends (see also Brown 1989). Cohen (1977) found that similarity was a prerequisite for friendship, not the consequence of friendship.

Interestingly, the subjective feeling of similarity is important to the friends themselves even when the similarities themselves seem trivial: Parker and Gottman (1989) state that "it is not so much the nature of their similarities, as the presence of commonalities that interests these children. Indeed, children destined to become friends sometimes give the appearance of going to almost any length to find commonality, regardless of how frivolous (A: 'We both have chalk on our hands'; B: 'Right!')" (p. 110).

### **Evolved Systems Influencing the Resource Value of Children in the Peer Group**

The above account has emphasized perceived interests in peer interactions but has not provided an evolutionary account of the specific resources sought in peer relationships. The following attempt to develop an evolutionary account of children's perceived interests in individual differences among their peers. The section will focus on the findings of research on peer sociometric status.

There are good theoretical reasons to suppose that humans will be greatly interested in the genetic and phenotypic diversity represented by individual differences among peers. For example, individual differences in personality may be viewed as an adaptive landscape in which "perceiving, attending to, and acting upon differences in others is crucial for solving problems of

survival and reproduction" (Buss 1991: 471). At a basic level, individual genetic and phenotypic variation constitutes the playing field on which the evolutionary game is played (MacDonald, 1991). Evolutionary theory implies that organisms will be keenly interested in genetic variation and its expression in a wide array of phenotypic traits. Phenotypic variation must therefore be seen as containing cues which influence how people evaluate each other, and different evaluations will be made depending on the putative role of the other person in their lives (Lusk et al 1993). An evolutionary perspective suggests that children will be highly sensitive to the resource environment represented by individual diversity and mechanisms will evolve in order to take advantage of this diversity (MacDonald 1991).

As conceptualized by Coie, Dodge, and Coppotelli (1982), sociometric status is established by a child's standing on two fairly independent dimensions of liking and disliking. Within this conceptualization, the characteristics of popular children can be viewed as assets from the perspective of the social group, while the characteristics of rejected children constitute a set of liabilities. The assets are thus a set of resources for the child who possesses them as well as for the other children who value them. Similarly, the liabilities are attributes which not only fail to conform to the interests of other children, but are characteristics which children actively dislike. Individual differences in children can be viewed as a resource environment from the standpoint of other children, with popular children possessing a high net positive value of assets.

Regarding the characteristics of popular children, Coie, Dodge, and Kupersmidt (1990) find that positive social status at all ages of childhood is related to helpfulness, rule conformity, friendliness, and prosocial interaction. Popular children become leaders and set norms for the group, and, especially as children get older, popular children tend to have high academic and athletic achievement. Popular children are also physically attractive (see Coie, Dodge, & Coppotelli 1982). Rejected social status, especially among boys, is related to aggression, hyperactivity, being off task in the classroom (inattention), and disruptiveness. In addition, Asher (1990) notes specific subgroups of rejected children, including mildly retarded and learning disabled children. Finally, Coie et al (1990) describe evidence that neglected social status is associated with very low aggression as well as shyness and active social withdrawal.

These lists of attributes may be viewed as an empirically derived set of resources relevant to peer status. Several of the attributes of popular children can easily be seen as suggesting reciprocity and commonality of interest with peers. Thus helpfulness, friendliness, and prosocial interaction are clearly attributes which suggest that popular children's peer relations are characterized not by attempts at exploitation but rather by reciprocity of positive social interactions. There is even the suggestion that the social status of popular children is achieved in part by maintaining a net resource outflow: other children become indebted to them as a result of acts of friendliness, support and helpfulness. Popular children are also characterized by highly heritable attributes such as athletic ability and physical attractiveness which appear to be valued in all cultures, suggesting natural selection for high valuation of these traits (Weisfeld & Billings 1988). Within an evolutionary framework, athletic ability in males may be viewed as linked to success in warfare and hunting (Weisfeld & Billings 1988), while physical attractiveness has been linked to physical symmetry which is itself linked to resistance to parasites (Gangestad et al, 1994). Intelligence and academic success are also resources which are related to achieving status within our own society and they are highly valued resources in mate choice around the world (Buss 1994). For rejected children it is easy to see that their behavior has a negative resource valuation by peers. Offensive aggression is an attempt to exploit others, while disruptiveness and inattention also conflict with other children's interests.

An evolutionary perspective proposes that at least some of the assets and liabilities important for sociometric status involve individual differences in evolved systems. While extreme levels of behavioral approach are linked to peer rejection (including many children diagnosed as ADHD [MacDonald 1988 1992]), it is likely that moderate levels are actually a positive asset. Sociability and extraversion are genetically and phenotypically linked to the other behavioral approach systems emphasized here (Fulker 1981), and presumably are linked with peer leadership and being at ease socially—traits linked to popularity. Controversial children would appear to be even higher on these externalizing traits: Coie, Dodge, and Kupersmidt (1990) state that

Controversial children are the most socially active of all children. They are often engaged in active interaction with peers and are rarely observed in solitary

activity. They talk frequently with peers and adults and make the peer group laugh with their humor. They are among the most aggressive of all children, and because of their disruptive activities, they are most often reprimanded by adult supervisors. They appear to be easily aroused to anger and yet are also seen as much more facilitative in groups than rejected children and are group leaders (p. 52).

In terms of the present discussion, controversial children appear to be highly extraverted to the point where their behavior, while attractive to some, is aversive to others. This fits well with the findings of Cairns et al (1988) that aggressive children form social networks of friends but are also disliked by many children. Controversial children would thus appear to be intermediate on this dimension to popular children and the rejected/hyperactive children.

Another personality dimension proposed as a resource for peer relations derives from the human affectional system described above. Children (especially girls) who are high on the human affectional system are expected to find intimate, affectionate relationships to be highly rewarding and eagerly seeks out relationships, including peer relationships, in which this stimulation is available. Because the other person in such a relationship also finds this stimulation rewarding, the relationship is characterized by reciprocal positive affective exchanges. (See also LaFrenière's [1995] discussion of attachment and reciprocity.) Friends are "intimate associates" and their relationship is characterized by reciprocity, commitment, cooperation and engaging in reciprocated prosocial support, intimacy and affection (Hartup 1989).

In conformity with these expectations, I have already noted a sex-differentiated pattern in which girls are more strongly attracted to relationships, including peer relationships, characterized by warmth and intimacy. Moreover, Sroufe (1991; see also Sroufe and Fleeson 1986) has found that securely attached children are more likely to have close friendships during early adolescence. Park and Waters (1989) found that pairs of securely attached children were more harmonious, less controlling, more responsive, and happier than secure-insecure pairs.

In addition to being a *sine qua non* of close friendship, warmth is undoubtedly an important positive asset in measures of liking in sociometric assessment. As described by Coie et

al (1990) popular children are friendly, helpful, supportive of peers, and engage in prosocial behavior. Empathy, nurturance and prosocial behavior also appear to be traits linked to the human affectional system (see Digman 1990; John 1990; MacDonald 1988).

Finally, children whose personalities are dominated by behavioral inhibition are clearly withdrawn and shy (Kagan et al 1989)—exactly the characteristics of neglected children (Coie, Dodge, & Kupersmidt 1989; Dodge, Murphy, & Buchsbaum 1984. In terms of the present perspective, moderate levels of these traits are not resources for other children, either negatively or positively, but being behaviorally inhibited results in a lack of engagement with the wider peer group. Thus whatever other resources such children may have are not available for other children, and the result is social neglect.

However, extremely withdrawn children can become rejected by the peer group (Rubin, LeMare, & Lollis 1990; see also Asher, Parkhurst, Hymel, & Williams 1990). Asher et al (1990) review data indicating that some extremely withdrawn children become victimized by the peer group, and that there is a sub-group of rejected children who are described as very shy and as likely to play alone. These data indicate that the characteristics of extremely socially withdrawn children are viewed not as neutral but as liabilities. Such victimized children are at the low end of the social status hierarchy and are thus viewed negatively by peers as children with whom they do not want to engage in positive relationships.

### Morality and Altruism

An evolutionary approach also has implications for thinking about morality and altruism. As indicated above, an important strand of evolutionary thinking emphasizes what one might term the individualistic/self-interested implications of evolutionary theory. Such a perspective is based on a fairly clear evolutionary logic, and much of the data in the area of morality and altruism can be interpreted in a manner that conforms to this logic.

Thus Charlesworth (1995; see also Charlesworth & Dzur 1987) has shown that self-interest emerges as an important factor in a paradigm involving cooperation and competition for a limited resource. Studies conducted within the social learning paradigm have also shown a large main effect for self-interest. Self-interest is typically apparent in the baseline condition and

is still apparent after the treatment (see MacDonald 1988: 242ff). Increases in helping or donating behavior are often rather small even when they involve resources of little value and even in a laboratory situation where there is often a strong "pull" for donating behavior. There is also a tendency for treatment effects to disappear over time.

Further, the tendency to help other children is a function of the degree of expected reciprocity. For example, Kanfer et al (1981) found that 3-6-year-old children would not continue a dull sorting task if the recipient of the reward for doing so was anonymous. Higher levels of work occurred if the recipient as a classmate, and even higher levels if the recipient was a friend.

The area of moral reasoning and its relation to behavior is also highly compatible with an evolutionary perspective (see MacDonald 1988, p. 246ff). Although children do indeed reason in a more abstract manner as they get older (and are therefore more effective than young children in rationalizing their behavior to themselves and others), there is little, if any, connection between moral reasoning and moral behavior. Moreover, reasoning about moral issues changes depending on the possible costs and benefits to the reasoner. As Haan (1978; 1985) found, interpersonal reasoning focused on gaining resources through face to face encounters occurs in situations where there are high levels of costs and benefits resulting from this reasoning. On the other hand, formal Kohlbergian reasoning is more likely to occur "in pleasant situations where verbalizations could be cheaply produced" (Haan 1978, p. 297).

Studies such as that of Gilligan (1982) also show the importance of self-deception in rationalizing real-world moral dilemmas involving abortion. Evolutionists have shown considerable interest in deception and self-deception as mechanisms for furthering evolutionary goals (Trivers 1985; 1991). As Trivers (1985; 1991) emphasizes, the best deceivers are self-deceivers, and many of Gilligan's subjects rationalize abortions in situations where the father would not provide financial or emotional support for the child. However, rationalizations, in order to be psychologically effective, must be convincing to the rationalizer and this may require self-deception.

For example, Gilligan (1982) describes a subject's reasoning about whether she should seek an abortion. The subject realistically realizes that having a baby will cut into her time and

entail a lot of responsibility and she rejects her previous idea that having a baby would make her feel happy as "selfish." By counterfactually suggesting that having the baby would make her happy and then engaging in self-deception by providing a negative label such as "selfish" to this false idea, she is free to choose what in fact is a self-interested course of action and consider her course of action as moral or even altruistic. Other studies reviewed in MacDonald (1988) indicate that people sometimes use advanced moral reasoning in a cynical (i.e., not involving self-deception) manner to deceive others and that people sometimes act in a selfish manner against their own moral reasoning.

Alexander (1979; 1987) has shown that the self-interested patterns of moral behavior can be observed cross-culturally as well. This does not, of course imply that children do not co-operate with each other or that human relationships are necessarily exploitative. We have seen that reciprocity is an important aspect of children's peer relationships and that close friends are very cooperative and share valued resources. Even dominance relationships do not imply exploitation, and are actively sought by children.

Moreover, human cultures are able to provide intensive socialization pressures which are at least somewhat successful at tipping the balance more in favor of altruism (see MacDonald 1988: 296ff; 1994). These intensive socialization pressures are typically aimed at inculcating a very high level of within-group cohesion and altruism and are combined with hostility and exploitation of outgroups, as in the case of ancient Sparta and Nazi Germany.

Within the mainstream developmental literature, these findings are highly compatible with the classic findings of Sherif et al (1961) that within-group cohesion and positive social interactions are maximized in the context of hostility toward outgroups. Human moral behavior is highly compartmentalized and there is every reason to suppose that this is a feature of evolutionary design. Research on social identity processes has shown that the tendency to discriminate in favor of ingroups and against outgroups occurs even in so-called "minimal groups", i.e., groups that are arbitrarily constituted and do not interact with each other (Hogg & Abrams 1987). These findings can be generalized across subjects of different ages, nationalities, social classes, and a wide range of dependent variables (Bourhis 1994), and anthropological evidence indicates the universality of the tendency to view one's own group as superior (Vine

1987). Moreover, social identity processes occur very early in life, prior to explicit knowledge about the outgroup. An evolutionary interpretation of these findings is also supported by results indicating that social identity processes occur among advanced animal species such as chimpanzees (Van der Dennen 1991). Finally, the fact that social identity processes increase during times of resource competition and threat to the group (see Hogg & Abrams 1987) is highly compatible with supposing that these processes involve facultative mechanisms triggered by between-group conflict. As emphasized by evolutionists such as Alexander (1979), external threat tends to reduce internal divisions and maximize perceptions of common interest among group members. Such changes presumably reflect a species-wide facultative strategy of accepting higher levels of external authority and becoming more group-oriented under conditions of external threat.

#### Reproductive Strategies: The Coherence of Development

It was argued above that intelligence may be viewed as a domain-general information processing device that evolved in order to more effectively attain evolutionary goals. However, the main message for developmentalists deriving from IQ research is the very substantial coherence of individual development on a very wide range of variables revealed by this research (e.g., Herrnstein & Murray 1994; Rushton 1988; 1995). Besides variables directly related to mental testing, such as school performance, these results indicate associations among IQ, poverty and welfare dependency, proneness to illegitimacy, child abuse, low birth weight, sexual behavior, divorce (unstable pair bonding), psychiatric diagnosis, rates of physical maturation, parent-child relationships, criminality, and even the likelihood of being classified as disabled. For all of these results, IQ is a better predictor of variables related to social functioning than is parental socioeconomic status. Moreover, the results indicate non-linear trends at the lower end of the IQ distribution with a very strong upsurge in problem frequency in these populations. Similarly, although IQ is not considered in their analysis, Belsky et al (1991) review data which support the general coherence of individual development, including especially the large intercorrelations among spousal harmony, parent-child relationship quality, children's interpersonal style, timing of puberty, sexual behavior, and level of parental investment.

Traditional developmental research as well as evolutionary perspectives tend to compartmentalize humans into various domain-specific systems that (from an evolutionary perspective) evolved to solve particular adaptive problems. However, this research shows that there is also a very important central core of co-varying systems (many of them presumably domain-specific; see below) centered around at least one highly domain-general ability—the *g* factor of IQ tests. While the associations among the various systems are not robust enough to preclude an important role for discrete evolved systems such as the personality systems discussed above, the substantial coherence of individual development strongly suggests the importance of life-history theory in conceptualizing human development. Life history approaches to human development focus fundamentally on variation in reproductive strategies (e.g., Belsky et al 1991; Chisholm 1993, 1995; MacDonald 1994; Miller 1994a; Rushton 1988 1995), and within such perspectives parental investment is the critical variable.

Life history theory is highly compatible with the coherence of development because a reproductive strategy involves a coordinated organismic response to a central external ecological contingency that selects for optimum levels of partitioning mating effort and parenting effort, with the result that variables such as mortality rates, longevity, pair bonding, age of first reproduction, period of pre-adult dependency, and levels of paternal and maternal investment evolve as a coordinated response to environmental pressures. The fundamental dimension of reproductive strategies may be construed as a dimension that ranges from a high-parental-investment/low-mating-effort strategy to a low-parental-investment/high-mating-effort strategy (e.g., Wilson 1975).

Within this perspective, a critical aspect of high levels of parental investment is the provision of optimal environments for children. If we accept the proposition that there was natural selection for high-investment parenting among humans (e.g., Fisher 1992; Flinn & Low 1986; Lancaster & Lancaster 1987; Lovejoy 1981 MacDonald 1988), then it is reasonable to suppose that one result of this process is that high-investment parents provide certain types of high-quality environments for their children and that these environments contribute to the child's development. Parental investment clearly involves the provision of certain environments, and parents incur a considerable cost in providing these environments: Parental investment includes

developing a strong affective relationship with the child, providing relatively high levels of verbal stimulation and parent-child play, and active parental involvement in monitoring virtually every aspect of the child's life (e.g., children's progress in school, children's peer relationships) (Belsky et al 1991; MacDonald 1988, 1992, 1993).

From a theoretical perspective the best evidence that the environments provided by high-investment parents must have benefits is the very clear evidence that they are costly to provide. Theoretically it is difficult to conceive of a behavior with clear costs remaining in a population without some overcompensating benefits. For example, if children do not benefit from paternal investment, it is difficult to conceptualize why males would provide such investment or females would seek it. Under these circumstances, males would be better off competing with other males for access to additional females than to invest in the offspring of one female, and, indeed, this is a common pattern in nature, especially among mammals (e.g., Kleiman 1977, 1981).

While the foregoing argues for the importance of children's environments, it is also consistent with evidence that high-investment parenting is itself genetically influenced. There is evidence for reasonably high heritability of all of the behaviors related to parental investment. Thus measures of parents' and children's perceptions of parental control and especially parental warmth are genetically influenced, and parental stimulation and involvement (including measures of parental warmth and control) as measured by the Home Observation for Measurement of the Environment (HOME) and the Family Environment Scale (FES) also have a considerable genetic component (Plomin 1994). These measures of parental investment co-vary to a considerable degree with high IQ which is itself substantially heritable (Plomin 1994; see also below). Interestingly, research with the HOME also supports the coherence of development: There is a substantial covariation among the HOME subscales of emotional and verbal responsiveness, provision of play materials, maternal involvement, and opportunities for variety of stimulation (Bradley & Caldwell 1984). Parents who provide verbal stimulation and monitor their children more closely also tend to have close emotional relationships with them.

The behavioral genetic evidence may be interpreted as indicating that parents and their children are a co-evolving system in which passive genotype-environment correlations are of

great importance. Children would be expected to differentially benefit from the environments provided by high-investment parents depending on their genotype. Thus far the evidence does indeed indicate that in early childhood at least passive genotype-environment correlations are more important contributors to the correlations between measures of IQ and the HOME and FES measures of the environment than are active or reactive genotype-environment correlations (Plomin 1994). The evidence does not show that the environments parents provide are of no importance, but it strongly suggests that the environments that parents provide are effective largely as a result of their being an aspect of a co-evolutionary process in which children are genetically inclined to benefit from the behaviors that parents are genetically inclined to provide (MacDonald 1997).

There remains controversy surrounding the issue of whether variation in human reproductive strategies is environmentally induced or whether such variation primarily reflects additive genetic variation. The former view, associated with Belsky et al (1991) and Chisholm (1993, 1995), proposes that low-investment reproductive strategies are a response to resource-poor environments, while high-investment strategies are a response to resource-rich environments. While Belsky et al (1991) do not rule out a role for heritable genetic variation, they propose that variation in reproductive strategies results from a uniform, species-typical system that provides alternate strategies depending on environmental input. On the other hand, MacDonald (1997; in press) argues that the data are more compatible with supposing that variation in reproductive strategies results mainly from genetic variation and that there are theoretical and empirical difficulties with the alternate strategy point of view.

### Conclusion

Overall the results indicate that evolutionary theory is able to provide a powerful perspective on peer relations. Basic evolutionary theory predicts the importance of reciprocity and similarity in peer friendships. Moreover, the evolutionary theory of sex is a powerful predictor of sex differences in the evolved systems of sensation seeking/impulsivity, attraction to intimacy and behavioral inhibition which are assets or liabilities in peer interaction. No other theoretical perspective provides this type of *a priori* predictive power. Other theoretical

perspectives are consistent with the descriptive data of peer relationships and with theories on the proximal mechanisms involved. Only evolutionary theory is capable of providing an *a priori* predictive basis for the overall contours of children's social development.

Finally, the entire area of reproductive strategies represents perhaps the largest contribution of an evolutionary perspective because of its unifying effects on the field of children's social development and, indeed, its ability to incorporate other areas of child development, such as IQ data, within an overarching evolutionary paradigm. These general findings do not preclude an important independent role for a variety of evolved systems that evolved to solve discrete adaptive problems in the EEA, but they do show that developmentalists focusing only on particular systems are to a considerable extent missing the forest for the trees.

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