

WHY CHILDREN FROM THE SAME FAMILY ARE SO DIFFERENT FROM ONE ANOTHER

A Darwinian Note

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The well-established finding that siblings growing up in the same family turn out to be very different from one another has puzzled psychologists and behavior geneticists alike. In this theoretical note we describe the possible ontogeny and phylogeny of a sibling differentiation mechanism. We suggest that sibling competition for parental investment results in sibling differentiation on a number of characteristics, producing different developmental trajectories within families. Variations in developmental trajectories within families may have had fitness advantages in ancestral environments because (a) sibling competition for extrafamilial resources would be reduced and (b) these variations would be suited to environments containing a variety of niches or to changing environments. Predictions derived from this model and an example of an application to attachment theory are presented.

KEY WORDS: Behavior genetics; Development; Evolution; Family; Individual differences; Nonshared environment; Parental investment; Siblings.

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Behavior geneticists have brought a reliable yet unexpected finding to the attention of the scientific community: Biological siblings raised in the same family are likely to be as different from one another as any two children taken at random, even though these siblings are more similar to each other genetically and are reared together. This finding applies to a large array of characteristics in the domains of personality, physiology, psychopathology, and cognitive abilities (for reviews see Hetherington et al. 1994; Plomin and Daniels 1987; Rowe 1994).

The source of sibling differences has been termed "nonshared environment." Nonshared environment includes any post-zygote influences that are not shared by siblings (within-family variance). Nonshared environment explains up to 35% of the phenotypic variance in personality and cognitive abilities. By way of comparison, genetic variance accounts for 40 to 50% and shared environment (between-family variance) accounts for 5% of the phenotypic variance (Locurto and Freeman 1994). The remainder of the variance is attributable to measurement error. Growing up in the same family appears to make biological siblings different rather than similar.

Such a puzzling phenomenon invites two types of questions. The first concerns the ontogenic process that creates within-family differences. This issue has received most of the attention of researchers (e.g., Dunn and Plomin 1991; Locurto and Freeman 1994; Plomin and Daniels 1987; Scarr and Grajek 1982; Schachter 1982; Smith 1993), and there seems to be general agreement that the causes of within-family variation are to be found outside the family (e.g., Harris 1995; Lynn et al. 1989; but see Dunn and Plomin 1991; Sulloway 1995). For example, Rowe (1994:7) recently asserted: "I share with other behavior geneticists (Scarr 1992) the position that parents in most working- to professional-class families may have little influence on what traits their children will eventually develop as adults."

The second question concerns the possibility that an evolutionary adaption underlies this variation. Perhaps surprisingly, this possibility has not received much attention from behavior geneticists. In response to Buss's (1987) suggestion to use the principles of evolutionary biology to understand the findings of behavior geneticists, the purpose of this theoretical note is to suggest possible answers to these two questions from a Darwinian perspective and to stimulate discussion.

ONTOGENY

According to a Darwinian view, individuals compete for limited resources associated with growth, survival, and reproduction. The man-

ner in which the competition takes place and the resources that are sought are determined by the particular evolutionary history of a given species. Individuals compete with members of other species, with conspecifics, and with kin.

Within multi-child families, siblings compete for the same resource, parental investment. Trivers (1972:139) defines parental investment as "any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring." Parental investment is by definition limited, and siblings attempt to maximize their share (Trivers 1974). Parents do not indiscriminately invest in their children (as commented in the same context by Buss 1987; see also Daly and Wilson 1980), and to the extent that investment is discriminate, sibling competition is expected.

Differential parental solicitude is likely associated with initial differences among siblings on characteristics related to survival and reproduction. These initial differences can be explained by genetic differences, age, order of birth, or sex of offspring. Initial differences on a given characteristic, such as verbal or athletic ability, may give one child an advantage over the other, and the less skilled child may have to display a different or additional type of ability or propensity to receive an equivalent share of parental attention.¹ In this process siblings are steered towards different developmental trajectories.

As would be expected from this family dynamic, studies report that differences in sibling characteristics are related to variation in parental behavior and that siblings do not perceive their familial environment in the same way. More important, measures of psychological adjustment correlate with measures of parental treatment *within* the family (Daniels and Plomin 1985; Daniels et al. 1985; Dunn et al. 1990; Lytton 1980; Plomin et al. 1988). Although more research is needed, research on siblings supports the view that sibling differentiation may occur within the family as an outcome of initial differences among siblings and discriminative parental solicitude.²

PHYLOGENY

Sibling differentiation may have had Darwinian consequences in ancestral environments. We suggest that sibling differentiation may steer siblings toward different developmental trajectories, and to the extent that these different trajectories produced average fitness gains superior to the average gain of multiple copies of a single trajectory in ancestral environments, the process underlying differentiation may have been

selected for and refined. Thus, sibling differentiation, begun as a by-product of ontogenic competition for parental investment, may have been maintained and furthered by its long-term fitness effects.

Selection may have favored processes producing developmental specialization contingent upon one's characteristics and the characteristics of one's siblings in ancestral environments for two reasons. First, specialization would have reduced competition for extrafamilial resources among siblings, leading to a sort of "passive" cooperation. Second, developmental specialization would have been advantageous in the context of stable environments that contained a number of niches or in the context of rapidly changing environments. It is thus possible to imagine a gene or a set of genes coding for a within-family process that would support the development of meaningful variations among offspring on personality and other characteristics associated with different, specialized developmental trajectories. In terms of its ultimate function this process is similar in one respect to sexual reproduction in that it is "used in the face of an uncertain future" (Daly and Wilson 1983:65), but it allows the maintenance of individual genotypic structures. One example of variation in developmental trajectories is the allocation of male energy to status competition or to early mating attempts (e.g., Belsky et al. 1991).

Thus, competition for limited resources within the family may exaggerate sibling differences on a number of characteristics. These differences may lead to different developmental trajectories having an impact on extrafamilial status/resource competition and acquisition. To the extent that variation in developmental trajectories resulted in a greater number of reproducing offspring in ancestral environments, the process underlying variation would have been favored by natural selection.

PREDICTIONS

This model of sibling differentiation leads to a very specific and counter-intuitive prediction: Siblings should grow *more dissimilar* the more time they spend together in the same family. Contemporary socialization theories would predict exactly the opposite (see Maccoby and Martin 1983). Naturally occurring experiments where twins are separated during the first few years of life offer a test of this prediction. Johnson (1963), Pedersen et al. (1985), and Vandenberg and Johnson (1968) report that the length of time twins were reared in the same family was *negatively* related to similarity in cognitive abilities (but see Bouchard 1983, who found no relation). Pedersen et al. (1992:261-262) found for some personality measures, such as extraversion, agreeableness, and open-

ness to experience, that "twins separated earlier, with the greatest separation or for the longest time were more similar than those pairs separated later, with the least separation or separated for the shortest time." This line of research suggests that the people who should be most different from each other are unrelated individuals reared together.

Another prediction is that the characteristics most likely to be susceptible to influence by an evolved within-family differentiation process should be those more closely associated with *particular* developmental trajectories than those more *generally* associated with reproductive and survival success. For example, within a given sample, personality characteristics such as impulsivity and extroversion may show more within-family variability than a general factor of intelligence or characteristics such as height and weight (for support of this hypothesis see Lynn et al. 1989; McCartney et al. 1990; Pedersen et al. 1984).

One consideration in predicting sibling differences is that the process generating sibling differentiation should be sensitive not only to initial sibling characteristics but to extrafamilial contexts as well. For example, developmental trajectories supporting cooperative behavior should still be more likely to be observed in environments in which cooperative endeavors are rewarded. Incidentally, antisocial tendencies show more shared-environment effects than many other traits or characteristics in behavior genetics studies (Lykken 1995).

Finally, the differentiation process should affect boys more strongly than girls because males in general compete with each other more than females for access to mates (Clutton-Brock and Vincent 1991), often through competition for within-group status. Within-sex competition often leads to the selection of alternative strategies (Trivers 1985), and sons should thus be more strongly subject to the differentiation process. Schachter (1982) reports greater same-sex than opposite-sex "deidentification" but did not distinguish by sex; Rowe et al. (1992) report larger effects of nonshared environment (birth order) on delinquency for brothers than for sisters or opposite-sex siblings. Braungart-Rieker et al. (1995) report greater shared-environment effects on behavior problems for girls than for boys. More research is needed to test sex differences in sibling differentiation directly.

APPLICATION TO ATTACHMENT THEORY

One potential application of a Darwinian perspective on sibling differences is to attachment theory. As noted by Baumeister and Leary (1995:499), competition for limited resources, such as parental investment, provides "a powerful stimulus to forming interpersonal connec-

tions." A number of studies on attachment have found that early attachment patterns, such as secure, anxious-avoidant, ambivalent, and disorganized, influence later development, particularly with regard to vulnerability or resistance to psychopathology (for a review see Goldsmith and Alansky 1987). In general, securely attached children have advantages later in life (i.e., are more competent, sociable, flexible, resilient) than children with other kinds of attachment (Radke-Yarrow et al. 1995). The recognized attachment patterns and the observed developmental stability are likely cross-cultural (Wartner et al. 1994). A Darwinian perspective invites exploration of how variations in attachment histories relate to adult adaptations to varied putative ecological/social niches.

Radke-Yarrow et al. (1995) found that developmental outcomes are affected by attachment history in interaction with environmental context. Under some environmental conditions, secure attachment is less protective than insecure attachment. For example, insecure attachment to a mother with bipolar depression is associated with an absence of problematic anxiety six years later, whereas secure attachment is associated with clinical depression. It is thus possible that under particular environmental conditions, such as low maternal support, siblings with different attachment histories compete less for limited resources. In the same vein, Chisholm (1996) argues that variations in attachment patterns may be alternative responses part of a facultative strategy and related to differences in life histories.

It is thus possible that the nature of parent-offspring attachment is one of the developmental triggers that traject offspring toward different niches. Very little is known about sibling differences in attachment history, and this Darwinian model may offer a theoretical framework for its investigation.

CONCLUSION

Even though shared environmental influence has been found to have little impact on child development, the source of sibling differentiation may be a result of an intrafamilial process. At the same time, the nature and the extent of sibling differentiation should be influenced by the context of the family and the broader social environment.

Little is known about sibling differentiation in other species. Also, little is known about variations in development in humans from a functional perspective; sibling differentiation in humans has been mainly studied in the psychopathological tradition. We hope this Darwinian

approach will stimulate research and theorizing on a possible intra-familial process underlying sibling differentiation and on the possible adaptive functions of within-family variation.

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NOTES

1. Parental investment can take many forms, such as time and energy devoted to care, allocation of physical resources, etc. Differential parental investment can also take subtle forms: Spangler et al. (1994) show that mother sensitivity to infant behavior can alter adrenocortical functions. This suggests that the process underlying sibling differentiation can involve not only behavior modification through contingent reward and punishment, but physiological modification through parental responsiveness.

2. One reviewer pointed out the interesting possibility that the process underlying sibling differentiation may also involve prenatal influences. Negative parity effects, for example, show that male neurodevelopment is affected by the number of previous male offspring born by the same mother. As noted by Gualtieri and Hicks (1985:431), "successive pregnancies are not independent events . . . there exists a kind of 'memory' in the phenomenon of reproduction. The fate of one pregnancy influences, even predicts, the outcome of the next." Differential maternal solicitude could thus begin in utero. Prenatal, perinatal, and neonatal effects that are specific to each offspring would also be included as nonshared environmental variance in behavior genetics studies (Rowe 1994).

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