wire inferrischere with any other generalist happens to be heckere. expens in office purest, our chance of exactly matching in offsetter genetype is halved. The differences are genetic, has not represented so such in the additive model, making them part of "that which is to 1", and three are at boast not high shared. The stiller of refining the fractionation of "covinsuscental" variance is therefore limited by the content to which it might well. and he convincemental at all. Circus the same parental genetopes and the same potential distribution of the observate thereof. the a gener probability of my altitug having a given generous will be the same so that he mostlest of the same sex, regardless of the transmission mechastem. For all lot the simplest modes of francoissum, that Show your of how have a referen York surly in our generics course for medical students we affectigit to faces their affection on the mechanisms by which genetic diversity among humans is generated and distributed. and to convey in our hectures none approvation of to automial range. he some variation of the following: Harrier generalization is where one from each of 25 parts of chromic some triangle queries. Are given shall represente one of \mathbb{R}^{N} above \mathfrak{M} 't fillion' proofite choices of a termal art of decomposition than those of the quereit, accoming out televanescene comes to the shift countly as 8 proved from a prosolipsered to one of the purests. Then useds the But. Individual genes motion and numbers of showmoome pairs recharge parts with each other before being noted and house generics. The recombination econoges is succeed one suchnois are Occurrence arm. He begge arms having more Reconfination of gener between obviousness homologues in crosses potential generic curation. Each point on the "average themsessons, it which recombination really labs also shoulder the have of the exponentiation. Greek even one good on such obsesses some and free jet obsessment at after reconfination might secure. She morehor of modulide structures for each chromosome the crosses: from two the eights, and potential geometries from \mathbb{R}^{N} to \mathbb{R}^{N} That is more than the total of bosons gametre over betilling, and will a strate sudgressionate. The children of mediated parents have more differences from which to shows If severe at best se reasonable to consider the observed sugge of alliling differences anomalously narrow as to helicus it saidly broad. Perhaps many of the possible combinations are also notionally equivalent. The extent of emphal presund mor-

Absence or underestimation of shared environment?

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failfy, plus portraité bélials, indicates flat perhaps se many se

half are forbidden. The potential variety, even between all-

logs, remains astronomical. I am not satisfied that current

linear genetic models account for anywhere near all of it.

How different children from the same family can be is well illustrated by the famous Mitford family. The six sisters from this upper-class English family were brought up in the twenties and thirties under very similar conditions: Not allowed to go to school or to have friends outside the family, they were all educated at home. Two sisters became convinced fascists. Unity lived in Germany as a member of Hitler's inner circle until the war broke out and Diana married the head of the British Union of Fascists. Of the other sisters, two did not seem to have any interest in politics, Nancy flirted a little with socialism, and Jessica became a devoted member of the American Communist Party. In her own account of these events Jessica Mitford (1977, p. 24) asks: "What propelled us in these different directions?" Her answer is "the Zeitgeist of the thirties." And in "Unity

Mitford: A Quest," David Pryce-Jones (1976, p. 4) writes: "Out of this childhood . . . the one evolved as a fascist and the other as a communist: one experience, but two outcomes."

Plomin & Daniels's (P&D's) target article is an important contribution towards understanding such differences among children of the same family. They have performed a useful service in demonstrating that behavior-genetic methods can be used, not only to estimate genetic variance, but also to partition environmental variance into a part shared by family members and a part unique to each individual. Their discussion of research on psychological characteristics can be supplemented with other examples: The importance of nonshared environmental factors is also evident in physiological measures such as lipid and lipoprotein levels (e.g., Namboodiri, Kaplan, Heuch, Elston, Green, Rao, Laskarzewski, Glueck, & Rifkind 1985) and blood pressure (e.g., Iselius, Morton & Rao 1983).

When various measures seem to show such a consistent picture of large unique influences and absence of shared family environment then either the phenomenon is real or there is a chance that our methods somehow underestimate the importance of shared environmental factors. One crucial assumption in behavior-genetics research is that all participating groups represent a random sample of all genotypes and environments present in the population. If nonparticipation is spread along the entire range of family environments, no problem arises. If certain groups are less likely to participate, however, then the effects of shared environment will be underestimated. In general, because children are adopted by parents of above average IQ and socioeconomic status, there is a fair chance that adoption studies are biased against detecting the influence of shared family environment. Alternatively, the absence of shared environmental effects in the American population may be caused by the large degree of uniformity of the environment produced by the schools and other public agencies (Woodworth 1941, in Scarr & Carter-Saltzman 1983, p. 219-20). In his discussion of a French adoption study by Schiff, Duyme, Dumaret, Stewart, Tomkiewicz, and Feingold (1978), Willerman (1979) also suggested that the standard deviation of environments sampled in American adoption studies may be too narrow to provide a test of social class environmental effects. Schiff et al. compared adopted children reared in high socioeconomic environments with their own full or half siblings who were brought up by their true mother in a lower social class. Adopted children had higher IQ (110.6 versus 94.7) and less failure in school (13% versus 55%). This contrast is close to that in the general population between children of upper-middle-class parents and unskilled workers. Schiff et al. emphasized that the adopted children and their own siblings are biologically equivalent so that the contrast between them is mainly of environmental origin.

Even if nonshared environmental factors are important in explaining sibling differences, nonshared environment is not the only part of the answer to the question posed in the title of P&D's article. Only for differences between identical twins are nonshared environmental factors the sole explanation. Jinks and Fulker (1970) showed how genetic variance may also be partitioned into genetic effects between and within families. If the behavior we study is influenced by genetic factors then the other part of the answer is genetic factors that are not shared by family members.

Finally, P&D's question of whether most nonshared variance is systematic or specific may be answered by multivariate behavior-genetics methods such as those developed by Martin and Eaves (1977) and Fulker (1979). Martin and Eaves found, in their analysis of monozygotic (MZ) and dizygotic (DZ) twins on five of Thurstone's Primary Mental Abilities, that most nonshared environmental variance was specific. That is, the environmental factors not shared by family members were also specific to different mental abilities. In contrast, the influence of shared environmental (and genetic) factors was more systematic in that they had a general influence on all abilities. Fulker (1979)

Commentary/Plomin & Daniels: Nonshared environment

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Evolutionary Sugarflavies can be tested with behavioral genetic

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Corners and environmental factors in the

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It is well established that the expression of all phenotypic

characters, quantitative se well so Wessleban, depends to vary-

ing degrees on both genetic and environmental influences. In

the hardest years our information about the nature and bustions

ing of individual genes has become much more concerts. Ex-

vironmental influences can be controlled in certain types of

experiments, such as studies of the growth of microarganisms

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in animals such as the fly Drosophile. In some more general

characters, however, the environmental and genetic factors involved in the expression of particular phenotypes are if

defined and difficult to analyze. Those characters include It-

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Nominic's Evolution of human acousting, \$655, 3(2), 1860.

provides a multivariate analysis of specific cognitive skills. According to his analysis of Loehlin and Nicols's large twin study of the National Merit Scholarship Qualifying Test, social environment appears to be very important in cognitive development. His analysis also suggests that shared family environmental effects are of a similar nature, whatever cognitive skills are involved, and that nonshared family influences exert little general effect. In the same article Fulker also carried out a multivariate genetic analysis of Taubman's twin data on schooling, occupation, and earnings. In this example, the general nature of shared family environment was even clearer. Moreover, this example showed that genetic and shared environmental factors that influence schooling subsequently influence adult occupational status and income. Nonshared environmental factors had little later influence. However, large independent genetic and nonshared environmental effects played the major role in explaining later differences in occupation and income.

Evalutionary hygortheses and behavioral

genetic methods: Piopes for a union of two disparate disciplines. David W. Buss Espainment of Psychology, University of Wolfspan, Ann. Advo. Molt. 66108. Phasin & Dusich (F&D) present one of the most starting and impartual findings to emerge from behavioral growth research in the past decade - the prevageoness of sondared revironmental influences on prosmality, psychopathology, and copintion. The finding is sturting because words all current floories. of syvinomental influency confluence, implicitly or cyclicitly. syvinamental lieture diared by children within the same limit It, such as autocommunic status or common parcetal childecuring attitudes, and those factors appear now to be of little causal august. The finding is important becomes it remains me of the few class we currently have about how environments. influence dispositions. Because of the receiver. Atthe theoretical guidance and reacte to facilities the coupling worth for extremate sources of nonthatrof switnessentid adherers. Record work in synhitesory. landage. Insureous granite-directly temperally legariles are that our he tested with helps and genetic methods. This commenture will address a few of these. The comments are meanf to suggest the possibility of a fruitful amon between two holografts ariented disciplines that have developed in apparent indution from one matter defendent greaters, which has developed powerful methods that can be applied to nearly are showing and are therefore largely constent: and theory free, and irodistrousry, Statings, which has generous affectife source of hypothesis had, at load with humans. Inc. not developed powerful methods to test Show hypotheres The following hat provides some evolutionarily based hypothsuperalisati avitomatis unarcocoff unadarcel onvironmental seffic succes that could be tested with behavioral genetic methods Hypothesis It: Parcette will expend more offers and confer greater transcerous on those children that are best able to trave-Mrs parental incordinant into signalization. Bowl on Trivors's HHT2 theory of differential parental investment, strategies that summs distribution of parential accomment to offiguring that can hed convert and licentism into gene copies will be arbeited ner also Minauder 1979. [See also Uning. Nortal Verses. Regnalactive Success (RES W1) (1996.) Republicia 2: Receive splitted reproductive strategies typtally lifts for human males and Femiles, parents will would or their milt and femile offspring differently. Specifically, miles will be usualized to be more appropries. harty, and manter to

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