
Commentary on Plomin, R. (1994). A proof and a disproof questioned

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The paper, *Nature, Nurture, and Social Development*, contains many assertions that are not, in fact, substantiated by the data in the citations. I will discuss just two, the assertion that research on the equal environments assumption proves it is a reasonable one, and the assertion that the research cited disproves the Hoffman hypothesis.

Equal environments

The assumption that monozygotic and dizygotic twins have equally similar environments and it is only their genetic relatedness that is different is basic for the method used to compute heritability, shared environment, and nonshared environment from comparisons of the two kinds of twins. If some of the difference between the correlations obtained for monozygotic and dizygotic twins is due to differences in their environment, then heritability is being over-estimated and non-shared and shared environment are each being underestimated.

But the environment of monozygotic twins cannot be only as similar as the environment of dizygotic twins if environment and genes interact as most of us believe they do. That is, if it is true, as Plomin and other behavioral geneticists ostensibly agree, that one's environment is affected by one's genetics, then how can two siblings who share all of their genes not have a more similar environment than two siblings who share half their genes? A pair of monozygotic twins will evoke more common reactions in others than will a pair of dizygotic twins, and they will interpret and selectively attend to the environment in a more similar fashion. As personality develops from a series of interactions between the individual and the environment, the more similar genetics and the consequently more similar environment interact so that the similarity of the monozygotic twins increases both through genetics and the more common environment in an accelerating fashion. In short, the assumption that genetics affects environment is logically incompatible with the assumption of equally similar environments.

In the citation for the research to support the assumption of equally similar environments, Plomin *et al.* (1990), four types of evidence are described. Each has been presented before and each has been previously criticized (e.g., Hoffman, 1985; 1991). The four are as follows.

- (1) If a parent or a child does not know the twins' zygosity, is the effect of

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actual zygosity eliminated? The answer is no, but monozygotic twins whom someone (a parent or one of the twins) has mislabeled are less similar on cognitive and personality test scores than properly labeled monozygotics. Most likely the mislabeling reflects lesser physical similarity and the lesser physical similarity leads to a less similar environment since other people respond to them differently than were they identical in appearance. Thus, these data would seem to support the idea that identical twins elicit a more common environment than do fraternal twins who are much less likely to look alike and may not resemble each other at all. The fact that actual zygosity still has an effect seems irrelevant to the assumption of equally similar environments. The sharing of identical genes, as noted above, is likely to lead to more similar environments and more similar interpretations of environmental experiences both directly and indirectly through previous experience and thus the greater similarity carried by zygosity *per se* can reflect genetics, environment, or the inextricable interaction between the two.

(2) Do monozygotic twins experience more similar environments than dizygotics? The answer from the research reported in Plomin *et al.* (1990) is yes but they point out that this greater environmental similarity may be driven by the greater similarity in the children's behavior. This interpretation of the research, however, does not deny that the environment is more similar.

(3) Do the environmental differences affect the child's behavior? The research that examines this used only identical twins. For selected variables (e.g., were they dressed alike) pairs of monozygotic twins who were treated alike were contrasted with pairs who were not and the differences in the twin correlations of cognitive and personality tests were not significant. This evidence is limited by two problems: (a) the differences in treatment are not the ones one would expect to make a difference on the traits examined; (b) the failure to find differences in a sample of identical twins does not indicate that there would be no difference in a sample of dizygotic twins. The assumption in question has to do with whether or not the environments of monozygotic twins are equally similar to the environments of dizygotic twins and thus the question is do *these* environmental differences have an effect. If Dan looks like his father, is short, and has a severe case of acne and his fraternal twin Don looks like his mother, is tall, and has clear skin are there environmental effects that do make a difference in behavior? This research does not address the crucial issue. The fact that the differences in the environment of Dan and Don may be driven by their genetic differences does not alter the fact that the environment is different and provides an additional dynamic.

(4) Are identical twins who look more alike more similar on I.Q. scores and personality test scores than identical twins who look less alike? The answer reported by Plomin *et al.* (1990), relying on a study by Matheny, Wilson, & Dolan (1976), is no. However, the difference in appearance between pairs of identical twins is not comparable to the difference in appearance between pairs of fraternal twins. A sample of the latter would show no greater similarity in appearance than a sample of nontwin siblings.

Thus, the research on the equal environments assumption reported in Plomin *et al.* does not prove it is a reasonable assumption. Yet this assumption is basic to the statistical operation used in twin studies to determine what percentage of a trait is genetic, what percentage is shared family environment, and what percentage is nonshared.

The Hoffman hypothesis

Another assertion in the Plomin article is that the research of Neiderhiser and her colleagues disproves the "hypothesis of Hoffman" (1991). The hypothesis in question is that the shared family environment is more likely to have an effect on some personality variables than others and, specifically, that coping skills, competency, and moral internalization, objectively measured, may be more responsive to general family patterns than self-concepts and traits such as dependency where contrast with siblings and ordinal position would lead to differences among siblings. The papers by Neiderhiser cited are interesting and provocative, but to describe them as disproving that hypothesis is not accurate.

The most relevant is the chapter by Neiderhiser and McGuire (in press). This research contrasts sibling similarity for adoptive and nonadoptive pairs at ages 7, 9, and 10. The variables examined are Harter's self-concepts, mothers' reports, and teacher ratings. The teacher ratings are relevant measures and showed significantly more sibling similarity for the nonadopted 7 and 9 year olds on popularity, confidence, and leadership. These results are like previous research in showing higher sibling similarity in nonadoptive families, but different in showing higher sibling similarity in the nonadoptive families than is generally found for personality traits. What the differences in similarity between adoptive and nonadoptive siblings means, however, is not clear. The authors see this as proving the effects of genetics. However, in two previous publications (Hoffman, 1985; 1991) I have suggested that the dynamics of adoptive and nonadoptive families may be different. It is possible that parents treat adopted children differently than they treat non-adopted children, and that knowing one is an adopted child is itself an environmental variable affecting the impact of the parents' influence. Whether both siblings were adopted or only one can also affect this process. Thus, the lesser similarity shown by nonbiological siblings need not reflect only genetics, but may also reflect the different family dynamics in adoptive and nonadoptive families.

In addition, however, for the particular variables involved here, interpretation needs to deal with the depressing fact that, for this age particularly, physical appearance plays a major role. Physical attractiveness is a major determinant of popularity, confidence, and leadership in the school peer group (Langlois, 1986; Hartup, 1983). Biological relatedness increases the likelihood of similarity in physical appearance, and similarity in attractiveness could be playing a strong role in these results. It is noteworthy that data presented by Neiderhiser *et al.* (1993) for adolescents on teacher ratings of social competence does not show significant similarity for the full biological siblings, a pattern consistent with previous research suggesting a decline in the importance of physical appearance *per se* after middle-childhood.

The research by Neiderhiser *et al.* uses a different approach to examine genetic and environmental influence on teacher ratings of social competence. Here the degree of biological relatedness is considered and their conclusion that shared environment is not involved is based solely on the difference between monozygotic and dizygotic twins – i.e., the DZ correlations are less than half the MZ correlations. The conclusion thus rests on the assumption of equally similar environments. Other results reported seem inconsistent with the genetic hypothesis. For example, half-siblings are more similar than full siblings in both non-divorced and remarried families.

Thus, an examination of the research cited as disproof of the Hoffman hypothesis suggests that conclusion is premature. The research of Baumrind, much replicated, showing that childrearing patterns relate to social competence in children, seems more relevant to the hypothesis.

The recent research by the behavioral geneticists such as Plomin and Neiderhiser is indeed exciting, but its value would be enhanced by a more open reading of the data and more respect for the complex, interacting influences that are involved in the socialization process.

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