

Personality and Birth Order in Monozygotic Twins Adopted Apart: A Test of Sulloway's Theory; Research Reviews: Twin Births and Cancer Risk in Mothers, Male Sexual Dysfunction, Twin Study of Ultimatum Game Behavior; Human Interest: 'The Land of Twins', Twin-Like Reunion-I, Twin-Like Reunion-II

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A brief overview of Sulloway's (1996) theory of birth order and personality is presented. A reared apart twin approach for testing his personality findings regarding openness to experience and conscientiousness in first borns and later borns is described. This is followed by summaries of three recent twin studies. The topics include cancer risk in mother of twins, sexual dysfunction in males and responder behavior during ultimatum games. This article concludes with a discussion of twinning rates and rituals among the Yoruba of western Nigeria, and descriptions of two unusual reunions between siblings and twins.

Personality and Birth Order in Monozygotic Twins Adopted Apart: A Test of Sulloway's Theory

This contribution was prepared in conjunction with Dr. Shirley McGuire, Department of Psychology, University of San Francisco and Christian von Pohle, California State University, Fullerton

Associations between personality and birth order have attracted research attention for decades (Ernst & Angst, 1983). The general consensus among investigators has been that birth order effects on personality are negligible (Plomin et al., 2001). However, this view was significantly challenged with the publication of Sulloway's

(1996, 2001, 2008) comprehensive investigation of birth order effects on personality and creativity. Briefly, his theory holds that firstborn children benefit from adhering to family values and traditions because doing so ensures their place as their parents' successor in the family. First borns should, therefore, outscore their later born siblings on measures of conscientiousness and conformity. In contrast, later born children should benefit by being more 'rebellious' than their elder siblings in an effort to fill a unique family niche. Later borns are, therefore, expected to

outscore their firstborn siblings in openness to experience.

Attempts at replicating Sulloway's theory have produced a mixed picture. Jefferson et al. (1998) and Michalski & Shackelford (2002) did not find the predicted relationships between personality and birth order, based on self-report data from adult sibling

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samples. However, some recent attempts to test the theory have yielded confirmatory findings (Beck et al., 2006; Healey & Ellis, 2007).

Beck et al. (2006) concluded their study with the hope that researchers would be 'willing to explore new angles and methods in birth-order research' (p. 958). The present report describes a unique, twin-based approach to assessing personality–birth–order relations. The design would include monozygotic twins reared apart from birth (MZA) and adopted into different birth orders within their respective families. (This idea was first expressed by Sulloway in a footnote on p. 432 of his 1996 book. I was actually disappointed to see it, believing that I had thought of it first!).

Studying MZA twins allows assessment of birth order effects unconfounded by genetic influences on personality. If such genetically identical individuals demonstrate the predicted birth order–personality relationships, this would underline the effects of sibship position in influencing personality traits. Birth order would then be understood as part of the non-shared environmental effects on personality; nonshared environments explain differences between MZ co-twins. In contrast, failure to uncover MZA co-twin differences associated with birth order would support the position that birth order does not contribute in a meaningful way to the nonshared environmental effects on personality.

We attempted to test these ideas using MZA twins from the Swedish Adoption Twin Study of Aging (SATSA; Pedersen et al., 1992) and the Minnesota Study of Twins Reared Apart (MISTRA; Bouchard et al., 1990). Drs Nancy L. Pedersen and Dr Thomas J. Bouchard, Jr. made the data available.

SATSA participants completed a short form of the NEO Personality Inventory-Revised (NEO-PI-R) as part of the standard test battery (Costa

& McCrae, 1992). The NEO-PI-R yields scores for the big five personality traits, but two, openness to experience (OPTOEX) and conscientiousness (CONSCI), were of interest. OPTOEX includes fantasy, aesthetics, feelings and ideas, whereas CONSCI includes competence, dutifulness, order and self-discipline. Sibship information was obtained during follow-up interviews.

MISTRA participants completed the Multidimensional Personality Questionnaire (MPQ), which yields scores for eleven personality scales; however, Traditionalism (TRAD) and Absorption (ABS) were of interest. Individuals scoring high on TRAD endorse high moral standards and value propriety and a good reputation. Individuals scoring high on ABS are 'emotionally responsive to sights and sounds', and can 'become absorbed in compelling recollections and imaginings' (Tellegen, 1982, p. 8). Openness to Experience relates to the adult dimension of perceptual sensitivity (Evans & Rothbart, 2007). Information on sibship was gathered from Life History Interviews and a Twin Relationship Survey (Segal et al., 2003).

The samples were limited to MZA twin pairs for whom both personality and sibship data were available for both co-twins. Twin pairs from both samples were then organized into two groups: Group I: co-twins were reared in the same birth order position and Group II: co-twins were reared in different birth order positions. We found that co-twins in the different-birth order positions did not differ from one another, but the sample sizes were too small to allow firm conclusions.

Singleton sibling studies can assess each sibling's personality traits in only one birth order position — thus, it cannot be fully known how a different birth order would modify a sibling's personality. Furthermore, studies of full siblings confound birth order effects with genetic contributions to personality. The use of MZA twins

can circumvent this situation, and would be a novel response to Beck's call for innovative birth order research. However, this approach, like the previous ones, is not without limitations. It is possible that the twins' age at entry into their adoptive family, and the inconsistent presence of other adoptive, foster and/or biological siblings could interfere with developmental processes linking birth order and personality. As Healey & Ellis (2007) noted, parental investment is likely to be greater for younger biological children than for older nonbiological children in blended families, an effect that could alter the predicted outcomes.

It is also worth noting that self-ratings made without reference to the sibling are less sensitive to birth order effects than self-ratings that do take the sibling into account (Sulloway, 2001). Of course, many MZA twins cannot make personality self-ratings with reference to their co-twin, because they have spent little or no time together. Personality ratings made by observers (e.g., peers, but not spouses) have provided some evidence of higher openness and agreeableness in later borns than in firstborns (Jefferson et al., 1998).

In conclusion, larger MZA twin samples would enable the necessary refinement of pairs with reference to important mediating influences, including siblings' age spacing, sex composition and years of co-residence. Using MZA twins to test personality–birth order relationships appears to be a potentially informative approach to understanding individual differences in behavioral development. Another approach would be to examine MZ twins reared together (MZT) who clearly assume different functional birth order positions within the twinship (e.g., due to size or parental rearing). Research along these lines may also be extended by an ongoing prospective study of young Chinese twins reared apart (Segal et al., 2008).

Research Reviews

Twin Births and Cancer Risk

The unique physiological and health-related characteristics of mothers of twins are of interest. A new study has documented the risks of breast, endometrial and ovarian cancer in mothers of twins (Ji et al., 2007). Subjects were drawn from the national Swedish Family Cancer Registry, that included over 30,000 women who had delivered twins. Mothers of twins with diagnoses of breast cancer ($n = 1010$), endometrial cancer (210), and ovarian cancer ($n = 174$) were identified from the Swedish Twin Registry; mothers of higher order multiple births were excluded. This appears to be the largest study of its kind.

Mothers of twins had a significantly decreased risk of breast cancer, compared with mothers of nontwins. This decrease was especially marked soon after the last pregnancy (when there were three or more pregnancies and the last pregnancy was twins), and if the mother was under age 30. In contrast, meaningful associations between twin births and endometrial or ovarian cancer were not obtained. However, endometrial cancer risk did increase with the number of pregnancies.

The authors suggested that mechanisms underlying twin births' protective effect against mothers' breast cancer are somewhat speculative. Explanations include higher concentrations of sex hormone-binding globulin (a protein that binds testosterone, dihydrotestosterone and estradiol) and higher levels of alpha fetoproteins (molecules produced by the developing embryo and fetus). It was reasoned that the increase in sex hormone-binding globulin may partially compensate for the effects of estrogens.

Male Sexual Dysfunction

Numerous twin studies have examined genetic and environmental influences on sexual orientation (Bailey et al., 2000; Hershberger & Segal, 2004) and gender identity (Knafo et al., 2005; Segal, 2006). In contrast, fewer

studies have used twins to explore sources of influence on sexual dysfunction. Jern et al. (2007) recently studied premature ejaculation (PE) and delayed ejaculation (DE) in male twins from Finland. The authors indicated that the worldwide prevalence of PE is approximately 30%. In contrast, the estimated prevalence of DE ranges between 1% to 4%.

Participants in this study were drawn from the population-based Genetics of Sexuality sample, that included 10,000 twins: 2000 male-male pairs, 2000 female-female pairs and 1000 male-female pairs between the ages of 33 and 43 years. Questionnaires were sent to all these individuals beginning in 2005. The final sample for this study included 91 MZ male and 110 DZ male twin pairs. Items of interest concerned objective and subjective aspects of ejaculatory function, for example, ejaculation latency time and feeling of control. Genetic influence was moderate (28%) for PE, but absent (0%) for DE; shared environment was estimated to be 24% for DE. Given the relative rarity of DE, the investigators indicated that larger samples would be needed to detect genetic effects on that behavior.

Twin Study of Ultimatum Game Behavior

MZ-DZ twin designs add new perspectives to understanding behavior in experimental game situations. Segal & Hershberger (1999) compared MZ and DZ twins' behaviors during a Prisoner's Dilemma game; MZ twins made more cooperative choices than DZ twins, as expected. More recently, Wallace et al., (2007) reported results from a twin study of responder behavior during an ultimatum game. In this situation, a pair of players takes the roles of proposer and responder. The proposer makes an offer as to how to divide a particular sum (in this case 100 SEK; the study used Swedish twins). If the offer is accepted, both players receive the specified amounts.

If the offer is rejected, both players receive nothing.

The study used 253 MZ twin pairs and 71 DZ twin pairs. In the first round, each individual twin was randomly paired with a player from another pair, and took the role of either proposer or receiver. In a subsequent round, twins were again matched randomly and took the role opposite to that taken in the previous round. It was found that genetic factors explained 40% of the variance in rejection behavior.

This study will, hopefully, attract the attention of other game theorists. Unfortunately, Wallace and colleagues did not observe social exchanges between co-twins, a procedure that would have revealed interesting information about genetic relatedness and mutuality. Another informative test would have been to compare outcomes between pairs created from (1) two unrelated MZ twins, (2) two unrelated DZ twins and (3) an unrelated MZ twin and unrelated DZ twin. It is possible that two MZ twins may be less cooperative/generous than two DZ twins, or a DZ twin interacting with an MZ twin, because they may have had less social experience with individuals different from themselves. This idea comes from seminal work conducted by J.P. Scott (1977) in which he found these patterns of behavior while observing different dog breeds in cooperation/competition tasks.

I applied this paradigm in a study of young twin children completing puzzles, but did not find the predicted behavioral differences between unrelated MZ twins and unrelated DZ twins (Segal et al., 1996). It was possible that the particular sample of MZ twins had had sufficient social exposure to other children. More recently, DiLalla (2006) found that 5-year-old twins were less prosocial than nontwins when playing with an unfamiliar peer, but they were not more aggressive. However, MZ-DZ differences in prosocial behaviors were not found.

Human Interest

'The Land of Twins'. The elevated frequency of fraternal twin births among the Yoruba of western Nigeria is well known (Bulmer, 1970). A recent overview of twinning and twinning rituals in the town of Igbo-Ora and in surrounding areas highlights important questions and attitudes towards multiple birth (Agoi, 2007).

The natural frequency of DZ twinning among the Yoruba is estimated to be 44.5/100 births, as compared with 8.9/100 births in the United Kingdom and 2.3/100 births in Japan (Machin & Keith, 1999). In fact, the residents of Igbo-Ora have hung a sign proclaiming their town to be 'The Land of Twins'. The two main reasons given for the high twinning rate are yam consumption and genetic factors. The yam (known locally as the agida and eaten frequently) contains phytoestrogen, a substance that appears to stimulate ovulation. However, some people believe that genetic factors are primarily responsible for the high twinning rate; one Yoruba family produced ten pairs of twins.

Various other explanations have been advanced to explain high fraternal twinning rates in other locations. For example, it has been argued that the greater availability of food sources underlies the higher twinning rate in Finland's archipelago of Aland and Aboland, compared with the mainland (Lummaa et al., 1998). Other factors associated with fraternal twinning include maternal age, coital frequency, seasonality, and stress (See Segal, 2000).

Twinning has been viewed as a mixed blessing across different cultures. However, twinning is valued and honored among the Yoruba. When a twin dies a 'ibeij' (carved wooden figure) is prepared to substitute for the deceased twin. This figure is carried by the mother as though it were the living child. When the living co-twin reaches maturity, he or she assumes care for the figure.

Twin-Like Reunion-I

Reared apart near-in-age siblings approximate the situation of dizygotic

twins reared apart (DZA). In September, 2007, Alex Aggar discovered that Bobby Malone, his best friend since childhood, was his younger full brother (MyFox Tampa Bay Reports, 2007). Their mother was unable to care for her elder son so put him up for adoption when he was an infant. However, the two boys lived only five miles apart, in Orange County, Florida, and became close friends. They played little league baseball together and attended the same high school. Classmates often told them that they looked alike. When they were about 18 years of age, their mother hired a lawyer to help her locate her firstborn son. It turned out that the boy who finally called to say he was her son was her son's best friend. The brothers now attend the same college.

DZ twins occur more commonly than MZ twins, but fewer DZA than MZA twin pairs are identified by investigators. I believe this is because MZ twins are often reunited due to mistaken identity, whereas DZ twins (because they look physically different) must rely on birth documents and other information to find one another. It is for this reason that twin researchers might consider including reared apart near-in-age full siblings in their research designs. Of course, full siblings do not share their intrauterine environment, nor are they the same age—but they do share 50% of their genes, on average, by descent, as do DZ twins. The story presented below continues this thread ...

Twin-Like Reunion-II

I was contacted by a DZ female twin, age 33, with an unusual life history. She and her twin sister were adopted away from their biological home at age four years and placed together in the same family. When the twins turned 19, they discovered that they had fraternal twin brothers, older by 1 year, who had been adopted away from them at the same time. The sisters recently placed a notice on the Internet that led their older brothers to find them in October 2007. The two twin pairs have never met, but

they have corresponded by telephone, e-mail, and web cam. Their observed similarities range from their blond hair and hazel eyes, to their intellectual and personality traits.

Bringing these two twin sets together would yield four 'DZA'—OS (DZ reared apart) twin pairs, as well as two DZT (DZ reared together) pairs. These unusual twins could be potentially valuable research participants. I hope to help them arrange a reunion.

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