CoSMoS and TwinPaW: Initial Report on Two New German Twin Studies

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After briefly recapitulating two earlier German twin studies (BiLSAT and GOSAT), we present two new German twin studies with a longitudinal perspective: CoSMoS and TwinPaW. The twin study on Cognitive ability, Self-reported Motivation and School performance (CoSMoS) aims to investigate predictors and influences of school performance in a genetically sensitive design, beginning with children in late elementary school. The Twin study on Personality And Wellbeing (TwinPaW) focuses on adult personality and its relation to physical health as well as health-related behavior in an adult sample of twins. Both studies are characterized by an effort to recruit new large twin samples through a novel recruitment procedure aimed at reducing self-selective sampling. In two German federal states, contact information on persons born on the same day and with the same name was retrieved from record sections. From the resulting pool of more than 36,000 addresses we contacted approximately 2000 parents of twins aged 9 and 10 for CoSMoS, as well as 2000 adult twin pairs for TwinPaW by telephone and mail. Personal contact by telephone proved to be more efficient with agreement rates of 63% in the children sample and 65% in the adult sample. In this article we briefly describe the rationale and the study aims of CoSMoS and TwinPaW as well as the characteristics of the sample we have recruited so far.

Earlier German Behavior Genetic Studies: BiLSAT and GOSAT

The last decade was a fruitful period for twin research in Germany. This is particularly remarkable as the early 1990s could also be regarded as the advent of reputable scientific behavior genetic research in Germany. There were virtually no efforts made in Germany in the second half of the 20th century to utilize twin or adoption methods to study the etiology of human behavior, with few exceptions (e.g., Geppert & Halisch, 2001; Kabat vel Job, 1991). This changed when in 1993 the Bielefeld Longitudinal Study of Adult Twins (BiLSAT) was initiated by Alois Angleitner (Bielefeld, Germany) and Jan Strelau (Warsaw, Poland) in order to study personality development in adulthood. As no German twin register was available at the time, the sample of more than 1100 monozygotic (MZ) and same- as well as opposite-sex dizygotic (DZ) twin pairs had to be specifically recruited, primarily through media announcements. The BiLSAT twins' ages varied between 14 and 80 years (M = 31.9, SD = 12.7) and the sample was heterogeneous with regard to education and employment status. As is typically observed with voluntary twin samples, however, females participated more frequently than males and MZ twins participated more frequently than DZ twins at a rate of approximately 2:1. An early objective of the BiLSAT involved the assessment of personality and temperament by peer reports in addition to self-reports in order to overcome the prevalence of self-reports in behavioral genetic research of adult personality. Consequently, the first major report from the BiLSAT provided evidence for substantial genetic influence on peer-reported personality on the NEO-FFI scales, validating previous findings based on self-report alone (Riemann et al., 1997). Heritability (h^2) estimates of the NEO-FFI scales on the basis of the averaged peer-report data alone were above .40. Multivariate behavioral genetic analyses of combined self- and peer-report data indicated even higher additive genetic influences that accounted for the major proportion of the phenotypic personality trait variance. The remaining variance was explained by nonshared environmental influences. Over the following years, many studies have utilized data from the BiLSAT, including recent cross-cultural analyses of the genetic structure of human personality and the extent to which it is universal (Yamagata et al., 2006).

The German Observational Study of Adult Twins (GOSAT; Spinath et al., 2002) was nested within BiLSAT and focused on the investigation of genetic and environmental influences on adult personality and cognitive abilities in the normal range through behavioral observation, supported by a grant from the German Research Foundation (Deutsche Forschungsgemeinschaft). A 1-day assessment aimed at eliciting behaviors in both social and nonsocial situations that

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were informative of the twins' personality was devised. These situations were videotaped and later rated on measures of the Big Five model of personality by assessors who did not know the twins prior to the study. A total of 300 MZ and same-sex DZ twin pairs participated in the GOSAT over the course of a 2-year assessment period. To avoid mutual influences within pairs and to preclude systematic rater bias, the twins were separated for most of the assessment day, tested by different experimenters, interacted with separate confederates in situations involving social interactions, and were rated by different sets of assessors on the basis of the videotapes. In addition to these behavior recordings, psychometric intelligence tests and computerized elementary cognitive tasks were administered over the course of the assessment day and several objective measures such as physical activity or behavioral counts (e.g., number of questions asked during certain tasks) were collected.

Model-fitting analyses of the video-based trait ratings suggested substantial genetic influences on personality of about 40% (Borkenau et al., 2001). Interestingly, we found some indication for shared environmental influence (c^2 = .25) on observer-rated personality traits that was consistent for all traits under study, except for Extraversion. A similar trend was found in the analysis of confederate and experimenter data. Data from the GOSAT has also been published in several research articles, either capitalizing on the substantial degree of control over situational constraints and investigating the etiology of Person × Situation profiles (Borkenau et al., in press) or focusing on the etiology of behavior on different levels of aggregation (Wolf et al., 2006).

Specifics of Recruitment of a Large New German Twin Sample for CoSMoS and Twin PaW

Both BiLSAT and GOSAT have been important steps for the progress of behavior genetic research in Germany with BiLSAT still ongoing and currently entering its third wave of measurement approximately 10 to 15 years after the initial assessment. Due to extended research interests and partly because of increasing attrition, especially concerning the DZ subgroup in the original BiLSAT sample, the authors decided to recruit a new German twin sample in 2004. Instead of asking twins for their participation through the media or twin clubs, a different recruitment procedure was used aimed at reducing self-selective sampling: through individual inquiries at registrations offices in two German federal states (North Rhine-Westphalia and Thuringia), we collected contact information on persons with the same birth name, the same birthday, and also the same birthplace. These requests resulted in 36,574 addresses of potential twin pairs — adult twins as well as parents of twins. As a first step, we selected people from this list in the relevant age-groups for the Cognitive ability, Self-reported Motivation and School performance (CoSMoS) study and the Twin study on Personality and Well-being (TwinPaW; birth cohorts 1995–1998 and 1955–1970, respectively). After matching the provided addresses with data found in public telephone directories, 1014 adult twins and 715 families with children twins were contacted by phone in 2005. An additional 1190 (CoSMoS) and 2642 (TwinPaW) households were contacted via mail.

First contact by phone turned out to be more efficient, as almost two thirds of all personally contacted twins agreed to participate as compared to only 26% (CoSMoS) and 10% (TwinPaW) of participations when first contact was made by mail. The total number of false positive contacts (that is, people born on the same day and with the same surname who claimed not to be twins) was relatively small (2.4% for CoSMoS and 4.3% for TwinPaW), rendering the chosen way of recruitment feasible and a decent alternative to former approaches through media advertisements. The fact that the full pool of addresses is now available and includes German twins of all ages makes it a valuable source for either contacting additional twins for new study purposes or adding new cohorts to CoSMoS and Twin PaW.

As the two projects are currently in their pilot phase, the aims and objectives of the studies will be described in the following sections rather than the final results presented. To date, booklets have been sent to parents of 896 participating twin pair children in CoSMoS and to 885 adult twin pairs in TwinPaW. So far we have received complete data, that is, two completely and correctly filled out questionnaires from each sibling, from 411 pairs of children (46%) and 302 pairs of adult twins (34%). Zygosity is being diagnosed by questionnaire measures that typically yield accuracies in the magnitude of 95% (Price et al., 2000). For CoSMoS, the data collected so far comprises 40% MZ, 27% same-sex DZ and 33% opposite-sex DZ twin pairs. In the sample, 49% of the children are male, 51% are female. The relatively even distribution of MZ and DZ twin groups underlines the notion that our recruitment procedure might be advantageous compared to recruitment via the media, as the well-documented bias towards MZ twins is absent in our sample.

For TwinPaW, the sample so far consists of 54% MZ, 23% same-sex DZ and 23% opposite-sex DZ twin pairs (M = 37.0 years, SD = 6.8 years). In the adult sample, 33% are male, 67% are female.

Major Research Focus and Study Rationale of CoSMoS and TwinPaW

CoSMoS

CoSMoS was conceptualized to tie in with the Twins' Early Development Study (TEDS; Trouton et al., 2002), the first large-scale population-based twin study in the United Kingdom, and the largest study by far ever conducted on language and cognitive development. The large sample size will enable TEDS to investigate the genetic and environmental etiology of abnormal development in the context of normal development. TEDS was also the first large twin study to include motivational measures to study the extent to which motivation contributes to the prediction of school achievement among elementary school children over and

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beyond general mental ability (*g*). After repeated assessments of intelligence at ages 2, 3, 4 and 7 years, TEDS began to assess self-perceived ability and intrinsic values based on the Eccles expectancy–value model of motivation (Eccles, 1983) in elementary school children at the age of 9. Recent analysis of the predictive power of ability and motivation in this dataset (Spinath et al., 2006) clearly demonstrated a prominent role of cognitive ability but also indicated incremental validity of motivational variables. Interestingly, multivariate genetic analyses pointed to a substantial genetic mediation among cognitive ability, motivation and school performance (Spinath et al., 2005), suggesting generalized genetic influences on achievement-related individual differences. This finding challenges popular and widely held beliefs concerning the etiology and the development of motivation both in the educational sciences and in the applied fields. The fact that on average cognitive and motivational variables combined explained no more than 25% of the variance in school performance suggests additional influences which have not been identified or addressed in TEDS. Consequently, CoSMoS was devised to take a closer and more detailed look at processes and developmental pathways in this field of major public and individual interest. We seek to replicate the results from TEDS in an independent twin sample from another country but also extend the palette of measures to include further motivational constructs, specific environmental influences both inside and outside the family, as well as parental and child personality characteristics and parental behavior (e.g., parenting styles, attitudes etc.). Cognitive ability is assessed according to the procedures described in Spinath et al. (2006). For CoSMoS, we used German adaptations of the cognitive tests used in TEDS. A complete list of measures in CoSMoS is available from the authors.

TwinPaW

Over the last decade much research has been conducted studying psychological factors associated with a variety of health problems. Results of those studies concordantly show that nowadays the main causes of mortality and serious diseases could be prevented or at least alleviated by changing certain behaviors or lifestyles (e.g., dietary behavior, physical activity, tobacco, alcohol, drugs, risky sexual behavior, etc.). However, there are only a few studies that investigate the reasons and mechanisms why some people engage in such behaviors and do not change risky behaviors despite knowing the consequences of these unhealthy behaviors, while others develop a healthier lifestyle (e.g., Bermúdez, 1999).

One line of research related to health behaviors examines personality characteristics, stable individual differences, as predispositions or facilitators of the development and preservation of certain patterns of behavior (Bermúdez, 1999). The identification of such variables and the analysis of their relation to certain kinds of behaviors would facilitate our understanding of influences on an individual's health and wellbeing. Although the Five Factor Model (FFM) has often been used as a framework for research on the relation between personality and health (e.g., Booth-Kewley & Vickers, 1994), it is still not clear whether the FFM is a sufficient framework to incorporate the different personality variables used in studies on personality and health (Bermúdez, 1999). As such, one aim of TwinPaW is to investigate the relationship of distal (e.g., personality as measured by the FFM) and proximal (e.g., self-efficacy) predictors of (health) behavior. To what extent can the FFM account for the relation between health and proximal personality variables? Besides focusing on various measures of individual differences TwinPaW also includes a broad range of health behaviors (eating, physical activity, tobacco, alcohol, medication, sleep), trying to overcome the imbalance in attention given to some health behaviors (e.g., tobacco) in previous studies (Bogg & Roberts, 2004).

Studying the phenotypic relations between various personality and health behaviors provides the means to improve the understanding of factors influencing wellbeing and health, however the behavior genetic framework of TwinPaW allows one to go beyond the mere description of relations. As such, a second aim of TwinPaW targets the etiology of the relationship between personality (broad and narrow bandwidth) and health/well-being. Furthermore, the underlying structure of distal and proximal predictors of (health) behaviors should be investigated.

Personality variables are of course not the only factors influencing health and wellbeing. As can be seen in an elegant model by Adler and Matthews (1994), next to individual dispositions and health behaviors, the social environment constitutes the third most important area influencing an individual's health. Social environmental factors are context-dependent experiences that either detract from (e.g., stressful events) or promote (e.g., social support) good health. The major problem regarding earlier studies focusing on social environment influences on health lies in their inability to identify true environmental variables. Various measures that presumably assess the (social) environment of individuals have been demonstrated to be heritable, a phenomenon that has become popular under 'nature of nurture' (Plomin, 1994). Behavioral genetic studies allow the disentangling of genetic and environmental influences and are as such a valuable extension of previous studies on the social environmental factors of health. In accordance with this, TwinPaW also aims to detect environmental influences on health and wellbeing through measures of life events, work and family environment.

Of course, the three factors influencing health and wellbeing — individual dispositions, health behavior and social environment — effect health individually as well as combined. As such, the possible moderating effects of personality regarding health behaviors and the effects of the gene–environment interplay on health will also be investigated within TwinPaW. A complete list of measures in TwinPaW is available from the authors.

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Future plans

Considering the nature of the present preliminary data collection and the restriction to two federal states of Germany, we plan to enlarge the CoSMoS as well as the TwinPaW sample to increase representativeness of Germans as a whole. An additional goal of CoSMoS and TwinPaW is to foster collaborative research and facilitate funded spin-off projects using the CoSMoS/TwinPaW samples. Consequently, CoSMoS and TwinPaW are open to national as well as international collaborations.

The questionnaire set for the TwinPaW is currently under revision to hone the assessment of health behaviors and to add measures of the environment, mainly work environment, to allow a better investigation of questions regarding work–life balance using a behavioral genetic framework.

Together with the recruitment of additional cohorts of participants, CoSMoS is currently preparing a second wave of assessment as most participating children are now either approaching the transition from elementary to secondary school or have already completed the transition. Reports on the progress of the project are about to be sent to the families and we plan to assess the children in their new school environment (including which type of secondary school was chosen, grades, and so on). We also intend to compare findings from TEDS and CoSMoS capitalizing on the fact that the two studies are highly comparable in terms of the assessment of cognitive ability, motivation, and school performance in two separate countries.

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