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The Bielefeld Longitudinal Study of Adult Twins (BiLSAT)

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The Bielefeld Longitudinal Study of Adult Twins (BiLSAT) is a German longitudinal study of monozygotic and dizygotic twins reared together, including more than 1,100 twin pairs aged between 14 and 80 who participated in the first wave. Data were collected at five waves of assessment between 1993 and 2009. Initially, the study focused on genetic and environmental influences on the structure and the development in adult temperament and personality. Today, the study includes a broad range of individual variables, such as personality disorders, major life goals, interests, attitudes, values, life and work satisfaction, and major life events. A special feature of this genetically informative study lies in the multiple-rater approach (i.e., self-reports and peer reports). Longitudinal multiple-rater analyses allow researchers to go beyond the basic nature–nurture decomposition of variance in self-reports examining genetic and environmental influences on stability and change in more accurately measured individual attributes. In the current article, we briefly describe the design and contents of BiLSAT as well as some recent major findings and future plans.

■ **Keywords:** multiple-rater twin study, personality, temperament, goals, interests, life events

Initial Research Focus and Data Collection From 1993 to 1997

As part of a joint twin research project in Germany and Poland (Oniszczenko et al., 2003; Riemann et al., 1997; Zawadzki et al., 2001), the Bielefeld Longitudinal Study of Adult Twins (BiLSAT) initially focused on the genetic and environmental contributions to the variance in temperament and personality traits as well as to the links among these traits. Twin pairs were recruited through several media announcements (e.g., newspapers, TV, and radio) and twin clubs in Germany. Interested twins could call an installed telephone hotline. Names, addresses, and date of birth of approximately 1,500 German twin pairs (mostly from the region around Bielefeld) who decided to participate were registered between 1993 and 1997. A total of 2,404 twins returned a complete set of questionnaires from the first mailing, and 1,765 twins completed a second set (see Table 1). The sets of inventories included a demographic questionnaire, several temperament and personality questionnaires (see Table 2), and a self-report questionnaire on physical resemblance and twins' medical history determining zygosity. The sample was heterogeneous with regard to education and employment status. For more detail of recruitment and descriptions of the initial sample, see a previous report (Spinath et al., 2002).

A special feature of BiLSAT is the collection of reports from well-informed peers (specific for each twin) in addition to self-reports from twins. In the first wave, almost 4,800 peers (mostly friends, relatives, spouses, and colleagues) provided ratings. This multiple-rater strategy allowed addressing several methodological problems with single-rater assessments (e.g., response styles, social desirability, self-deception, and contrast effects). As shown in the list of inventories used as first-person and third-person versions (see Table 2), the initial two waves of the study provided a rich, genetically informative multiple-rater data set based on different measures of temperament and

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TABLE 1

Sample Characteristics for the Bielefeld Longitudinal Study of Adult Twins (BiLSAT)

	Waves of assessment				
	1	2	3	4	5
Years of data collection	1993–1996	1994–1997	1999–2002	2005–2008	2006–2009
N of individuals (self-raters)	2,404	1,765	844	433	614
N of peer raters	4,795	3,519	1,678	831	1,160
N of MZ twin pairs[a]	732	531	225	139	169
N of DZ twin pairs[a,b]	386	275	113	63	93
Females (%)	74.7	77.5	81.0	83.4	80.5
Age range	14–80	13–83	22–75	27–80	27–80
Mean age	32.14	33.95	39.13	46.49	46.55

Note: MZ: monozygotic; DZ: dizygotic.
[a]Number of twin pairs with complete data.
[b]DZ twins included same-sex and opposite-sex pairs.

TABLE 2

Summary of Measures Collected for the Bielefeld Longitudinal Study of Adult Twins (BiLSAT)

		Wave 1		Wave 2		Wave 3		Wave 4		Wave 5	
Measures	*N* of items	Self	Peer	Self	Peer	Self	Peer	Self	Peer	Self	Peer
Temperament/personality											
PTS	72	X	X								
FCB-TI	120	X	X							X	X
NEO-FFI	60	X	X	X[a]		X[a]	X[a]	X[a]	X[a]	X	X
NEO-PI-R	240			X		X	X	X	X		
EAS[c]	20			X	X						
EPQ-RS	50			X	X						
DOTS-R[c]	54			X	X						
BIPOL	119			X	X	X				X	
UNIPOL	100			X							
MPQ[c]	276			X							
ZKPQ-III-R	99					X					
ANPS	110							X			
DAPP-BQ[c]	290					X					
Attachment styles[c]	4					X					
PANAS	20							X			
Interests/goals											
GIS	48					X	X				
GOALS	72					X		X[b]			
Social attitudes/values											
Political attitudes	35					X					
RVS[c]	36					X					
AVQ	54							X			
Life and work satisfaction											
SWLS	5							X			
Work statisfaction[c]	8							X			
Major life events[c]											
Work related	10					X		X			
Familial	10					X		X			
Personal	11					X		X			
Valence	31					X		X			

Note: Self: self-reports; Peer: peer reports; PTS: Pavlovian Temperament Survey (Strumpf et al., 1999); FCB-TI: Formal Characteristics of Behavior — Temperament Inventory (Strelau & Zawadski, 1993, 1995); NEO-FFI and NEO-PI-R: Neuroticism–Extraversion–Openness Five-Factor Inventory and Personality Inventory Revised (Borkenau & Ostendorf, 1993; Costa & McCrae, 1992; Ostendorf & Angleitner, 2004); EAS: Emotionality–Activity–Sociability temperament survey for adults (Buss & Plomin, 1984); EPQ-RS: Eysenck's Personality Questionnaire Revised Short form (Eysenck & Eysenck, 1991; Ruch, 1999); DOTS-R: Revised Dimensions of Temperament Survey (Windle & Lerner, 1986); BIPOL and UNIPOL: bipolar and unipolar adjective scales (Ostendorf, 1990); MPQ: Multidimensional Personality Questionnaire (Tellegen & Waller, 2008); ZKPQ-III-R: Revised Zuckerman-Kuhlman-Personality-Questionnaire (Ostendorf & Angleitner, 1994; Zuckerman, 2002); ANPS: Affective Neuroscience Personality Scales (Davis et al., 2003; Reuter et al., 2005); DAPP-BQ: Dimensional Assessment of Personality Pathology Basic Questionnaire (Livesley & Jackson, 2009); PANAS: Positive Affect Negative Affect Scale (Krohne et al., 1996; Watson et al., 1988); GIS: General Interest Scale (Brickenkamp, 1990); GOALS: major life goals (Pöhlmann & Brunstein, 1997); RVS: Rokeach Values Survey (Johnston, 1995; Rokeach, 1973); AVQ: Austrian Value Questionnaire (Renner, 2003); SWLS: Satisfaction With Life Scale (Diener et al., 1985; Sölva et al., 1995).
[a]NEO-FFI items of waves 2, 3, and 4 were included in the NEO-PI-R.
[b]Only the items capturing the importance of major life goals (24 items) were included in the fourth wave.
[c]Unpublished German versions were translated and developed by the Bielefeld research group.

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personality. These data contributed substantially to personality research and helped to answer different specific research questions. For example, more accurate measures that were based on the combination of peer-report and self-report data (controlling for random error variance and variance in self-rater biases) indicated higher heritability of temperamental and personality traits (e.g., Kandler, 2012; Riemann et al., 1997; Wolf et al., 2004; Zawadski et al., 2001). Moreover, examining the twin covariance among personality traits revealed the underlying genetic and environmental basis of hierarchical personality trait structures (e.g., Jang et al., 1998, 2002; McCrae et al., 2001).

Further Research Aims and Data Collection From 1999 to 2009

About 5 years after the twins and their peers completed the second set of questionnaires, a third set of questionnaires was sent out to the participants. Between 1999 and 2002, a total of 844 individuals, including 338 complete twin pairs and over 1,600 peer raters, provided data at this third measurement wave (see Table 1). Besides new measures, this set of questionnaires also included different Big Five measures a second time (see Table 2) in order to focus on the genetic and environmental sources of stability and change in personality. Additionally, the third wave included measures of major life goals, attitudes, interests, values, personality disorders, and life events, realizing a third aim of the study that addresses the genetically and environmentally mediated links between personality traits and other individual attributes, as well as specific environments.

All individuals who were still enrolled in the study were sent a fourth set of questionnaires about 5 years after they took part in the third measurement wave. That is, the fourth wave ran from 2005 to 2008. A total of 433 individuals, including 202 complete twin pairs and over 800 peer raters, provided data at this wave. The fourth set of questionnaires again included a broad measure of Big Five personality traits and personality facets (NEO-PI-R, see Table 2), allowing genetically informative longitudinal analyses across three waves of assessment over a time span of 10 years. In addition, this set involved further follow-up measures of major life goals and life events, allowing for longitudinal, genetically informative analyses of these variables as well as analyses of interdependencies among genetic and environmental sources of personality, goals, and life events over time.

One year after the fourth wave and 13 years after the study's initiation, we contacted each twin who participated at the first wave for a final participation between 2006 and 2009. A total of 614 individuals, including 262 complete twin pairs and over 1,100 associated peer raters, completed the fifth set of questionnaires focusing on temperamental and personality traits. The inclusion of these data in BiLSAT allows longitudinal analyses of self- and peer reports on twins' temperament and personality in adulthood over a period of almost 13 years. The combination of longitudinal, genetically informative, and multiple-rater data features BiLSAT as unique twin study worldwide.

Recent Major Findings

By now, a large number of published studies based on BiLSAT data exist. Some of the major findings were already presented in a previous report (Spinath et al., 2002). In this article, we focus on recent findings and analyses that have taken advantage of the multi-methodical and longitudinal features of BiLSAT. These major findings comprise (1) the underlying genetic basis of the hierarchical structure of personality, (2) the genetic and environmental stability and change in personality traits, and (3) the nature of the interrelations between personality traits and other individual characteristics or individual environments.

Multiple-rater data of twins' Big Five personality traits and facets from the third wave have been combined with personality data from other twin samples of different nations, such as Japan, Canada, or the United States. This combination showed cross-cultural evidence that genetic factors are more reflective of the phenotypic hierarchical structure of the Five-Factor Model of personality than are environmental factors (Jang et al., 2006; Yamagata et al., 2006). Furthermore, the self- and peer-report data of twins' personality have provided multi-methodical evidence for a combination of a bottom-up and a top-down model of genetic influences that appears to characterize the structure of each of the five broad personality dimensions and their corresponding facets (Kandler et al., 2010), whereas higher-order factors, such as the Big Two or a general factor of personality, mainly reflect artifacts (McCrae et al., 2008; Riemann & Kandler, 2010).

Beyond the structural consistency across cultures and methods of measurement, the longitudinal nature of BiLSAT allows a focus on genetic and environmental influences on stability and change in personality and other traits across adulthood. Bleidorn et al. (2009) focused on mean-level trends and individual differences in change using a genetically informative growth curve modeling approach across the second, third, and forth waves of assessment. They found pronounced genetic contributions to individual differences in change in personality traits (measured with the NEO-PI-R) that showed large mean-level trends (i.e., Neuroticism, Agreeableness, and Conscientiousness), but more pronounced environmental effects on individual differences in individual-level trends in traits with only small or no significant mean-level changes (i.e., Openness and Extraversion). This finding indicates not only a genetic contribution to personality maturation but also environmental effects on individual-specific developmental trends.

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Based on both self- and peer-report personality data, studies showed that genetic factors represent the main sources contributing to phenotypic rank-order and profile stability of personality in middle adulthood, whereas rank-order change and individual differences in personality profile change were predominantly attributable to environmental factors (Bleidorn et al., 2012; Kandler et al., 2010). Moreover, it was shown that phenotypic rank-order continuity in Big Five personality traits increased as a function of stabilizing environmental trait variance and decreasing environmental occasion-specific effects across young and middle adulthood (Kandler et al., 2010). This indicates cumulative and stabilizing environmental effects on personality in this period of life. On that note, recent longitudinal analyses provide support for a bidirectional model of gene–environment interplay between personality traits and life events (Kandler et al., 2012). More specifically, genetic variance in Extraversion and Openness accounted for genetic variance in positive events, whereas genetic variance in Neuroticism, Openness, and Agreeableness explained genetic variance in negative events. Controlling for these genetic factors between personality traits and life events, there were very small but significant effects from negative life events on Neuroticism, Openness, and Agreeableness accounting for a small proportion of environmental variance in these personality traits.

The third major field of research using BiLSAT data is the examination of the nature of the links between Big Five personality traits and other individual attributes. Until now, researchers have focused on the genetic and environmental links between personality and motivational variables, such as major life goals (i.e., agency and communion; Bleidorn et al., 2010) or general interests (e.g., artistic and social; Kandler et al., 2011). These studies indicated that personality traits are systematically and primarily genetically linked to individual motivations. However, large proportions of genetic variance in goals and interests could not be accounted for by genetic factors on personality traits, providing support for the hypothesis that Big Five personality traits and motivations are distinct characteristics to describe individual differences in behavior.

Future Plans

We are currently planning to provide BiLSAT data as open source. As presented above, BiLSAT data have contributed extensively to behavior genetic research on personality and related variables. Open questions concern, for example, the nature and nurture of political attitudes and collectivistic versus individualistic values and the role of personality traits. The preparation of BiLSAT data as open source enables international collaborations and offers researchers to use the data in order to answer their own specific research questions.

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