

The Boston University Twin Project (BUTP)

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The Boston University Twin Project (BUTP) is a multi-method, multi-situation, longitudinal study of early child temperament and related behaviors. The first phase of this project focused primarily on activity level and comprised over 300 twin pairs assessed in the home and lab at ages 2 and 3. Subject recruitment, sample characteristics, and study procedures are described. A second phase broadens our focus to the development of multiple temperament dimensions and developmental outcomes in a new cohort of 300 twin pairs to be assessed at 3, 4, and 5 years of age. Recruitment is currently underway.

■ **Keywords:** temperament, activity level, longitudinal, multi-method, multi-situation

Background

The initial phase of the Boston University Twin Project (BUTP) is a multi-situation, multi-method, longitudinal investigation of genetic influences on the temperament dimension of activity level (AL) in early childhood. The unique feature of this research is the use of mechanical measures to assess AL in the child's home environment and within structured laboratory situations. Behavioral genetic studies of child temperament have been criticized for relying on a single measure, usually parent ratings. This study addressed these criticisms by using multiple methods across different contexts, and provides a more complete picture of the etiology of AL in early childhood.

Recruitment and Sample Characteristics

Twins were recruited from birth records supplied by the Massachusetts Registry of Vital Records. Twins were selected preferentially for higher birth weight and gestational age. No twins with birth weights below 1,750 grams or with gestational ages less than 34 weeks were included in the study. Twins were also excluded if one or both twins had a health problem that might affect motor activity (e.g., cerebral palsy) or a known genetic/chromosomal disorder. We contacted 769 families and 314 agreed to participate. Given the extensive time commitment required by participating families, this response rate (41%) is impressive and compares favorably to large-scale questionnaire-based studies of young twins. Table 1 presents sampling information for each age. 84 families had some form of fertility treatment. The average age of mother at time of birth was 33.7 years (range 20.1–43.4).

Zygosity

At age 2, cheek scrapings were used to obtain DNA samples from twins and their parents. DNA extraction was performed at Prof. Asherson's lab at the Institute of Psychiatry (London, UK). Zygosity was determined via DNA analyses by genotyping 10 highly polymorphic simple sequence repeat (SSR) markers in each member of a twin pair. For three families who declined to provide DNA samples, zygosity was determined using parents' responses on physical similarity questionnaires.

Sample

Three hundred and fourteen same-sex pairs of twins (144 MZ, 168 DZ) participated in the age 2 assessments, and 304 (141 MZ, 163 DZ) returned for the age 3 assessments (96.8% retention rate). Of the 10 families who did not participate at age 3, two moved to a different state, four had a child diagnosed with a serious health/behavioral problem (e.g., brain tumor, autism), and four were too busy or gave no reason. Although the sample was predominately Caucasian (85.4%), ethnicity was generally representative of the Massachusetts population (3.2% Black, 2% Asian, 7.3% Mixed, 2.2% Other). Socioeconomic status ranged from low to upper middle class.

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TABLE 1
Date of Birth (DOB) and Dates of Tests for Each Birth Cohort

	2001 cohort	2002 cohort	2003 cohort	2004 cohort
DOB	07/2001–12/2001	02/2002–12/2002	01/2003–12/2003	01/2004–09/2004
N pairs age 2/age3	49/49	103/97	99/97	63/61
Age 2 test dates	07/2003–01/2004	02/2004–02/2005	02/2005–01/2006	01/2006–11/2006
Age 3 test dates	07/2004–01/2005	02/2005–02/2006	02/2006–01/2007	01/2007–11/2007

Strategies for Sample Retainment

We have been in regular contact with the families via birthday cards and project newsletters. We have obtained secondary contact information for close friends/relatives who are able to provide us with an address in the event that families move without providing us with a forwarding address. We have recently added e-mail addresses to our database (79% of families). To date, we have lost contact with only two families; however, 12 have moved out of state.

Study Procedure and Measures

Twins were assessed within approximately 2 weeks of their second and third birthdays. At each age, the procedure consisted of two visits, 48 hours apart, to the laboratory. Actigraphs were attached to each child (one per limb) at the first visit and removed at the second visit. The children tolerated the motion recorders well and most wore them for the entire 48-hour period. At the first visit within each age, one twin was assessed within a standardized test situation, while the other twin was assessed within a play situation. Situations were reversed at the second visit. Twins were assessed by different testers; however, the tester for each twin was the same across the two laboratory situations. This procedure allowed us to obtain an objective measure of AL in multiple situations (home, lab test, and lab play) at both ages (see Saudino & Zapfe, 2008, for details). We also have multiple measures of AL within the same situation (i.e., observer ratings of AL in each lab situation; parent ratings of AL within the home; see Saudino, 2009) and across age (Saudino, 2012).

In addition to AL, the BUTP includes observational measures of temperament-related constructs, including task orientation, affect/extraversion, inhibitory control, and emotion regulation. We also have observational/test data on a number of cognitive variables, such as mental development, imitative behavior, memory, theory of mind, and language development (the latter three at age 3 only). An observation of parent-child interaction was also obtained at age 3. Parent rating measures of child temperament, behavior problems, prosocial behavior, parenting, and child health are also available for both ages.

Families have been genotyped for specific genetic variants previously associated with attention

deficit/hyperactivity disorder or aspects of temperament in young children. This included 28 single nucleotide polymorphisms (SNPs) and four variable number tandem repeats spanning associated regions in the following genes: dopamine D4 receptor (DRD4), dopamine transporter (DAT1), noradrenergic transporter (NET1), monoamine oxidase A (MAOA), serotonin transporter gene (SERT), synaptosomal associated protein (SNAP25), and tryptophan hydroxylase 2 (TPH2). See Ilott et al. (2010a, 2010b).

New Directions

We have received funding to study a new sample of 300 twin pairs who will be followed longitudinally at ages 3, 4, and 5 years. Recruitment via birth records is currently underway. The focus of this second study is on developmental trajectories of temperament and parenting and their links with developmental outcomes. Many of the age 3 lab-based measures will overlap across the two studies, allowing us to combine data for more powerful analyses. We also hope to begin a follow-up of the original BUTP sample pending funding.

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