

**Longitudinal Studies of Twins: Papers presented at a symposium
at the Xth European Conference on Developmental Psychology,
Uppsala, Sweden, August 2001**

GUEST EDITORIAL

Developmental Studies of Twins from Birth on: Heredity, Environment, Biomedical Variables, and Co-twin Relations

Marilyn L. Riese

Louisville Twin Study, Department of Pediatrics, University of Louisville, Louisville, Kentucky, USA

The reports in this section demonstrate several ways in which longitudinal research with twins is informative for the study of development. All of these twins have been followed for long time periods. These results are the latest stage of study for each. By virtue of their long-term nature, together these studies provide information on patterns and changes in several developmental areas from infancy to adulthood. They also document when specific variables no longer exert any influence on development. The first report, by Alin Akerman and Suurvee ("The Cognitive and Identity Development of Twins at 16 Years of Age: A Follow-up Study of 32 Twin Pairs") is a study of twins followed from birth to 16 years of age. The second report, by Ebeling, Porkka, Penninkilampi-Kerola, Berg, Jarvi, and Moilanen ("Inter-twin Relationships and Mental Health"), is a study of twins followed from pregnancy to 22–30 years of age. The third report, by Lange ("Coping Ability at Mid-life in Relation to Genetic and Environmental Influences at Adolescence"), is a study of twins and singletons followed from 10 to 16 years of age to 35 years of age. The section attests to the perseverance of these authors as researchers, and to the strength of the personal relationships of these authors with the individuals in their projects.

The following three reports are based on presentations made at a symposium at the Xth European Conference on Developmental Psychology in Uppsala, Sweden, 26 August 2001 by Britta Alin Akerman, Irma Moilanen, and Anna-Lena Lange. The studies represent the latest evaluations of three groups of twins participating in long-term, intensive studies of relatively small samples done in the Nordic twin research tradition. The subject populations have been participating in the projects from very early ages; in two instances, before birth, and in the third instance, from 10 years of age. These studies are interesting not only for the information provided by the specific variables, but also because they personify the interests of these investigators in obtaining ongoing data built on many previous years of findings. Alin Akerman started her project in 1981.

Moilanen's twin pregnancy project began in 1974, and the developmental follow-up of the twins began in 1975; Hanna Ebeling and co-authors recently joined the project. The project that Lange is pursuing was begun in 1964, with data collected until 1971. She began the follow-up studies in 1991.

The first report, by Alin Akerman & Suurvee ("The Cognitive and Identity Development of Twins at 16 Years of Age: A Follow-up Study of 32 Twin Pairs"), is a study of twins followed from birth to 16 years of age. This study demonstrated that it is difficult for twins to develop independence and a positive identity. Identity, anxiety, and ambition at 16 years of age were influenced by the sex of the twins, zygosity, and term at birth, with interactions observed between sex and zygosity, and sex and term at birth. Furthermore, although sex, zygosity, and term at birth differences in cognitive scores had been noted at the earlier ages studied, by 16 years of age these variables no longer were related to cognitive development. An examination of longitudinal relations for mental development and cognitive scores between 9 months and 16 years of age indicated that 16-year scores began to be predicted by scores obtained at 4 years of age.

The second report, by Ebeling, Porkka, Penninkilampi-Kerola, Berg, Jarvi, and Moilanen ("Inter-twin Relationships and Mental Health"), is a study of twins followed from pregnancy to 22–30 years of age. These findings demonstrated sex differences in co-twin dominance during development by physical, psychological, and verbal domains, varying by age, until adulthood. When the twins reached adulthood, they appeared to be equal in dominance. The sex of the co-twins was related to the interaction of dominance/

Address for correspondence: M. L. Riese, Louisville Twin Study, Department of Pediatrics, University of Louisville, Louisville, Kentucky 40292, USA. Email: mlries01@gwise.louisville.edu

submissiveness and depressive, nervous, and psychosomatic symptoms. Overall, more stress occurred when submissiveness was observed in relation to a female co-twin than to a male co-twin.

The third report, by Lange ("Coping Ability at Mid-life in Relation to Genetic and Environmental Influences at Adolescence"), is a study of twins and singletons followed from 10 to 16 years of age to 35 years of age. It was demonstrated that, during adolescence, there was a modest genetic influence on environmental variables. At 35 years of age coping ability was found to be influenced by both genetic and perceived family and school environmental variables. Longitudinal relations between environmental influences during adolescence and coping ability at 35 years of age were observed, with the prediction by specific environmental variables varying by sex.

The history of these projects is varied, but interesting because of the initial rationale for the inception of each, as well as for the age at which the twins first began participation in the projects. Alin Akerman had worked for many years to train teachers responsible for children with various disabilities. When visiting the schools and institutions to gather insight on teaching these children, she learned that many of them were twins whose co-twins were healthy and attending regular schools. Because she saw many twins who required special education, she became interested in learning if being a twin was a risk variable for the individual. At the same time she was approached by an obstetrician who was interested in learning about the experiences of parents expecting twins, especially those mothers who had to be hospitalized during the pregnancy. For these reasons, she began a study of women during their twin pregnancies. Thus, the twins were still in utero when the project began, and she saw the twins themselves in the hospital when they were between 5 and 7 days of age.

Moilanen's beginning was similar to that of Alin Akerman's. She was a neonatologist who was approached by obstetricians to participate in a study on the treatment of twin pregnancies and deliveries, the outcome of the twins, and the relation between twin outcome and the management of the twin delivery. After that, a suggestion was made for her to do a pediatric, developmental, and neurological follow-up of the twins between the ages of 2 and 10 years, and she has continued the program from there. Her sample also, therefore, were in utero at the start of the project, although her first interaction with the twins was between 2 and 10 years of age.

Lange had been asked in 1991 by a colleague to follow up on a sample of twins that had been part of the Swedish Longitudinal Twin Study (SLU) project since 1964. The data for the project had been saved in the Swedish national archives since the beginning of the project. Thus, even though Lange was not involved with the project since its inception, she was working with a sample of twins who had been participating in a project that was almost 30 years old. Her cohort were in their mid-30s at the 1991 follow-up.

Consequently, the overall interest regarding twins has varied across the projects. In addition to the pregnancy interests that Alin Akerman had in the beginning of her project, a primary interest has been to study the twins' cog-

nitive development at different ages, and to compare that development with the results for singletons of the same age. For Moilanen, the initial interests were health and development, and later expanded to include human relationships and mental health. Lange's main interest at the twins' age of 35 has been to study genetic/environmental influences on development for males and females. The outcomes of development were studied regarding physical growth, educational level, cognitive development and mathematical achievement, occupational status, and coping ability/psychosocial development.

Additionally, the variables of interest have changed during the course of following the samples of twins. Although there is interest in evaluating genetic effects, the focus of these studies also has been on behavioral, developmental, and health variables for the participants as twins. It is clear from the descriptions that follow that these investigators have administered comprehensive assessments in an effort to learn about twin development, and whatever special needs they and their families might have.

The most important variables for Alin Akerman have been the relation between term at birth, size for date, sex, and zygosity, with cognitive development in the twins. At early ages parenting of twins and general development of the twins were of interest, and with increasing age, focus was on the twins' adaptation to school, the co-twin relationship, personality and temperament, and the development of identity at 13 and 16 years of age.

For Moilanen the variables changed across development. During pregnancy and at birth, the focus was on the health of the mother and the twins. Between 2 and 10 years of age, interests included the twins' cognitive and physical development, health, temperament, neurological status, and whether they were favored by the mother or father. Between 12 and 20 years of age, development, mental and physical health, academic achievement, hobbies, inter-twin relationships, dependency, and dominance-submissiveness, psychosomatic symptoms, temperament, and depression were evaluated. Between 22 and 30 years of age, the focus was on academic achievements, health, depression, life circumstances, inter-twin and parent-twin relationships, psychosomatic symptoms, and a retrospective view of their relationships.

The variables of interest for Lange's population between 10 and 16 years of age were physical measurements, ability and achievement measures, self-ratings, school adjustment, and socioeconomic background. At 35 years of age the focus was on genetic and environmental influences on family and school life, on socioeconomic variables, on parenting practices and child perceptions of parenting practices, on coping ability, and on the interaction between coping ability and adolescent school experiences differentially for males and females.

Over the years, and for each period of assessment, these investigators have spent a great deal of time with their participants. The time that Alin Akerman spent with families has ranged from 4 to 6 hours each visit. For Moilanen, the time varied at each age. Between 2 and 10 years of age, her examinations took 1 hour, the EEG took one hour, and the psychologist's examination took 1 to 2 hours. Between 12 and 20 years of age, her examination and the other child

psychiatrist's examination each took 1½ hours. At 22 to 30 years of age, both she and the other psychiatrist spent 1½ hours with the twins. Lange's contact with her participants mainly was by mail and telephone.

The continuation of each of these studies would not have been possible without the perseverance of each of these principal investigators. Each, however, did have collaborators at different stages of the project. During the years of her study, Alin Akerman has collaborated with an obstetrician and a pediatrician. Moilanen had different collaborators during the different stages of her project as she herself was in changing roles, including obstetricians, a clinical psychologist, a pediatric neurologist, other psychiatrists, a pediatrician, and statisticians. Currently, Moilanen indicates that she is happy to have had the opportunity to be able to include this group of younger researchers and child psychiatrists in her research group. After picking up the SLU project, Lange collaborated with another psychologist who had been involved with the study for a number of years.

As all researchers involved in longitudinal studies are aware, one of the most difficult challenges of maintaining such a program is finding funding for it. These researchers all had some funds for their studies, but there were components for which they received no compensation. Alin Akerman has been funded by the Allmanna Barnhuset Foundation, a private foundation, for certain expenses, such as coding, statistical help, conference fees, and translations into English. She has received no funds for her own compensation, and most of her work has been done on her own time. Moilanen received funding from local foundations and from the University Hospital. Lange's work has been funded by the Stockholm Institute of Education, the Swedish Council for Social Research, and Pennsylvania State University.

Another crucial aspect of longitudinal research is the ability to maintain contact with the participants over long periods of time. Alin Akerman has been able to keep in

touch with her cohort because the families and then the twins themselves were glad to have contact with someone who knows something about twins and who also is interested in the twins' concerns. Some families call on their own to ask if it is time for another meeting yet. Moilanen has kept in touch with her cohort by mail. Finland's good population registry helps her keep track of the twins. Similarly, Lange used the system in Sweden which allows those with a special permit to get addresses of people from the Swedish Data Inspection Board. She did that when the twins were 35 years old.

These investigators have known the people in their studies for many years. What is striking is how these researchers express their feelings of a personal relationship with the twins in their programs. Not only have they learned a great deal about variables of interest to other researchers, but they have learned about the personal lives of their subjects, and have become sources of support for them. We hope that the relationships will continue for many years so that the rest of us can be beneficiaries of their dedication and perseverance.

Acknowledgment

We are extremely grateful to Dr. Richard Rose of Indiana University, Bloomington, Indiana, for his significant efforts in encouraging publication of papers from this symposium and reviewing these manuscripts.

References

- Alin Akerman, B., & Suurveen, E. (2003). The cognitive and identity development of twins at 16 years of age: A follow-up study of 32 twin pairs. *Twin Research*, 6, 328–333.
- Ebeling, H., Porkka, T., Penninkilampi-Kerola, V., Berg, E., Jarvi, S., & Moilanen, I. (2003). Inter-twin relationships and mental health. *Twin Research*, 6, 334–343.
- Lange, A-L. (2003). Coping ability at mid-life in relation to genetic and environmental influences at adolescence. *Twin Research*, 6, 344–350.