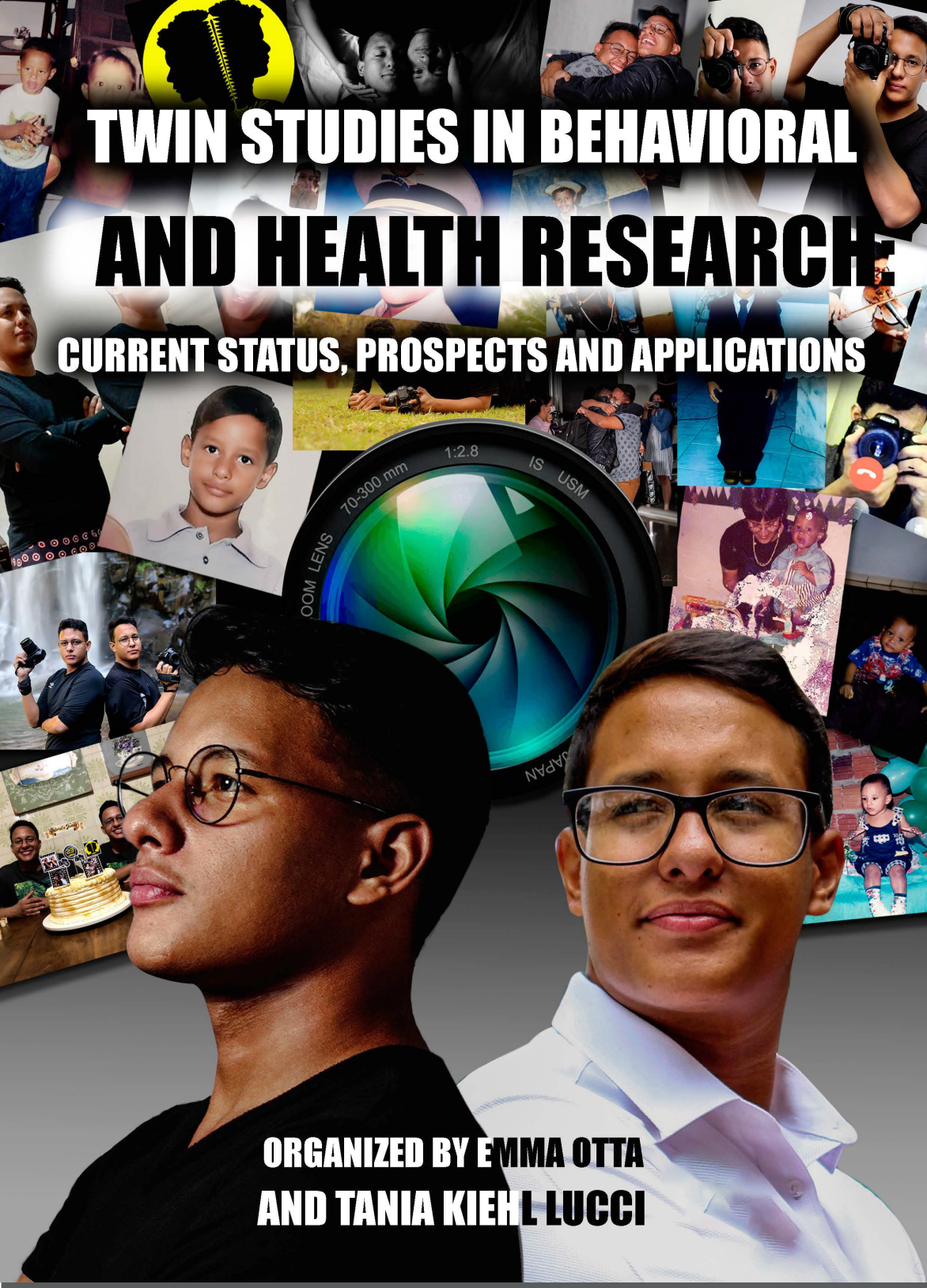

TWIN STUDIES IN BEHAVIORAL AND HEALTH RESEARCH

CURRENT STATUS, PROSPECTS AND APPLICATIONS

ORGANIZED BY EMMA OTTA
AND TANIA KIEHL LUCCI

DOI: 10.11606/9786587596167

Universidade de São Paulo
Reitor – Prof. Dr. Vahan Agopyan
Vice-Reitor – Prof. Dr. Antonio Carlos Hernandes
Pró-Reitor de Pesquisa – Prof. Dr. Sylvio Roberto Accioly Canuto
Pró-Reitor de Pós-Graduação – Prof. Dr. Carlos Gilberto Carlotti Júnior
Pró-Reitor de Pós-Graduação – Prof. Dr. Edmund Chada Baracat
Pró-Reitora de Cultura e Extensão Universitária – Profa. Dra. Maria Aparecida de Andrade Moreira Machado

Instituto de Psicologia
Diretora – Profa. Dra. Ana Maria Loffredo
Vice-Diretor – Prof. Dr. Gustavo Martineli Massola

Departamento de Psicologia Experimental
Chefe – Prof. Dr. Marcelo Fernandes Da Costa
Vice-Chefe – Prof. Dr. Marcelo Frota Lobato Benvenuti

Organizing Committee of the Twin Studies in Behavioral and Health Research: Current Status, Prospects and Applications
Profa. Dra. Emma Otta (IPUSP)
Profa. Dra. Patrícia Ferreira Monticelli (FFCLRP)
Prof. Dr. Claudio Possani (IME-USP)
Dra. Tania Kiehl Lucci (IPUSP)
Dr. Ricardo Prist (IPUSP)

Cover Photo: Tomaz Maranhão
Book formatting: Sofia Barbosa Lima
English Editing Services: Michael Germain and Lisa Burger, MC TRADUÇÕES S/S LTDA

Apoio:

Catalogação na publicação
Serviço de Biblioteca e Documentação
Instituto de Psicologia da Universidade de São Paulo

Twin studies in behavioral and health research: current status, prospects and aplications / Organized by Emma Otta e Tania Kiehl Lucci -- São Paulo, Instituto de Psicologia da Universidade de São Paulo, 2021.

170 p.

ISBN: **978-65-87596-16-7**

DOI: **10.11606/9786587596167**

1. Gêmeos. 2. Pesquisa comportamental. 3. Pesquisa em saúde. I. Otta, E., ed. II. Lucci, T. K., ed. III. Título.

Ficha elaborada por: Cristiane de Almeida Camara - CRB 5384/08

Chapter 7

Twin Relationships in Childhood: Effects of Zygosity, Age and Sex

Isabella França Ferreira, Tania Kiehl Lucci, Vinicius Frayze David, Emma Otta

The relationship between siblings is the most enduring in life, but has been less studied than that between parents and children (Dunn, 2014). Even less studied is the relationship between twin siblings. Twinship is a singular type of sibling relationship since children grow up with a constant presence of another individual of the same age and similar demands. A better knowledge of twin relationships by parents, teachers and counselors can promote healthier emotional development and improve decision making (Noble et al., 2017).

The classic twin design is considered an important methodological tool in understanding the genetic and environmental effects on human behavior (Knafo-Noam, Vertsbergez, & Israel, 2018). A comparison of monozygotic (MZ, virtually sharing all of their DNA sequence) and dizygotic twins (DZ, sharing an average of 50% of their genetic variability) is also informative for understanding the emergence of sibling relationships, considering that both types of twins develop in similar overlapping environments.

Twin studies have been inspired by developmental theories that emphasize proximal factors and evolutionary theories that focus on the ultimate causes of behavior (e.g., N. Segal, 1993, N. Segal et al., 2018, Vázquez et al., 2017). MZ twins are more altruistic (N. Segal et al., 1996), more cooperative, less competitive (N. Segal, 1984) and more likely to self-sacrifice for their co-twins (Tornero et al., 2018) than their DZ counterparts. Using a self-report scale, the Painel USP de Gêmeos [University of São Paulo Twin Panel] carried out a study on adult attachment between siblings, showing greater attachment between MZ than DZ twins and non-twins (Landenberger et al, 2021). From the perspective of ultimate causation (Hamilton, 1964), MZ twins, who are genetically identical, should be especially interested in supporting their co-twin and this perspective has been explored in several twin studies. From a proximate standpoint, MZ twins exhibit more similar psychological traits, which contribute to a more intense attachment

bond between them when compared to DZ twins. MZ twins share interests and abilities that contribute to establishing a closer relationship (Plomin et al., 2001; Tancredy & Fraley 2006; Landerberger et al. 2021).

Age is also a factor that influences the relationship between siblings. During childhood several prosocial skills are developed. Children become more aware of others' feelings and perspectives, understanding that these may differ from their own. These abilities are important elements for the development of interpersonal relationships (Eisenberg et al., 2015). Few studies have investigated the effect of age on twin relationships. Vandell et al. (1988) found that one-year-old same-sex twins interacted similarly with both their co-twins and peers. However, at three years old, they were more likely to interact with each other, compared to their peers.

Dyad sex-composition is another factor that may affect the quality of sibling relationships. Higher levels of negativity (physical aggression, arguing, and teasing) were reported by mothers of male twins when compared to female pairs and opposite-sex twins, but not by fathers (Mark et al., 2017). Fortuna et al. (2010) found that at age three, same-sex dizygotic (SS-DZ) girl dyads exhibited higher levels of closeness and lower levels of conflict than SS-DZ boy dyads. In opposite-sex twins (DZOP), girls were more dominant than boys, taking on a more active role in social relationships (Bryan, 1992). Based on adolescent twin self-reports, Penninkilampi-Kerola and Moilanen (2005) found that girls reported themselves as being more dependent on their co-twins than boys, regardless of the zygosity of the pair.

Although the relationship between twins can be assessed in several ways, there is a lack of validated instruments to evaluate twin relationships in their several dimensions. For a comprehensive overview, the Twin Relationship Questionnaire is an adequate approach, given that Closeness, Dependence, Conflict, Rivalry, and Dominance behaviors are assessed (Fortuna et al., 2010; H. Segal & Knafo-Noam, 2019). This instrument also allows intercultural comparisons. Since there are no studies on this perspective in Brazil, our goal is to examine the relationship between twins and compare it with a previous study (Fortuna et al., 2010).

Objectives and Hypotheses

Inspired by Fortuna et al. (2010), our aim was to investigate the influence of zygosity, age and dyad-sex composition on the dimensions of twin relationships (closeness, dependence, conflict, rivalry and dominance).

Our hypotheses were: a) monozygotic twins would be closer and more dependent than their dizygotic counterparts; b) male peers would be more conflictive, less close and less dependent than female peers; c) older children would be considered by their mothers to be closer than younger children; d) girls would be more dominant in opposite sex pairs than their brothers.

Methodology

Participants

The participants were 882 Brazilian mothers of one to twelve-year-old twins (N = 1764 twins). Mothers' mean age was 35.8 years (SD = 6.14). The majority of the sample lived in the Southeast (62.4%) or South of Brazil (24.2%), but there were respondents from all regions of the country (North=1.49%, Northeast=5.6%, Midwest=5.3%), and a small number of Brazilians living abroad (1%). Most respondents had high educational levels (High School = 35.4%, College = 23.5%, and Graduate Course = 35.1%).

The average age of the children was 4.56 years (SD = 2.72). According to the zygosity assessed by a questionnaire developed by Christiansen et al. (2003) and adapted for parental reports, 41.6 and 58.4% of the twins were MZ and DZ, respectively. With respect to MZ twin pairs, 49.9% were boys and 50.1% girls, while the DZ twin pairs consisted of 26.6% boys, 28.3% girls and 45.1% opposite-sex.

Instruments

Zygosity Questionnaire. To assess twin zygosity, we adapted for parental reports and translated the 4-item questionnaire (Christiansen et al., 2003) into Brazilian Portuguese, which has been used in the zygosity assessment of the Danish Twin Registry for more than half a century.

Twin Relationship Questionnaire. The original English version of the 22-item Twin Relationship Questionnaire was developed by Fortuna et al. (2010) and validated by H. Segal and Knafo-Noam (2019). The Brazilian Portuguese version is being validated by our group (Ferreira et al., in preparation). The twins' mothers rated the degree to which each item described each of their twins, using a 5-point Likert scale ranging from 1 = not characteristic at all to 5 = very characteristic.

Procedure

Respondents completed the Brazilian online version of the questionnaire, available on the Painel USP de Gêmeos website[3]. This study was approved by the Research Ethics Committee of the University of São Paulo's Institute of Psychology (CAAE: 79708517.8.0000.5561).

Data analysis

We performed data cleaning procedures with Excel. Initially, the dataset contained 937 mothers of twins, but 55 were excluded because their children were classified as unknown zygosity on Christiansen's Questionnaire, leaving 882 mothers and 1764 individual twins. Descriptive statistics of respondents' sociodemographic characteristics were calculated and the distribution of twin zygosity was examined.

The Linear Mixed Models (LMM) with restricted maximum likelihood (REML) was used to investigate the possible influence of zygosity, sex, and age on the latent variables of TRQ. Zygosity, sex and their interaction were included as fixed factors, age as a covariate and the responding mothers as a random factor. DZ and female were used as default. As in Fortuna et al. (2010), we started our analysis by comparing MZ and DZ same sex twins (DZSS) only, in order to unconfound the possible effects of sex composition. Because we were interested in dimensions with dyadic characteristics, we used dependence, closeness, conflict and rivalry as latent variables. Given that the dominance dimension is expected to have little to no inter-twin correlations (H. Segal & Knafo-Noam, 2019), it was not used in this model. For this dimension, we compared the dominance of females and males by applying Repeated Measures ANOVA on dizygotic opposite sex twins (DZOS). The analyses were conducted using Stata version 14.

Results

The values of each factor were calculated for the children using factor scores standardized as z-scores. For this analysis, we considered only MZ and DZSS for the dimensions Dependence, Closeness, Conflict and Rivalry. The LMM analysis of mothers' TRQ responses revealed a main effect of zygosity on Closeness, $t\ (1,1295) = 2.50$, $p = 0.012$, and Dependence, $t\ (1,1295) = 2.55$, $p = 0.011$, but not for Rivalry, $t\ (1,1295) = 0.18$, $p = 0.855$ or Conflict, $t\ (1,1295) = 1.62$, $p = 0.105$. LMM also revealed a significant main effect of age on Closeness,

[3] https://www.paineluspdegemeos.com.br/

t (1,1295) = 3.40, p = 0.001 and a marginally significant effect on Dependence, t (1,1295) = 1.91, p = 0.057. A main effect of sex was found for proximity, t (1,1295) = 2.00, p = 0.046 and conflict, t (1,1295) = 2.44, p = 0.015.

According to mothers' perception, MZ twins were closer than DZSS, β = 0.54 (CI: 0.12-0.96) more dependent on one another than DZSS, β = 0.48 (CI: 0.11-0.85). With respect to age, the older the children, the closer β = 0.10 (CI: 0.05-0.15) and more dependent β = 0.05 (CI: 0.01-0.055) they were perceived to be by their mothers. Mothers considered male twins to be less close, β = -0.44 (CI: 0.01-0.87) and more conflictive than their female counterparts, β = 0.54 (CI: 0.15-0.93). No interaction effects were found.

Although we did not analyze dominance in terms of zygosity for the reasons previously explained, a number of studies show that girls tend to be more dominant than their male twin in psychological aspects (Ebeling et al., 2003). Thus, we decided to analyze only the DZOP through a paired t-test. As expected, our results revealed that mothers considered girls to be more dominant than boys, t (1,231) = 11,508, p<0.001. The average difference was 2.23 SD (CI: 1.84-2.60).

Monozygotic twins exhibited greater covariance in all the dimensions, with the exception of dominance, demonstrating that they are more similar in the characteristics evaluated than dizygotic twins. The average increase in covariance of MZ twins was 30.8% for closeness, 22.7% for dependence, 22.4% for conflict, and 13.3% for rivalry.

Discussion

To encourage twin research from a psychological perspective in Brazil and throughout Latin America, we created the Painel USP de Gêmeos (The University of São Paulo Twin Panel) in 2017 at the USP Institute of Psychology (Otta et al., 2019).

In our study on twin relationships conducted with Brazilian mothers, MZ twin children were considered closer and more dependent than their DZ counterparts. These results are in accordance with previous studies (N. Segal, 2011; Fortuna et al., 2010). Differences in the relationships between MZ and DZ twin children can be explained by the Kin Selection Theory. This theory predicts that the greater the genetic similarity, the more altruistically an individual tends to behave toward another (i.e., close relatives), thereby contributing to increasing their inclusive fitness (Hamilton, 1964). This behavior is also associated with the similarity of psychological aspects, which contributes to a more intense attachment bond between MZ twins (Landenberger, 2021).

Additionally, MZ twin children showed greater covariance for proximity, dependence, rivalry and conflict than DZ twins. These results were expected since MZ share virtually 100% of their genes and therefore tend to be more similar in most temperamental and behavioral characteristics (Scott et al., 2016).

Our results showed that twins' proximity and dependence increased with age. Based on developmental patterns, it can be argued that children gradually develop abilities that are important for interpersonal relationships (Dumontheil et al., 2010), thereby improving their interpersonal skills from early childhood onwards. As in Vandell et al. (1988), our results showed that older siblings were considered closer by their mothers than their younger counterparts.

Considering same sex dyads, we found that boys were deemed less close and more conflictive than girls, regardless of their zygosity. We expected that girls would also be more dependent than boys, but this was not the case. This may have happened because our hypothesis was based on the results with adolescents (Penninkilampi-Kerola and Moilanen, 2005), and our study was with children. In addition, results regarding dominance in DZOP corroborate the findings of Ebeling et al. (2003), who explored the asymmetry of the twin relationship and found that girls were more dominant than boys in the psychological and verbal domains, before and during school age.

Conclusion

This was the first Brazilian study on twin relationships in childhood considering the five dimensions of TRQ. Similarly to studies conducted in other cultures, monozygotic twins were perceived by their mothers to be closer and more dependent than dizygotic twins, in line with the Kin Selection Theory. Our study also confirms that male peers were considered by their mothers to be more conflictive and less close than female peers. In addition, in opposite-sex pairs, the mothers reported that the girls were more dominant than the boys. In regard to age, our results showed that twins' proximity and dependence increased over time. The study of twin relationships is of great importance, especially in family and school contexts. Thus, understanding the peculiarities of the twin relationship dynamic will contribute to implementing better twin-related practices, as well as promoting policies that account for the specific needs of each pair and their well-being.

References

Bryan, E. M. (1992). *Twins and higher multiple births: A guide to their nature and nurture*. Edward Arnold.

Christiansen, L., Frederiksen, H., Schousboe, K., Skytthe, A., von Wurmb-Schwark, N., Christensen, K., & Kyvik, K. (2003). Age-and sex-differences in the validity of questionnaire-based zygosity in twins. *Twin Research and Human Genetics, 6(4)*, 275-278.

Dunn, J. (2014). Sibling relationships across the life-span. In Debbie Hindle & Susan Sherwin-White (Ed.) *Sibling Matters* (pp. 69-81). London: Routledge.

Dumontheil, I., Apperly, I. A., & Blakemore, S. J. (2010). Online usage of theory of mind continues to develop in late adolescence. *Developmental science, 13(2)*, 331-338.

Ebeling, H., Porkka, T., Penninkilampi-Kerola, V., Berg, E., Järvi, S., & Moilanen, I. (2003). Inter-twin relationships and mental health. *Twin Research and Human Genetics, 6(4),* 334-343.

Eisenberg, N., Spinrad, T. L., & Knafo-Noam, A. (2015). Prosocial development. In Lerner, R.M., & Lamb, M.E (Eds.). *Handbook of Child Psychology and Developmental Science* (pp. 1-47). New Jersey: Wiley.

Ferreira, I. F., Short, P. C. A., Lucci, T. K., David, V. F., Crispim, A. C., Reali, T., Marty, E. S., Rocha, V., Grinberg, A., Segal, N.L, Segal, H., Knafo-Noam, A., & Otta, E. Psychometric properties of the Brazilian version of the Twin Relationship Questionnaire (TRQ). (In preparation).

Fortuna, K., Goldner, I., & Knafo, A. (2010). Twin relationships: A comparison across monozygotic twins, dizygotic twins, and non twin siblings in early childhood. *Family Science, 1(3-4)*, 205-211.

Hamilton, W. D. (1964). The genetic evolution of human behaviour. *Journal of Theoretical Biology, 7(1)*, 1–52.

Knafo-Noam, A., Vertsberger, D., & Israel, S. (2018). Genetic and environmental contributions to children's prosocial behavior: brief

review and new evidence from a reanalysis of experimental twin data. *Current Opinion in Psychology, 20,* 60-65

Landenberger, R. O., Lucci, T. K., David, V. F., Ferreira, I. F., Fernandes, E. S., Segal, N., & Otta, E. (2021). Hierarchy of attachment figures among adult twins and non-twins. *Personality and Individual Difference, 170,* 110404.

Mark, K. M., Pike, A., Latham, R. M., & Oliver, B. R. (2017). Using twins to better understand sibling relationships. *Behavior Genetics, 47(2)*, 202-214.

Noble, N., Bradley, L., Parr, G., & Duemer, L. (2017). Fostering twins' identity development: A family issue. *The Family Journal, 25(4)*, 345-350.

Otta, E., Fernandes, E. S., Bueno, J. A., dos Santos, K. L., Segal, N. L., Lucci, T. K., …, Ribeiro, F. J. L. (2019). The University of São Paulo Twin Panel: Current status and prospects for Brazilian twin studies in behavioral research. *Twin Research and Human Genetics, 22(6)*, 467-474.

Penninkilampi-Kerola, V., Moilanen, I., & Kaprio, J. (2005). Co-twin dependence, social interactions, and academic achievement: A population-based study. *Journal of Social and Personal Relationships, 22(4)*, 519-541.

Scott, B. G., Lemery-Chalfant, K., Clifford, S., Tein, J. Y., Stoll, R., & Goldsmith, H. H. (2016). A twin factor mixture modeling approach to childhood temperament: Differential heritability. *Child development, 87(6)*, 1940-1955.

Slaughter, V. (2015). Theory of mind in infants and young children: A review. *Australian Psychologist, 50(3)*, 169-172.

Segal, H., & Knafo-Noam, A. (2019). The Twin Relationship Questionnaire: Testing a five-factor model from early to middle childhood. *European Journal of Psychological Assessment, 1(1)*, 1-13.

Segal, N. L. (1984). Cooperation, competition, and altruism within twin sets: A reappraisal. *Ethology and Sociobiology, 5(3)*, 163-177.

Segal, N. L. (1993). Twin, sibling, and adoption methods: Tests of evolutionary hypotheses. *American Psychologist, 48(9)*, 943-956.

Segal, N.L. (2011). Twin, adoption and family methods as approaches to the evolution of individual differences. In D.M. Buss & P. Hawley (Eds.). *The evolution of Personality and Individual Differences* (pp. 303-337). Oxford: Oxford University Press.

Segal, N. L., Connelly, S. L., & Topoloski, T. D. (1996). Twin children with unfamiliar partners: Genotypic and gender influences on cooperation. *Journal of Child Psychology and Psychiatry, 37(6)*, 731-735.

Segal, N. L., Montoya, Y. S., & Becker, E. N. (2018). Twins reared apart and twins in families: The findings behind the fascination. *Twin Research and Human Genetics, 21(4)*, 295-301.

Tornero, E., Sánchez-Romera, J. F., Morosoli, J. J., Vázquez, A., Gómez, Á., & Ordoñana, J. R. (2018). Altruistic behavior among twins. *Human Nature, 29(1)*, 1-12.

Vandell, D. L., Owen, M. T., Wilson, K. S., & Henderson, V. K. (1988). Social development in infant twins: Peer and mother-child relationships. *Child Development, 59(1)*, 168-177.

Vázquez, A., Gómez, Á., Ordoñana, J. R., Swann, W. B., & Whitehouse, H. (2017). Sharing genes fosters identity fusion and altruism. *Self and Identity, 16(6)*, 684-702.