



UvA-DARE (Digital Academic Repository)

Testing distributional assumptions in psychometric measurement models with substantive applications in psychology

Molenaar, D.

Publication date
2012

[Link to publication](#)

Citation for published version (APA):

Molenaar, D. (2012). *Testing distributional assumptions in psychometric measurement models with substantive applications in psychology*.

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

References

- Abad, F. J., Colom, R., Juan-Espinosa, M., & Garcia, L. F. (2003). Intelligence differentiation in adult samples. *Intelligence, 31*, 157-166.
- Agresti, A. (2002). *Categorical Data Analysis* (2nd ed.). New York: Wiley.
- Anderson, M. (1992). *Intelligence and development: A cognitive theory*. Oxford, England: Blackwell.
- Ansari, A., Jedidi, K., & Dube, L. (2002). Heterogeneous factor models: A Bayesian approach. *Psychometrika, 67*, 49–78.
- Arden, R., & Plomin, R. (2007). Scant evidence for Spearman's law of diminishing returns in middle childhood. *Personality and Individual Differences, 42*, 743-753.
- Arnold, B. & Beaver, R. (2002). Skewed multivariate models related to hidden truncation and/or selective reporting. *Test, 11*, 7-54.
- Arnold, B. C., Beaver, R. J., Groeneveld, R. A., & Meeker, W. Q. (1993). The nontruncated marginal of a truncated bivariate normal distribution. *Psychometrika, 58*, 471–188.
- Asch, S. E. (1936). A study of change in mental organization. *Archives of Psychology Columbia University, 195*, 30.
- Asparouhov, T. (2005). Sampling weights in latent variable modeling. *Structural equation modeling, 12*, 411-434.
- Austin, E. J., Deary, I. J., & Gibson, G. J. (1997). Relationships between ability and personality: Three hypotheses tested. *Intelligence, 25*, 49–70.
- Austin, E.J., Hofer, S.M., Deary, I.J., & Eber, H.W. (2000). Interactions between intelligence and personality: results from two large samples. *Personality and Individual Differences, 29*, 405-427.
- Azzalini, A. & Dalla Valle, A. (1996). The multivariate skew-normal distribution. *Biometrika, 83*, 715–726.
- Azzalini, A. (1985). A class of distributions which includes the normal ones. *Scandinavian Journal of Statistics, 12*, 171-178.
- Azzalini, A. (1986). Further results on a class of distributions which includes the normal ones. *Statistica, 46*, 199-208.
- Azzalini, A. (2005). The skew-normal distribution and related multivariate families. *Scandinavian Journal of Statistics, 32*, 159-188.
- Azzalini, A. & Capatano, A. (1999). Statistical applications of the multivariate skew normal distribution. *Journal of the Royal Statistical Society. Series B, 61*, 579-602.
- Azevedo, C.L.N., Bolfarine, H., & Andrade, D.F. (2011). Bayesian inference for a skew-normal IRT model under the centred parameterization. *Computational Statistics and Data Analysis, 55*, 353-365.
- Bartels, M., van Beijsterveldt, C.E.M., & Boomsma, D.I. (2009a). Breast feeding, maternal education, and cognitive function: a prospective study in twins. *Behavior genetics, 39*, 616-622.

- Bartels, M., & Boomsma, D.I. (2009b). Born to be happy? The etiology of subjective well-being. *Behavior Genetics*, *39*, 605-615.
- Bartholomew, D.J., Deary, I.J., & Lawn, M. (2009). A New Lease of Life for Thomson's Bonds Model of Intelligence. *Psychological Review*, *116*, 567-579.
- Bauer, D.J. (2005a). The Role of Nonlinear Factor-to-Indicator Relationships in Tests of Measurement Equivalence. *Psychological Methods*, *10*, 305-316.
- Bauer, D.J. (2005b). A Semiparametric Approach to Modeling Nonlinear Relations Among Latent Variables. *Structural Equation Modeling*, *12*, 513-535.
- Bauer, D.J. & Hussong, A.M. (2009). Psychometric approaches for developing commensurate measures across independent studies: Traditional and new models. *Psychological Methods*, *14*, 101-125.
- Baumeister, R.E. & Tice, T.M. (1988). Metatraits. *Journal of personality*, *56*, 571-598.
- Bazán, J. L., Bolfarine, H. & Branco, D. M. (2004). *A new family of asymmetric models for item response theory: A Skew-Normal IRT Family*. Technical report (RT-MAE-2004-17). Department of Statistics. University of São Paulo.
- Bázan, J.L., Branco, M. D., & Bolfarine, H. (2006). A skew item response model. *Bayesian Analysis*, *1*, 861-892.
- Bickley, P. G., Keith, T. Z., & Wolf, L. M. (1995). The three-stratum theory of cognitive abilities: Test of the structure of intelligence across the life span. *Intelligence*, *20*, 309-328.
- Birnbaum, A. (1968). Some latent trait models and their use in inferring an examinee's ability. In E M. Lord & M. R. Novick (Eds.), *Statistical theories of mental test scores* (chap. 17-20), Reading, MA: Addison Wesley.
- Bloom, A. S., Allard, A. M., Zelko, F. A., Brill, W. J., Topinka, C.W., & Pfohl, W. (1988). Differential validity of the K-ABC for lower functioning preschool children versus those of higher ability. *American Journal on Mental Retardation*, *93*, 273-277.
- Bock, R.D. (1972). Estimating item parameters and latent ability when responses are scored in two or more nominal categories. *Psychometrika*, *37*, 29-51.
- Bock, R. D., & Aitkin, M. (1981). Marginal maximum likelihood estimation of item parameters: Application of an EM algorithm. *Psychometrika*, *46*, 443-459.
- Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.
- Bollen, K. A. (1996). A limited-information estimator for LISREL models with or without heteroscedastic errors. In G. A. Marcoulides & R. E. Schumacker (Eds.), *Advanced structural equation modeling: Issues and techniques*, 227-241. Mahwah, NJ: Erlbaum.
- Bollen, K.A., & Stine, R.A. (1993). Bootstrapping goodness-of-fit measures in structural equation models. In: K.A. Bollen & J.S. Long (Eds). *Testing structural equation models* (pp. 111-135). Newbury Park, CA: Sage.
- Bonaccio, S., & Reeve, C.L. (2006). Differentiation of cognitive abilities as a function of neuroticism level: A measurement equivalence/invariance analysis. *Intelligence*, *34*, 403-417.

- Boomsma, D. I., de Geus, E. J. C., van Baal, G. C. M., & Koopmans, J. M. (1999). A religious upbringing reduces the influence of genetic factors on disinhibition: Evidence for interaction between genotype and environment on personality. *Twin Research*, 2, 115–125.
- Boomsma, D. I., Vink, J. M., van Beijsterveldt, T. C., de Geus, E. J., Beem, A. L., Mulder, E. J., Derks, E. M., et al. (2002). Netherlands Twin Register: A focus on longitudinal research. *Twin Research*, 5, 401–406.
- Boomsma, D. I., & Martin, N. G. (2002). Gene–environment interactions. In H. D’haenen, J. A. den Boer, P. Willner, *Biological Psychiatry* (pp. 181–187). New York: Wiley.
- Borsboom, D. (2008). Latent variable theory. *Measurement*, 6, 25–53.
- Borsboom, D., & Dolan, C.V. (2006). Why g is not an adaptation: A comment on Kanazawa (2004). *Psychological Review*, 113, 433–437.
- Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. New York: Basic Books.
- Brand, C.R. (1984). Intelligence and inspection time: An ontogenic relationship? In C.J. Turner & H.B. Miles (Eds.). *The biology of human intelligence*. Humberside, England: Nafferton.
- Brendgen, M., Vitaro, F., Boivin, M., Girard, A., Bukowski, W.M., Dionne, G. et al., (2009). Gene-environment interplay between peer rejection and depressive behavior in children. *Journal of Child Psychology and Psychiatry*, 50, 1009–1017.
- Browne, M. W. (1984). Asymptotically distribution-free methods for the analysis of covariance structures. *British Journal of Mathematical and Statistical Psychology*, 37, 62–83.
- Brody, N. (1992). *Intelligence*. San Diego: Academic Press.
- Buse, A. (1982). The likelihood ratio, Wald, and Lagrange multiplier tests: An expository note. *American Statistician*, 36, 153–157.
- Byrne, B. M. & Stewart, S. M. (2006). The MACS Approach to Testing for Multigroup Invariance of a Second-Order Structure: A Walk Through the Process. *Structural Equation Modelling*, 13, 287–321
- Carlstedt, B. (2001). Differentiation of cognitive abilities as a function of level of general intelligence: A latent variable approach. *Multivariate Behavioral Research*, 36, 589–609.
- Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. Cambridge: Cambridge University Press.
- Chiogna, M. (2005). A note on the asymptotic distribution of the maximum likelihood estimator for the scalar skew-normal distribution. *Statistical Methods & Applications*, 14, 331–34.
- Chen, M.-H., Dey, D. K., and Shao, Q. M. (1999). A New Skewed Link Model for Dichotomous Quantal Response Data. *Journal of the American Statistical Association*, 94, 1172–1186.
- Christofferson, A. (1975). Factor analysis of dichotomized variables. *Psychometrika* 40, 5–32.

- Clark, M. P. (1944). Changes in primary mental abilities with age. *Archives of Psychology Columbia University*, 291, 30.
- Cohen, J. (1983). The cost of dichotomization. *Applied Psychological Measurement*, 7, 249-253.
- Colom, R., Garcia, L. F., Juan-Espinosa, M., & Abad, F. J. (2002). Null sex differences in general intelligence: Evidence from the WAIS-III. *The Spanish Journal of Psychology*, 5, 29– 35.
- Costa, P.T., Jr. & McCrae, R.R. (1992). *NEO PI-R*. Odessa, FL: Florida Psychological Assessment Resources.
- Cox, D.R. & Small, N.T.H. (1978). Testing Multivariate Normality. *Biometrika*, 65, 263-272.
- Cramer, A.O.J., van der Sluis, S., Franić, S., Epskamp, S., Noordhof, A., Aggen, S.H., et al. (2011). *Dimensions of normal personality as networks in search of equilibrium: You can't like parties if you don't like people*. Manuscript in preparation.
- Cramer, A. O. J., Waldorp, L. J., Van der Maas, H. L. J., & Borsboom, D. (2010). Comorbidity: a network perspective. *Behavioral and Brain Sciences*, 33, 137–193.
- Cramér, H. (1937). *Random Variables and Probability Distributions*. Cambridge University Press, Cambridge.
- Cramér, H. (1946). *Mathematical Methods of Statistics*. Princeton, NJ: Princeton University Press.
- Curran, P.J., West, S.G., & Finch, J.F. (1996). The Robustness of Test Statistics to Nonnormality and Specification Error in Confirmatory Factor Analysis. *Psychological Methods*, 1, 16-29.
- Czado, C. & Santner, T. J. (1992). The Effect of Link Misspecification on Binary Regression Inference. *Journal of Statistical Planning and Inference*, 33, 213-231.
- Deary, I. J., Egan, V., Gibson, G. J., Austin, E. J., Brand, C. R., & Kellaghan, T. (1996). Intelligence and the differentiation hypothesis. *Intelligence*, 23, 105–132.
- Detterman, D. K., & Daniel, M. H. (1989). Correlations of mental tests with each other and with cognitive variables are highest for the low IQ groups. *Intelligence*, 13, 349–359.
- Dick, D.M., Bernard, M., Aliev, F., Viken, R., Pulkkinen, L., Kaprio, J., & Rose, R.J. (2009). The role of socioregional factors in moderating genetic influences on early adolescent behavior problems and alcohol use. *Alcoholism: Clinical and Experimental Research*, 33, 17-39-1748.
- Digman, J.M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41, 417-440.
- Distel, M.A., Rebollo-Mesa, I., Abellaoui, A., Derom, C.A., Willemsen, G., Cacioppo, J.T., & Boomsma, D.I. (2010). Family resemblance for loneliness. *Behavior Genetics*, 40, 480-494.

- Dolan, C.V. (1994). Factor analysis of variables with 2, 3, 5 and 7 response categories: A comparison of categorical variable estimators using simulated data. *British Journal of Mathematical and Statistical Psychology*, *47*, 309-326.
- Dolan, C. V. (2000). Investigating Spearman's hypothesis by means of multi-group confirmatory factor analysis. *Multivariate Behavioral Research*, *35*, 21– 50.
- Dolan, C.V., Colom, R., Abad, F.J., Wicherts, J.M., Hessen, D.J., & van der Sluis, S. (2006). Multi-group covariance and mean structure modeling of the relationship between WAIS-III common factors and gender and educational attainment in Spain. *Intelligence*, *34*, 193-210.
- Dolan, C. V., & Hamaker, E. L. (2001). Investigating Black–White differences in psychometric IQ: Multi-group confirmatory factor analyses of the WISC-R and K-ABC and a critique of the method of corrected factors. In F. Columbus (Ed.), *Advances of Psychological Research*, *6*, 31–59. Huntington: Nova Science.
- Dolan, C. V., Roorda, W., & Wicherts, J. M. (2004). Two failures of Spearman's hypothesis: The GATB in Holland and the JAT in South Africa. *Intelligence*, *32*, 155–173.
- Dolan C.V., van der Sluis, S., & Grasman R. (2005). A note on normal theory power calculation in SEM with data missing completely at random. *Structural Equation Modeling*, *12*, 245–262.
- Eaves, L.J. (2006) Genotype x environment interaction in psychopathology: Fact or Artifact? *Twin research and human genetics*, *9*, 1-8.
- Eichler, E.E., Flint, J., Gibson, G., Kong, A., Leal, S.M., Moore, J.H., & Nadeau, J.H. (2010). Missing heritability and strategies for finding the underlying causes of complex disease. *Nature Reviews Genetics*, *11*, 446-450.
- Emons, W.H., Meijer R.R., & Denollet. J. (2007). Negative affectivity and social inhibition in cardiovascular disease: Evaluating type-D personality and its assessment using item response theory. *Journal of Psychosomatic Research*, *63*, 27–39.
- Etezadi-Amoli, J., & McDonald, R. P. (1983). A second generation nonlinear factor analysis. *Psychometrika*, *48*, 315–342.
- Evans, D.M., Gillespie, N.A., & Martin, N.G. (2002). Biometrical genetics. *Biological Psychology*, *1-2*, 33–51.
- Facon, B. (2004). Are correlations between cognitive abilities highest in low-IQ groups during childhood? *Intelligence*, *32*, 391-401.
- Facon, B. (2006). Does age moderate the effect of IQ on the differentiation of cognitive abilities during childhood? *Intelligence*, *34*, 375–386.
- Facon, B. (2008). How does the strength of the relationships between cognitive abilities evolve over the life span for low-IQ vs high-IQ adults? *Intelligence*, *36*, 339-349.
- Filella, J. F. (1960). Educational and sex differences in the organization of abilities in technical and academic students in Colombia, South America. *Genetic Psychology Monographs*, *61*, 115–163.
- Finkel, D., Pedersen, N.L., McGue, M., & McClearn, G.E. (1995). Heritability of Cognitive Abilities in Adult Twins: Comparison of Minnesota and Swedish Data. *Behavior Genetics*, *25*, 421-431.

- Fisher, R.A. (1928). The general sampling distribution of the multiple correlation coefficient. *Proceedings of the royal society series A*, 121, 654–673.
- Flora, D.B., & Curran, P.J. (2004). An Empirical Evaluation of Alternative Methods of Estimation for Confirmatory Factor Analysis With Ordinal Data. *Psychological Methods*, 9, 466-491.
- Fogarty, G. J., & Stankov, L. (1995). Challenging the “Law of Diminishing Returns”. *Intelligence*, 21, 157-174.
- Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item response theory analysis of selfreport measures of adult attachment. *Journal of Personality and Social Psychology*, 78, 350-365.
- Franić, S., Dolan, C.V., Borsboom, D., Hudziak, J.J., van Beijsterveldt, C.E.M., & Boomsma, D.I. (2011). *Can Genetics Help Psychometrics? Improving Dimensionality Assessment through Genetic Factor Modeling*. Manuscript submitted for publication.
- García, L.F., Ruiz, M.Á., & Abad, F.J. (2003) Factor structure of the Spansih WAIS III. *Psicothema*, 15, 155-160.
- Garrett, H. E. (1946). A developmental theory of intelligence. *American Psychologist*, 1, 278–372.
- Gignac, G. E. (2008). Higher-Order Models Versus Direct Hierarchical Models: *g* as Superordinate or Breadth Factor? *Psychology Science*, 50, 21-43.
- Gottfredson, L.S. (1997). Why *g* matters: The complexity of everyday life. *Intelligence*, 24, 79-132.
- Grant, M.D., Kremen, W.S., Jacobson, K.C., Franz, C., Xian, H., Eisen, S.A., et al. (2010). Does parental education have a moderating effect on the genetic and environmental influences of general cognitive ability in early adulthood? *Behavior Genetics*, 40, 438-446.
- Guadagnoli, E, & Mor, V. (1989). Measuring cancer patients’ affect: Revision and psychometric properties of the Profile of Mood States (POMS). *Psychological Assessment*, 1, 150–154.
- Gustaffson, J.-E. (1984). A Unifying Model for the Structure of Intellectual Abilities. *Intelligence*, 8, 179-203.
- Gustafsson, J. E. (1992). The relevance of factor analysis for the study of group differences. *Multivariate Behavioral Research*, 27, 239–247.
- Gustafsson, J.-E., & Balke, G. (1993). General and specific abilities as predictors of school achievement. *Multivariate Behavioral Research*, 28, 407–434.
- Hancock, G. R., Lawrence, F. R., & Nevitt, J. (2000). Type I error and power of latent mean methods and MANOVA in factorially invariant and noninvariant latent variable systems. *Structural Equation Modeling*, 7, 534-556.
- Harden, K.P., Turkheimer, E., & Loehlin, J.C. (2007). Genotype by environment interaction in adolescents’ cognitive aptitude. *Behavior Genetics*, 37, 273–283.
- Harvey, A.C. (1976). Estimating regression models with multiplicative heteroscedasticity. *Econometrica*, 44, 461-465.
- Hartmann, P. (2006). *Investigating Spearman's "Law of Diminishing Returns"*. Unpublished PhD thesis, University of Aarhus, Denmark, Aarhus.

- Hartmann, P., & Reuter, M. (2006). Spearman's "Law of Diminishing Returns" tested with two methods. *Intelligence*, *34*, 47-62.
- Hartmann, P., & Teasdale, T.W. (2004). A test of Spearman's "Law of Diminishing Returns" in two large samples of Danish military draftees. *Intelligence*, *32*, 499-508.
- Haworth, C.M.A, Wright, M.J., Luciano, L., Martin, N.G., de Geus, E.J.C., van Beijsterveldt, C.E.M., et al. (2010). The heritability of general cognitive ability increases linearly from childhood to young adulthood. *Molecular Psychiatry*, *15*, 1112-1120.
- Heath, A. C., Eaves, L. J., & Martin, N. G. (1998). Interaction of marital status and genetic risk for symptoms of depression. *Twin Research*, *1*, 119-122.
- Hessen, D.J. & Dolan, C.V. (2009). Heteroscedastic one-factor models and marginal maximum likelihood estimation. *British journal of mathematical and statistical psychology*, *62*, 57-77.
- Hicks, B.M., DiRago, A.C., Iacono, W.G., & McGue, M. (2009a). Gene-environment interplay in internalizing disorders: consistent findings across six environmental risk factors. *Journal of Child Psychology and Psychiatry*. *50*, 1309-1317.
- Hicks, B.M., South, S.C., DiRago, A.C., Iacono, W., & McGue, M. (2009b). Environmental adversity and increasing genetic risk for externalizing disorders. *Archives of General Psychiatry*, *66*, 640-648.
- Holzinger, K. J., & Swineford, E (1937). The bi-factor method. *Psychometrika*, *2*, 41-54.
- Horn, J. L. (1970). Organization of data on life-span development of human abilities. In L.R. Goulet & P. B. Baltes (Eds.), *Life-span developmental psychology: Research and theory* (pp. 423-466). New York: Academic Press.
- Horn, J. L. (1997). On the mathematical relationship between factor or component coefficients and differences in means. *Cahiers de Psychologie Cognitive*, *16*, 721-728.
- Horn, J. L., & Donaldson, G. (1980). Cognitive development in adulthood. In O. G. Brim & J. Kagan (Eds.), *Constancy and change in human development* (pp. 445-529). Cambridge, MA: Harvard University Press
- Horn, J. L., & Noll, J. (1994). A system for understanding cognitive capabilities: A theory and evidence on which it is based. In D. K. Detterman (Ed.), *Current topics in human intelligence: Theories of intelligence* (Vol. 4, pp. 151-204). Norwood, NJ.
- Irwing, P. (2007, December). A two stage procedure for locating group differences in latent means of higher-order factor models. Paper presented at the meeting of the International Society for Intelligence Research, Amsterdam, The Netherlands.
- Jaccard, J., Turrissi, R., & Wan, C. K. (1990). *Interaction effects in multiple regression*. Newbury Park, CA: Sage.
- Jaccard, J. & Wan, C.K. (1995). Measurement error in the analysis of interaction effects between continuous predictors using multiple regression: Multiple indicator and structural equation approaches. *Psychological Bulletin*, *117*, 348-357.

- Jensen, A. R. (1998). *The g factor: The science of mental ability*. Westport, CT: Praeger.
- Jensen, A. R. (2003). Regularities in Spearman's law of diminishing returns. *Intelligence*, *31*, 95-105.
- Jinks, J. L., & Fulker, D. W. (1970). Comparison of the biometrical genetical, mava, and classical approaches to the analysis of human behavior. *Psychological Bulletin*, *73*, 311-349
- Johnson, W. & Bouchard, T.J. (2004). The structure of human intelligence: It is verbal, perceptual, and image rotation (VPR), not fluid and crystallized. *Intelligence*, *33*, 393-416.
- Johnson, W., Bouchard, T.J., Krueger, R.F., McGue, M., & Gottesman, I.I. (2004). Just one g: consistent results from three test batteries. *Intelligence*, *32*, 95-107.
- Johnson, W., Deary, I.J, & Iacono, W.G. (2009). Genetic and environmental transactions underlying educational attainment. *Intelligence*, *37*, 466-478.
- Johnson, W., & Krueger, R.F. (2005). Genetic Effects on Physical Health: Lower at Higher Income Levels. *Behavior Genetics*, *35*, 579-590.
- Johnson, W., McGue, M., & Iacono, W.G. (2009). School performance and genetic and environmental variance in antisocial behaviour at the transition from adolescence to adulthood. *Developmental Psychology*, *45*, 973-987.
- Johnson, W., Kyvik, K.O., Mortensen, E.L., Skytthe, A., Batty, G.D., & Deary, I.J. (2010). Education reduces the effects of genetic susceptibilities to poor physical health. *International Journal of Epidemiology*, *39*, 406-414.
- Jöreskog, K. G. (1971). Simultaneous factor analysis in several populations. *Psychometrika*, *36*, 409-426.
- Jöreskog, K.J. (2002). Structural equation modeling with ordinal variables using LISREL. (Scientific Software International Inc.) Retrieved November 3, 2010, from: <http://www.ssicentral.com/lisrel/techdocs/ordinal.pdf>.
- Jöreskog, K. G., Sörborm, D., du Toit, S., & du Toit, M. (1999). *LISREL 8: New statistical features*. Chicago: Scientific Software.
- Juan-Espinosa, M., Garcia, L., Colom, R., & Abad, F. J. (2000). Testing the age related differentiation hypothesis through the Wechsler's scales. *Personality and Individual Differences*, *29*, 1069-1075.
- Juan-Espinosa, M., Garcia, L.F., Escorial, S., Rebollo, I., Colom, R., & Abad, F.J. (2002). Age dedifferentiation hypothesis: Evidence from the WAIS-III. *Intelligence*, *30*, 395-408.
- Kaplan, D., & George, R. (1995). A study of the power associated with testing factor mean differences under violations of factorial invariance. *Structural Equation Modeling*, *2*, 101-118.
- Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman assessment battery for children second edition: Technical manual*. Circle Pines, MN: American Guidance Service.
- Kelderman, H. & Molenaar, P.C.M. (2007). The effect of individual differences in factor loadings on the standard factor model. *Multivariate behaviour research*, *42*, 435-456.
- Kendler, K.S. (2001). Twin studies of psychiatric illness: an update. *Archives of General Psychiatry*, *58*, 1005-1014.

- Kendler, K. S., Heath, A. C., Martin, N. G., & Eaves, L. J. (1987). Symptoms of anxiety and depression: Same genes, different environments? *Archives of General Psychiatry* 44, 451-457.
- Keselman, H. J. & Lix, L. M. (1997). Analyzing multivariate repeated measures designs when covariance matrices are heterogeneous. *British Journal of Mathematical and Statistical Psychology*, 50, 319-338.
- Kenny, D. A., & Judd, C. M. (1984). Estimating the nonlinear and interactive effects of latent variables. *Psychological Bulletin*, 96, 201-210.
- Kirisci, L., Hsu, T., & Yu, L. (2001). Robustness of Item Parameter Estimation Programs to Assumptions of Unidimensionality and Normality. *Applied psychological measurement*, 25, 146-162.
- Klein, A. & Moosbrugger, H. (2000). Maximum likelihood estimation of latent interaction effects with the LMS method. *Psychometrika*, 65, 457-474.
- Lawley, D. N. (1943). The application of the maximum likelihood method to factor analysis. *British Journal of Psychology*, 33, 172-175.
- Lawley, D. N., & Maxwell, A. E. (1971). *Factor analysis as a statistical method*. New York: American Elsevier.
- Lee, S.-Y., & Zhu, H.-T. (2002). Maximum likelihood estimation of nonlinear structural equation models. *Psychometrika*, 67, 189-210.
- Lenroot, R.K., Schmitt, J.E., Ordaz, S.J., Wallace, G.L., Neale, M.C., Lerch, J.P. et al (2009). Differences in genetic and environmental influences on the human cerebral cortex associated with development during childhood and adolescence. *Human Brain Mapping*, 30, 163-174.
- Lewin-Koh, S., & Amemiya, Y. (2003). Heteroscedastic factor analysis. *Biometrika*, 90, 85-97.
- Li, S.-C., Lindenberger, U., Hommel, B., Aschersleben, G., Prinz, W., & Baltes, P. B. (2004). Transformations in the couplings among intellectual abilities and constituent cognitive processes across the life span. *Psychological Science*, 15, 155-163.
- Loehlin, J. C. (2000). Group differences in intelligence. In R. J. Sternberg (Ed.), *Handbook of intelligence* (pp. 176-198). Cambridge University Press.
- Loehlin, J. C., & Nichols, P. L. (1976). *Heredity, environment, and personality: A set of 850 twins*. Austin: University of Texas Press.
- Long, J.S. & Ervin, L.H. (2000). Using Heteroscedasticity Consistent Standard Errors in the Linear Regression. *American Statistician*, 54, 217-224.
- Lord, F.M. (1952). *A theory of test scores* (Psychometric Monograph No. 7). Iowa City, IA: Psychometric society.
- Lubke, G.H., Dolan, C.V., & Kelderman, H.(2001). Investigating group differences using Spearman's hypothesis: An evaluation of Jensen's method, *Multivariate Behavioral Research*, 36, 299-324.

- Lunn, D.J., Thomas, A., Best, N., and Spiegelhalter, D. (2000) WinBUGS -- a Bayesian modelling framework: concepts, structure, and extensibility. *Statistics and Computing*, 10, 325–337.
- Lynn, R. (1994). Sex differences in intelligence and brain size: A paradox resolved. *Personality and Individual Differences*, 17, 257–271.
- Lynn, R. (1999). Sex differences in intelligence and brain size: A developmental theory. *Intelligence*, 27, 1–12.
- van der Maas, H.L.J., Dolan, C.V., Grasman, R.P.P.P, Wicherts, J.M., Huizenga, H.M., & Raijmakers, M.E.J. (2006). A dynamical model of general intelligence: The positive manifold of intelligence by mutualism. *Psychological Review*, 113, 842–861.
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, 7, 19–40.
- Mackintosh, N. J. (1998). *IQ and human intelligence*. Oxford, England: Oxford
- Maher B (2008) The case of the missing heritability. *Nature*, 456, 18–21.
- Manolio TA, Collins FS, Cox NJ, Goldstein DB, Hindorff LA, et al. (2009). Finding the missing heritability for complex diseases. *Nature Reviews Genetics*, 461, 747–753.
- Mardia, K.V. (1970). Measures of multivariate skewness and kurtosis with applications. *Biometrika*, 57, 519-530.
- Markus, H. (1977). Self-Schemata and Processing Information About the Self. *Journal of personality and social psychology*, 35, 63-78.
- Masters, G.N. (1982). A Rasch model for partial credit scoring. *Psychometrika*, 47, 149-174.
- Mather, K. (1973). *Genetical Structure of Populations*. London: Chapman & Hall.
- Maxwell, S. E., & Delaney, H. D. (1993). Bivariate median splits and spurious statistical significance. *Psychological Bulletin*, 113, 181–190.
- McArdle, J. & Goldsmith, H. H. (1984). Structural equation modeling applied to the twin design: Comparative multivariate models of the WAIS. *BehaviorGenetics* 14, 609.
- McCaffery, J.M., Padandonatos, G.D., Lyons, M.J., & Niaura, R. (2008). Educational attainment and the heritability of self-reported hypertension among male Vietnam-era twins. *Psychosomatic Medicine*, 70, 781-786.
- McCaffery, J.M., Padandonatos, G.D., Bond, D.S., Lyons, M.J., & Wing, R.R. (2009). Gene x environment interaction of vigorous exercise and body mass index among male Vietnam-era twins. *American Journal of Clinical Nutrition*, 89, 1011-1018.
- McDonald, R.P. (1962). A general approach to nonlinear factor analysis. *Psychometrika*, 27, 392-415.
- McDonald, R. P. (1967). *Nonlinear factor analysis* (Psychometric Monograph No. 15). Richmond, VA: William Byrd Press.
- McDonald, R.P. (1999). *Test theory: A unified treatment*. Mahwah, NJ: Lawrence Erlbaum.
- McGue, M. (1997). The democracy of the genes. *Nature*, 388, 417-418.
- Medland, S.E., Neale, M.C, Eaves, L.J., & Neale, B.M. (2009). A note on the parameterization of Purcell's GxE model for ordinal and binary data. *Behaviour genetics*, 39, 220-229.

- Mehta, P.D. & Neale, M.C. (2005). People Are Variables Too: Multilevel Structural Equations Modeling. *Psychological Methods, 10*, 259–284.
- Mehta, P.D., Neale, M.C. & Flay, B.R. (2004). Squeezing interval change from ordinal panel data: Latent growth curves with ordinal outcomes. *Psychological Methods, 9*, 301–333.
- Meijer, E., & Mooijaart, A. (1996). Factor analysis with heteroscedastic errors. *British Journal of Mathematical and Statistical Psychology, 49*, 189–202.
- Mellenbergh, G. J. (1989). Item bias and item response theory. *International Journal of Educational Research, 13*, 127–143.
- Mellenbergh, G. J. (1994). A unidimensional latent trait model for continuous item responses. *Multivariate Behavioral Research, 29*, 223–236.
- Mellenbergh, G.J. (1994). Generalized linear item response theory. *Psychological Bulletin, 115*, 300–307.
- Meredith, W. (1964). Notes on factorial invariance. *Psychometrika, 29*, 177–185.
- Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika, 58*, 525–543.
- Micceri, T. (1989). The unicorn, the normal curve and other improbable creatures. *Psychological Bulletin, 105*, 156–166.
- Millsap, R. E. (1997). The investigation of Spearman’s hypothesis and the failure to understand factor analysis. *Cahiers de Psychologie Cognitive, 16*, 750–757.
- Molenaar, D. (2007). Accounting for non-normality in latent regression models using a cumulative normal selection function. *Measurement and Research Department Report, 3*. Arnhem: Cito.
- Molenaar, D., Dolan, C.V., & de Boeck, P. (in press). The Heteroscedastic Graded Response Model with a Skewed Latent Trait: Testing Statistical and Substantive Hypotheses related to Skewed Item Category Functions. *Psychometrika*.
- Molenaar, D., van der Sluis, S., Boomsma, D.I., & Dolan, C.V. (in press). Detecting Specific Genotype by Environment Interactions using Marginal Maximum Likelihood Estimation in the Classical Twin Design. *Behavior Genetics*.
- Molenaar, D., Dolan, C.V., & van der Maas, H.L.J. (2011). Modeling ability differentiation in the second-order factor model. *Structural Equation Modeling, 18*, 578–594.
- Molenaar, D., Dolan, C.V., & Verhelst, N.D. (2010). Testing and Modeling Non-Normality within the One Factor Model. *British Journal of Mathematical and Statistical Psychology, 63*, 293–317.
- Molenaar, D., Dolan, C.V., & Wicherts, J.M. (2009). The power to detect sex differences in IQ test scores using Multi-Group Covariance and Means Structure Analyses. *Intelligence, 37*, 396–404.
- Molenaar, D., Dolan, C.V., Wicherts, J.M., & van der Maas, H.L.J. (2010). Modeling differentiation of cognitive abilities within the higher-order factor model using moderated factor analysis. *Intelligence, 38*, 611–624.
- Molenaar, P. C. M., & Boomsma, D. I. (1987). Application of nonlinear factor-analysis to genotype environment interaction. *Behavior Genetics, 17*, 71–80.

- Monti, A. C. (2003). A note on the estimation of the skew normal and the skew exponential power distributions. *Metron, LXI*, 205–219.
- Muthén, B.O. (1989). Factor structure in groups selected on observed scores. *British journal of mathematical and statistical psychology, 42*, 81-90.
- Muthén, B.O. (1989). Dichotomous Factor Analysis of Symptom Data. *Sociological Methods & Research, 18*, 19-65.
- Muthén, B.O. (2008). Latent variable hybrids: Overview of old and new models. In Hancock, G. R., & Samuelsen, K. M. (Eds.), *Advances in latent variable mixture models* (pp. 1-24). Charlotte, NC: Information Age Publishing, Inc.
- Muthén, B., & Hofacker, C. (1988). Testing the assumptions underlying tetrachoric correlations. *Psychometrika, 53*, 563 – 578.
- Muthén, L.K., & Muthén, B.O. (2007). *Mplus User's Guide. Fifth Edition*. Los Angeles, CA: Muthén & Muthén
- Naglieri, J. A., & Jensen, A. R. (1987). Comparison of black-white differences on the WISC-R and K-ABC: Spearman's hypothesis. *Intelligence, 11*, 21–43.
- Neale, M.C. (1998) Modeling interaction and nonlinear effects with Mx: A general approach. In: G. Marcoulides & R. Schumacker (Eds). *Interaction and Non-linear Effects in Structural Equation Modeling*, pp. 43-61. New York: Lawrence Erlbaum Associates
- Neale, M.C., Aggen, S.H., Maes, H.H., Kubarych, T.S., Schmitt, J.E. (2006) Methodological issues in the assessment of substance use phenotypes. *Addictive Behavior, 31*, 1010-34.
- Neale, M.C., Boker, S.M., Xie, G., & Maes, H.H. (2006). *Mx: statistical modeling, 7th ed.* VCU, Department of Psychiatry, Richmond.
- Neale, M.C. & Miller, M. (1997). The use of likelihood-based confidence intervals in genetic models. *Behavior Genetics, 27*, 113-120.
- Nesselroade, J.R., & Thompson, W.W. (1995). Selection and related threats to group comparison: An example comparing factorial structures of higher and lower ability groups of adult twins. *Psychological bulletin, 117*, 271-284.
- Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist, 61*, 622–631.
- Nyborg, H. (2003). Sex differences in g. In H. Nyborg (Ed.), *The scientific study of general intelligence* (pp. 187– 222). Amsterdam: Pergamon.
- van den Oord, E. J. (2005). Estimating Johnson curve population distributions in MULTILOG. *Applied Psychological Measurement, 29*, 45–64.
- Osborne, R.T. (1980). *Twins: black and white*. Athens, GA: Foundation for Human Understanding.
- Penke, L., Denissen, J.J.A., & Miller, G. (2007). The evolutionary genetics of personality. *European Journal of Personality, 21*, 549-587.
- Piaget, J. (1952). *The child's conception of number*. New York: Humanities Press.
- Plomin, R., DeFries, J.C., & Loehlin, J.C. (1977). Genotype-Environment Interaction and Correlation in the Analysis of Human Behavior. *Psychological Bullitin, 84*, 309-322.

- Plomin, R., & Daniels, D. (1987). Why are children in the same family so different from each other? *Behavioral and Brain Sciences*, *10*, 1-16.
- Plomin, R., & Spinath, F.M. (2002). Genetics and general cognitive ability (*g*). *Trends in Cognitive Sciences*, *6*, 169-176.
- Plomin, R. & Spinath, F.M. (2004). Intelligence: Genetics, Genes, and Genomics. *Journal of Personality and Social Psychology*, *86*, 112–129.
- Psychological Corporation (1997). *WAIS-III WMS-III Technical manual*. San Antonio: Harcourt Brace & Co
- Purcell, S. (2002). Variance Components Models for Gene–Environment Interaction in Twin Analysis. *Twin Research*, *5*, 554–571.
- R Development Core Team (2007). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. URL: <http://www.R-project.org>.
- Ramsay, J. O., & Abrahamowicz, M. (1989). Binomial regression with monotone splines: A psychometric application. *Journal of the American Statistical Association*, *84*, 906-915.
- Rathouz P.J., van Hulle C.A., Rodgers J.L., Waldman I.D., Lahey B.B. (2008). Specification, testing, and interpretation of gene-by-measured-environment models in the presence of gene–environment correlation. *Behavior Genetics*, *38*, 301–315.
- Ree, M. J. (1979). Estimating item characteristic curves. *Applied Psychological Measurement*, *3*, 371–385.
- Reckase, M.D. (2009). *Multidimensional Item Response Theory*. New York: Springer.
- Reynolds, M. R., & Keith, T. Z. (2007). Spearman's law of diminishing returns in hierarchical models of intelligence for children and adolescents. *Intelligence*, *35*, 267–281.
- Reynolds, M.R., Keith, T.Z., & Beretvas, N. (2010). Use of factor mixture modeling to capture Spearman's law of diminishing returns. *Intelligence*, *38*, 231-241.
- Risch, N., Herrell, R., Lehner, T., Liang, K.Y., Eaves, L., Hoh, J., Griem, A., Kovacs, M., Ott, J., & Merikangas, K.R. (2009). Interaction between the serotonin transporter gene (5 HTTLPR), stressful life events, and risk of depression: a meta-analysis. *JAMA*, *301*, 2462–2471.
- Rietveld, M. J. H., Dolan, C. V., van Baal, G. C. M., & Boomsma, D. I. (2003). A twin study of differentiation of cognitive abilities in childhood. *Behavior Genetics*, *33*, 367–381.
- Rigby, R.A., & Stasinopoulos, D.M. (2005). Generalized additive models for location, scale and shape. *Applied Statistics*, *54*, 507-554.
- Rochon, J. (1992). ARMA Covariance Structures With Time Heteroscedasticity for Repeated Measures Experiments. *Journal of the American Statistical Association*, *87*, 777-784.
- Rogers, T.B., Kuiper, N.A., & Kirker, W.S. (1977). Self-Reference and the Encoding of Personal Information. *Journal of personality and social psychology*, *35*, 677-688.

- Ratcliff, R. (1978). A theory of memory retrieval. *Psychological Review*, 85, 59–108.
- Royston, P., Altman, D.G., & Sauerbrei, W.. (2006). Dichotomizing continuous predictors in multiple regression: a bad idea. *Statistics in Medicine*, 25, 127–141.
- Samejima, F. (1969). Estimation of ability using a response pattern of graded scores. *Psychometrika Monograph, No. 17*.
- Samejima, F. (1997). Departure from normal assumptions: A promise for future psychometrics with substantive mathematical modeling. *Psychometrika*, 62, 471–493.
- Samejima, F. (2000). Logistic positive exponent family of models: Virtue of asymmetric item characteristic curves. *Psychometrika*, 65, 319–335.
- Samejima, F. (2008). Graded response model based on the logistic positive exponent family of models for dichotomous responses. *Psychometrika*, 73, 561–578.
- Saris, W. E. ,& Satorra, A. (1993). Power evaluations in structural equation models. In K.A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 181–204). Newbury Park, CA: Sage.
- Satorra, A., & Bentler, P. M. (1988). Scaling corrections for chi-square statistics in covariance structure analysis. *ASA Proceedings of the Business and Economic Section*, 308–313.
- Satorra, A., & Saris, W. E. (1985). The power of the likelihood ratio test in covariance structure analysis. *Psychometrika*, 50, 83–90.
- Saris, W.E., de Pijper, M., Mulder, J.(1978). Optimal Procedures for Estimation of Factor Scores. *Sociological Methods & Research* 7, 85–106.
- Schafer, J. L.,&Graham, J.W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, 7, 147–177.
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research*, 8, 23–74.
- Schmid, J. & Leiman J.M. (1957). The development of hierarchical factor solutions. *Psychometrika*, 22, 53–61.
- Schmitt, J.E., Mehta, P.D., Aggen, S.H., Kubarych, T.S., Neale, M.C. (2006). Semi Nonparametric Methods for Detecting Latent Non-normality: A Fusion of Latent Trait and Ordered Latent Class Modeling. *Multivariate behaviour research*, 41, 427–443.
- Schmittmann, V.D., Cramer, A.O.J., Waldorp, L.J., Epskamp, S., Kievit, R.A., & Borsboom, D. (in press). Deconstructing the construct: A network perspective on psychological phenomena. *New ideas in psychology*.
- Schmueli, G. (2010). To explain or to predict. *Statistical science*, 25, 289–310.
- Seong, T. J. (1990). Sensitivity of marginal maximumlikelihood estimation of item and ability parameters to the characteristics of the prior ability distributions. *Applied Psychological Measurement*, 14, 299–311.
- Shapiro, S.S. & Wilks, M.B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52, 591–611.

- Silberg, J. L., Rutter, M., Neale, M. C., & Eaves, L. J. (2001). Genetic moderation of environmental risk for depression and anxiety in adolescent girls. *British Journal of Psychiatry*, *179*, 116–121.
- van der Sluis, S., Derom, C., Thiery, E., Bartels, M., Polderman, T.J.C., Verhulst, F.C., et al. (2008). Sex differences on the WISC-R in Belgium and the Netherlands. *Intelligence*, *36*, 48-67.
- van der Sluis, S., Dolan, C.V., Neale, M.C., Boomsma, D.I., & Posthuma, D. (2006). Detecting Genotype–Environment Interaction in Monozygotic Twin Data: Comparing the Jinks and Fulker Test and a New Test Based on Marginal Maximum Likelihood Estimation. *Twin Research and Human Genetics*, *9*, 377–392.
- van der Sluis, S., Dolan, C.V., Neale, M.C., & Posthuma, D. (2008). Power calculations using exact data simulation: a useful tool for genetic study designs. *Behavior genetics*, *38*, 202-211.
- van der Sluis, S., Posthuma, D., Dolan, C. V., de Geus, E. J. C., Colom, R., & Boomsma, D.I. (2006). Gender differences on the Dutch WAIS-III. *Intelligence*, *34*, 273-289.
- van der Sluis, S., Willemsen, G., de Geus, E.J.C., Boomsma, D.I., & Posthuma, D. (2008). Gene-environment interaction in adults' IQ scores: measures of past and present environment. *Behavior Genetics*, *38*, 372-389.
- Sörbom, D. (1974). A general method for studying differences in factor means and factor structure between groups. *British Journal of Mathematical and Statistical Psychology*, *27*, 229–239.
- Sörbom, D. (1989). Model modification. *Psychometrika*, *54*, 371-384.
- Spearman, C.E. (1904). “General intelligence” objectively determined and measured. *American Journal of Psychology*, *15*, 201–293.
- Spearman, C. E. (1927). *The abilities of man: Their nature and measurement*. New York: Macmillan.
- Stone, C. A. (1992). Recovery of marginal maximum likelihood estimates in the two parameter logistic response model: An evaluation of MULTLOG. *Applied Psychological Measurement*, *16*, 1–16.
- Stroud, A. H., & Secrest, D. (1966). *Gaussian quadrature formulas*. Englewood Cliff, NJ: Prentice-Hall.
- Swaminathan, H., & Gifford, J. (1983). Estimation of parameters in the three parameter latent trait model. In D. J. Weiss (Ed.), *New horizons in testing: Latent trait test theory and computerized adaptive testing* (pp. 13–30). New York: Academic Press.
- Takane, Y. & de Leeuw, J. (1987). On the relationship between item response theory and factor analysis of discretized variables. *Psychometrika*, *52*, 393-408.
- Taylor, J., Roehrig, A.D., Soden Hensler, B., Connor, C.M., & Schatschneider, C. (2010). Teacher quality moderates the genetic effects of early reading. *Science*, *328*, 512-514.
- Tellegen, A. (1988). The Analysis of Consistency in Personality Assessment. *Journal of personality*, *56*, 621-663.
- te Nijenhuis, J., & Hartmann, P. (2006). Spearman's "Law of diminishing returns" in samples of Dutch and immigrant children and adults. *Intelligence*, *34*, 437-447.

- Tideman, E., & Gustafsson, J. E. (2004). Age-related differentiation of cognitive abilities in ages 3–7. *Personality and Individual Differences, 36*, 1965-1974.
- Timberlake, D.S., Rhee, S.H., Haberstick, B.C., Hopfer, C., Ehringer, M., Lessem, J.M., Smolen, A., & Hewitt, J.K. (2006). The moderating effects of religiosity on the genetic and environmental determinants of smoking initiation. *Nicotine and Tobacco Research, 8*, 123-133.
- Tucker-Drob, E.M. (2009). Differentiation of cognitive abilities across the life span. *Developmental Psychology, 45*, 1097-1118.
- Tucker-Drob, E.M., Harden K.P., Turkheimer, E. (2009). Combining nonlinear biometric and psychometric models of cognitive ability. *Behavior genetics, 39*, 461-471.
- Tucker-Drob, E.M., Rhemtulla, M., Harden, K.P., Turkheimer, E., & Fask, D. (2011). Emergence of a Gene x Socioeconomic Status Interaction on Infant Mental Ability Between 10 Months and 2 Years. *Psychological Science, 22*, 125-133.
- Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science, 14*, 623–628.
- Turkheimer, E., Harden, K. P., D'Onofrio, B., & Gottesman, I. I. (2009). The Scarr Rowe interaction between measured socioeconomic status and the heritability of cognitive ability. In K. McCartney, & R. A. Weinberg (Eds.) *Experience and development: A festschrift in honor of Sandra Wood Scarr* (pp. 81-97). New York: Psychology Press.
- Turkheimer, E., & Waldron, M. (2000). Nonshared environment: A theoretical, methodological, and quantitative review. *Psychological bulletin, 1*, 78-108.
- Tuvblad, C., Grann, M., & Lichtenstein, P. (2006). Heritability for adolescent antisocial behavior differs with socioeconomic status: gene-environment interaction. *Journal of Child Psychology and Psychiatry, 47*, 734-743.
- Verhelst, N.D. (2009). *Latent variable analysis with skew distributions*. Manuscript in preparation.
- Verhelst, N.D. & Verstralen, H.H.F.M. (2002). *Structural analysis of a univariate latent variable (SAUL): Theory and a computer program*. Arnhem: Cito.
- Vermunt, J. K. (2004). An EM algorithm for the estimation of parametric and nonparametric hierarchical nonlinear models. *Statistica Neerlandica, 58*, 220 - 233.
- Vermunt, J. K., & Hagnaars, J. A. (2004). Ordinal longitudinal data analysis. In R. C. Hauspie, N. Cameron, & L. Molinari (Eds.), *Methods in human growth research*, 374–393. Cambridge, UK: Cambridge University Press.
- Venzon, D.J. & Moolgavkar, S.H. (1988). A method for computing profile-likelihood based confidence intervals. *Applied Statistics, 37*, 87-92.
- Vorst, H.C.M. & Bermond, B. (2001). Validity and reliability of the Bermond-Vorst alexithymia questionnaire. *Personality and individual differences, 30*, 413-434.

- Wainer, H., Dorans, N.J., Flaugher, R., Green, B.F., Mislevy, R.J., Steinberg, L., et al. (1990). *Computerized adaptive testing: A primer*. Hillsdale, N J: Lawrence Erlbaum Associates.
- Wang, J.J., & Kaufman, A.S. (1993). Changes in fluid and crystallized intelligence across the 20-to 90-year age range on the K-BIT. *Journal of Psychoeducational Assessment, 11*, 29–37.
- Wallace, G.L., Schmitt, J.E., Lenroot, R., Viding, E., Ordaz, S., Rosenthal, M.A., et al. (2006). A pediatric study of twin brain morphology. *Journal of Child Psychology and Psychiatry, 47*, 987-993.
- Wechsler, D. (1991). *Wechsler Intelligence Scale for Children (WISC-III)*. San Antonio, TX: Psychological Corp.
- Wechsler, D. (1997). *Wechsler Adult Intelligence Scale- III (WAISIII)*. San Antonio, TX: Psychological Corp.
- Wirth, R.J. & Edwards, M.C. (2007). Item factor analysis: Current approaches and future directions. *Psychological Methods, 12*, 58-79.
- Wood, R., Wilson, D. T., Gibbons, R. D., Schilling, S. G., Muraki, E., & Bock, R. D. (2002). TESTFACT: Test scoring, item statistics, and item factor analysis. Chicago: Scientific Software International, Inc.
- Woods, C. M. (2007). Ramsay-curve IRT for Likert type data. *Applied Psychological Measurement, 31*, 195-212.
- Yalcin, I. & Amemiya, Y. (2001). Non linear factor analysis as a statistical method. *Statistical science, 16*, 275-294.
- Yung, Y. F., Thissen, D., & McLeod, L. D. (1999). On the relationship between the higher-order factor model and the hierarchical factor model. *Psychometrika, 64*, 113-128.
- Zelinski, E.M., & Lewis, K.L. (2003). Adult age differences in multiple cognitive functions: Differentiation, dedifferentiation, or process-specific change? *Psychology and aging, 18*, 727-745.
- Zhang, Z., Ilies, R., & Arvey, R.D. (2009). Beyond genetic explanations for leadership: the moderating role of the social environment. *Organizational Behavior and Human Decision Processes, 110*, 118-128.
- Zwinderman, A.H., (1991). A generalized Rasch model for manifest predictors. *Psychometrika, 56*, 589-600.
- Zwinderman, A.H. & van den Wollenberg, A.L. (1990). Robustness of Marginal Maximum Likelihood Estimation in the Rasch model. *Applied psychological measurement, 14*, 73-81.