One, two, three, and more…
From the Analysis of One Data Table to Two, Three, and More Data Tables:
From Principal Component Analysis to Partial Least Squares, Multiple Factor Analysis, and DiSTATIS

Hervé Abdi, Ph.D. – The University of Texas at Dallas

September 24th, 2025 (13:00–16:00) / October 1st, 2025 (9:00–12:00)
Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal

In this, we present Principal Component Analysis (PCA, the oldest and still the most popular multivariate method) and its modern generalizations. PCA analyzes data tables where rows are observations and columns are variables. PCA extracts the information in these data by computing optimal linear combinations (called components) of the variables. These components are then used to create two types of maps: one map for the observations where the similarity structure of the observations is represented by the distance between observations and one map for the variables where the similarity structure of the variables is represented by (the cosine of) the angles they form with the origin. PCA—and its interpretation rules—is also adapted for symmetric data tables: distances for observations (when it becomes Classical Multidimensional Scaling, MDS) and scalar products (including covariance and correlation) for variables. Originally, PCA was used as a dimension-reducing descriptive method, but it now often incorporates cross-validation-based inferences (jackknife, and bootstrap).

PCA has recently been extended to the analysis of multiple data tables. For two data tables, PCA becomes Partial Least Squares Correlation (PLSC, also called co-inertia analysis or inter-battery analysis), redundancy analysis, or canonical correlation. These methods all compute optimal linear combinations of the variables of two data tables in order to extract common information between these two data tables, and they differ only in their definition of optimality (or equivalently, their definition of the common information).

For three or more data tables, PCA can now be extended in several ways. A versatile method—DiSTATIS—generalizes PCA, MDS, multiple factor analysis (MFA), and a few more, to analyze sets of data tables and to identify both common and specific information in these sets of data tables.

Curriculum Vitae - Hervé Abdi, Ph.D.

Education

Tenured Professor
The University of Texas at Dallas
School of Brain and Behavioral Sciences

Academic Appointments

- Professor, University of Texas at Dallas (1994–Present)
- Adjunct Professor, UT Southwestern Medical Center (2001–2016)
- Associate Professor, UT Dallas (1989–1994)
- Professor, Université de Bourgogne (1988–1998)
- Associate Professor, Université de Bourgogne (1983–1988)
- Assistant Professor, Université de Franche-Comté (1979–1983)
- Visiting Professor, Brown University (1986–1987)

Research Interests

- Advanced Multivariate Statistics
- Psychometrics & Sensometrics
- Analysis of Qualitative Data
- Brain Imaging & Genomics Methodology
- Psychology of Memory

Recent Selected Publications
(Total number of publications 331 / h-index: 93)

Yu, J.-C., Le Borgne, J., Krishnan, A., Gloaguen, A., Yang, C.-T., Rabin, L. A., Abdi, H., & Guillemot, V. (2025). Sparse factor analysis for categorical data with the group-sparse generalized singular value decomposition. *Computational Statistics & Data Analysis*, **208,** 108179**.** https://doi.org/10.1016/j.csda.2025.108179

Moraglia, L. E., Weigman, B., Abdi, H., Styner, M., Kim, S. H., Burrows, C. A., Shen, M. D., Ravi, S., Wolff, J. J., Dager, S. R., Hazlett, H. C., Pandey, J., Schultz, R. T., Girault, J. B., Botteron, K. N., Marrus, N., Estes, A. M., St. John, T., Zheng, G., Piven, J., Swanson, M. R., & the IBIS Network. (2025). Brain morphometry in infants later diagnosed with autism is related to later language skills. *Human Brain Mapping*. **46,** 1–17**.** https://doi.org/10.1002/hbm.70221

Schwartz, A. M., Melamed, T. C., Bowers, J., Perez & Abdi, H. (2025). Caregivers' attitudes towards persons with language disorder: validation of a multidimensional attitudes scale. *Speech, Language and Hearing*, **28**(1), 2501774. doi: 10.1080/2050571X.2025.2501774

Wu, D., Moraglia, L.E., Ravi, S., Elison, J.T., Wolff, J.J., Estes, A., St. John, T., Zwaigenbaum, L., Marrus, N., Hazlett, H., Schultz, R., Botteron, K., Dager, S.R., Abdi, H., Piven, J., & Swanson, M.R. (2025). Clarifying the developmental association between gesture and later vocabulary for autistic children. *Infant Behavior and Development*, **79**, 102058. https://doi.org/10.1016/j.infbeh.2025.102058

Calderon-Williams, D.R., de Souza, R.R., Tseng, C.T., Abdi, H., Sandoval-Flores, A., Ploski, J.E., Thorn, C.A., & McIntyre, C.K. (2025). Optogenetic inhibition of the locus coeruleus blocks Vagus nerve stimulation-induced enhancement of extinction of conditioned fear in rats. *Learning & Memory*, **32**, 1–9. https://www.learnmem.org/cgi/doi/10.1101/lm.053958.124.

Schwartz, A. M., Gonzales, M. D., Melamed, T. C., & Abdi, H. (2025). How do speech language pathologists use the Schwartz et al. (2015) rubric for read-aloud storybook selection? *Speech, Language and Hearing,* **28**. https://doi.org/10.1080/2050571X.2024.2404315

Vandenberghe-Descamps, M., Mizener, B., Abdi, H., & Chollet, S. (2025). Multisensory interactions: The influence of context on beverage and soundtrack pairing. *Food Quality and Preference,* **12***2*, 105297. https://doi.org/10.1016/j.foodqual.2024.105297

Wu, D., Moraglia, L.E., Ravi, S., Elison, J.T., Wolff, J.J., Estes, A., St John, T., Zwaigenbaum, L., Marrus, N., Hazlett, H., Schultz, R., Botteron, K., Dager, S.R., Abdi, H., Piven, J., Swanson, M.R. (2025). Clarifying the developmental association between gesture and later vocabulary for autistic children. *Infant Behavior and Development*, **7***9,*

Wu, D., Wolff, J. J., Ravi, S., Elison, J. T., Estes, A., Paterson, S., St. John, T., Abdi, H., Moraglia, L. E., Piven, J., Swanson, M. R., & for the IBIS Network. (2024) Infants who develop autism show smaller inventories of deictic and symbolic gestures at 12 months of age. *Autism Research*, **17**(4), 838-851**.** https://doi.org/10.1002/aur.3092

Baracchini, G., Yu, J.C., Rieck, J., Beaton, D., Guillemot, V., Grady, C., Abdi, H., & Spreng, R. N. (2024). covSTATIS: A multi-table technique for network neuroscience. *Aperture-Neuro, 5*.

Nakua, H., Yu, J-C, Abdi, H., Voineskos, A., Hill, S., Lai, M.-C., Wheeler, A. L., McIntosh, A. R., & Ameis, S. H. (2024). Comparing the stability and reproducibility of brain–behaviour relationships found using canonical correlations analysis and partial least squares within the ABCD sample. *Network Neuroscience,* **8.** https://doi.org/10.1162/netn_a_00363