Workshop in data analysis

Objectives

The aims of the workshop are specific to the three parts in which it is divided: to learn to use R and R-Commander for analyzing data and to develop basic programming skills (Part 1), to get to know the particularities of single-case designs and how these features affect the possibilities of data analysis (Part 2), and finally to start learning the meta-analytical procedures when combining results from a set of original articles (Part 3). Additionally, R and R-Commander will be used for practicing the analytical procedures related to single-case designs and quantitative integration.

Methodology

The theoretical explanations in all three parts will be complemented with examples. The use of R and R-Commander in the sessions will enable the students to play with the topics discussed during the course. The three-way interaction between the professors, the students, and the R program is intended to offer the possibility for a procedural and not only declarative knowledge of the workshop topics.

Workshop duration: 15h - 5h for each of the three parts

Workshop organization: 6 sessions, 2.5h each session

Course program

Part 1 (5h)**:** R for researchers (David Leiva)

1.1 R and R-Commander (1 h)
1.2 Statistics with R (2 h)
1.3 Introduction to R programming (2 h)

Recommended readings for Part 1:

Fox, J. (2005). The R Commander: A basic-statistics Graphical User Interface to R. *Journal of Statistical Software, 14*, 1–42.

Ihaka, R., & Gentleman, R. (1996). R: A Language for Data Analysis and Graphics. *Journal of Computational and Graphical Statistics, 5*, 299–314.

Verzani, J. (2005). *Using R for Introductory Statistics*. Boca Raton: Chapman & Hall/CRC.

Additional readings for Part 1:

Chambers, J. M. (2008). *Software for data analysis: Programming with R*. Nueva York: Springer.

Crawley, M.J. (2007). *The R Book*. Chichester: John Wiley & Sons.

Jones, O., Maillardet, R., & Robinson, A. (2009). *Scientific programming and simulation using R*. Boca Raton: Chapman & Hall/CRC.

Murrell, P. (2011). *R Graphics*. Florida: CRC Press.

Rizzo, M.L. (2008). *Statistical Computing with R*. New York: Chapman & Hall/CRC.

Ugarte, M. D., Militino, A. F., & Arnholt, A. T. (2008). *Probability and Statistics with R*. Boca Raton: CRC Press.

Verzani, J. (2011). *Getting started with RStudio*. Sebastopol: O'Reilly Media Publishers.

Part 2 (5h)**:** Single-case designs (Rumen Manolov)

1.1 Single-case designs features (0.5h)
1.2 Visual analysis and related procedures (1.5h)
1.3 Regression analysis (1h)
1.4 Randomization tests (1h)
1.5 Single-case designs analysis with R and R-Commander (1h): throughout the whole part 2

Recommended readings for Part 2:

<u>Single case designs features and applications:</u>

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179.

Kazdin, A. E. (1978). Methodological and interpretive problems of single-case experimental designs. *Journal of Consulting and Clinical Psychology, 46*, 629-642.

Lundevold, D. A., & Belwood, M. F. (2000). The best kept secret in counseling: Single-case (N=1) experimental designs. *Journal of Counseling and Development, 78*, 92-102.

Sideridis, G. D., & Greenwood, C. R. (1997). Is human behavior autocorrelated? An empirical analysis. *Journal of Behavioral Education, 7*, 273-293.

<u>Visual analysis and visual aids:</u>

Fisher, W. W., Kelley, M. E., & Lomas, J. E. (2003). Visual aids and structured criteria for improving visual inspection and interpretation of single-case designs. *Journal of Applied Behavior Analysis, 36*, 387-406.

Gast, D. L., & Spriggs, A. D. (2009). Visual analysis of graphic data. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 199−233). London: Routledge.

Parker, R. I., Cryer, J., & Byrns, G. (2006). Controlling baseline trend in single-case research. *School Psychology Quarterly, 21*, 418-443.

Procedures related to visual analysis:

Parker, R. I., & Vannest, K. J. (2009). An improved effect size for single-case research: Nonoverlap of all pairs. *Behavior Therapy, 40*, 357-367.

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing single-subject research: Issues and applications. *Behavior Modification, 22*, 221-242.

Solanas, A., Manolov, R., & Onghena, P. (2010). Estimating slope and level change in N=1 designs. *Behavior Modification, 34*, 195-218.

Regression analysis:

Allison, D. B., & Gorman, B. S. (1993). Calculating effect sizes for meta-analysis: The case of the single case. *Behaviour Research and Therapy, 31*, 621-631.

Gorsuch, R. L. (1983). Three methods for analyzing limited time-series (N of 1) data. *Behavioral Assessment, 5*, 141-154.

Randomization tests:

Bulté, I., & Onghena, P. (2008). An R package for single-case randomization tests. *Behavior Research Methods, 40*, 467-478.

Edgington, E. S. (1980a). Random assignment and statistical tests for one-subject experiments. *Behavioral Assessment, 2*, 19-28.

Edgington, E. S. (1980b). Validity of randomization tests for one-subject experiments. *Journal of Educational Statistics, 5*, 235-251.

Onghena, P. (1992). Randomization tests for extensions and variations of ABAB single-case experimental designs: A rejoinder. *Behavioral Assessment, 14*, 153-171.

Part 3 (5h)**:** Meta-analysis (Georgina Guilera)

1.1 Integrating results in psychology (0.5h)
1.2 Meta-analysis based on continuous, binary and correlational data (2.5h)
1.3 Meta-analysis based on 3D data: Activation likelihood estimation (1h)
1.4 *Metafor*: R package for meta-analysis (1h): throughout the whole part 3

Recommended readings for Part 3:

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester, UK: John Wiley & Sons.

Cooper, H., Hedges, L. V., & Valentine, J. C. (Eds.)(2009). *The handbook of research synthesis and meta-analysis* (2nd ed.). New York: Russell Sage Foundation.

Eickhoff, S. B., Laird, A. R., Grefkes, C., Wang, L. E. Zilles, K., & Fox, P. T. (2009). Coordinate-based activation likelihood estimation meta-analysis of neuroimaging data: a random-effects approach based on empirical estimates of spatial uncertainty. *Human Brain Mapping, 30*, 2907-2926.

Hedges, L. V., & Olkin, I. (1985). *Statistical Methods for Meta-analysis.* New York: Academic Press.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical Meta-analysis.* Thousand Oaks, CA: Sage Publications.

Turkeltaub, P. E., Eden, G. F., Jones, K. M., & Zeffiro, T. A. (2002). Meta-Analysis of the functional neuroanatomy of single-word reading: Method and validation. *Neuroimage, 16*, 765–780.

Additional readings for Part 3:

Cooper, H. (2010). *Research synthesis and meta-analysis: A step-by-step approach* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Eickhoff, S. B., Bzdok, D., Laird,A. R., Kurth, F., & Fox, P. T. (2012). Activation likelihood estimation revisited. *Neuroimage, 59*, 2349-2361.

Eickhoff, S. B., Laird, A. R., Grefkes, C., Wang, L. E., Zilles, K., & Fox, P. T. (2009). Coordinate-based activation likelihood estimation meta-analysis of neuroimaging data: A random-effects approach based on empirical estimates of spatial uncertainty. *Human Brain Mapping, 30*, 2907-2926.

Glass, G. V., McGaw, B., & Smith, M. L. (1981). *Meta-analysis in Social Research*. Beverly Hills, CA: Sage Publications.

Grissom, R. J., & Kim, J. J. (2011). *Effect sizes for research: Univariate and multivariate applications* (2nd ed.). New York: Routledge.

Hartung, J., Knapp, G., & Sinha, B. K. (2008). *Statistical meta-analysis with applications.* Hoboken, NJ: John Wiley & Sons.

Hunter, J. E. & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research synthesis* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Laird, A. R., Fox, M., Price, C. J., Glahn, D. C., Uecker, A. M., Lancaster, J. L., et al.. (2005). ALE meta-analysis: Controlling the false discovery rate and performing statistical contrasts. *Human Brain Mapping, 25*, 155-164.

Littell, J. H., Corcoran, J., & Pillai, V. (2008). *Systematic reviews and meta-analysis.* Oxford, UK: Oxford University Press.

Rosenthal, R. (1991). *Meta-analytic Procedures for Social Research* (rev. ed.). Newbury Park, CA: Sage Publications.

Rothstein, H. R., Sutton, A.J., & Borenstein, M. (Eds.) (2005). *Publication bias in meta-analysis: Prevention, assessment, and adjustments.* Chichester, UK: John Wiley & Sons.

Turkeltaub, P.E., Eickhoff, S. B., Laird, A. R., Fox, M., Wiener, M., & Fox, P. (2012). Minimizing within-experiment and within-group effects in activation likelihood estimation meta-analyses. *Human Brain Mapping, 33*, 1-13.

Course evaluation:

Activities during the sessions: 25% of the grade

Course work: 75% of the grade (25% for each of the three parts)