Title: Workshop: Hypothesis Evaluation Using the Bayes Factor

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Abstract:

Since Cohen's (1994) paper "the earth is round, p< .05" there is increasing awareness that the null-hypothesis, e.g., H0: m1=m2=m3, where the m's denote the means in three groups, only rarely represents the expectations that researchers have. Informative hypotheses (Gu et al., 2018, Hoijtink et al., 2019) use equality and inequality constraints to formally represent researcher's expectation. Two (hypothetical) examples of such hypotheses are: H1: m1 > m2 > m3 and H2: m1 – m2 > m2 – m3. Since both H1 and H2 may be wrong, it is customary to add Hu: m1, m2, m3 to the set of hypotheses of interest. In Hu there are no restrictions on the parameters of interest. Only if H1 and H2 are better than Hu they may be valuable.

Additionally, in the last years there is increasing for alternatives for null-hypothesis significance testing. One such alternative, (informative) hypothesis evaluation using the Bayes factor, will be introduced. The Bayes factor quantifies the support in the data for a pair of hypotheses based on the fit and the complexity of the hypotheses. Loosely formulated, if, for example estimates of the three means in H1 are, 2, 5, and 7, respectively, then the fit of H1 is rather bad. It can also be seen that H1 is more specific than H2 (and therefore less complex) because it imposes more constraints on the three means. If, for example, BF12 = 5 and BF1u =10, this means that the support in the data for H1 is 5 times larger than the support for H2 and 10 times larger than for Hu. This would imply that, currently, H1 is the best available description of the population of interest.

In the workshop it will be elaborated what the Bayes factor is, how it can be applied and should be interpreted. There will be attention for Bayesian updating (an alternative for power analysis), Bayesian (conditional) error probabilities, limitations of the approach, and the statistical underpinnings of the software with which the Bayes factor can be computed.

Assignment:

Participants can prepare by reading the tutorial about Bayesian hypothesis evaluation (Hoijtink et al, 2019, downloading the course materials, and installing R, R-studio, and Bain on their laptop. Course materials retrievable from https://informative-hypotheses.sites.uu.nl/software/bain/ at the bottom of the page under SMiP-Mannheim 2/3 December 2021 (course materials will be updated mid November 2021).

Credits: 2 workshop days

References:

Cohen, J. (1994). The earth is round, p< .05. *American Psychologist*, 49, 997-1003.

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Hoijtink H., Gu, X., and Mulder, J. (2019). Bain, multiple group Bayesian evaluation of informative hypotheses. \emph{British Journal of Mathematical and Statistical Psychology, 72,} 219-243. DOI: 10.1111/bmsp.12145

Hoijtink, H., Mulder, J., van Lissa, C., and Gu, X. (2019). A tutorial on testing hypotheses using the Bayes factor. Psychological Methods, 24, 539-556. DOI: 10.1037/met0000201

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