Investigating causal relations in personality by combining path analysis and search algorithms

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OBJECTIVES

We propose a methodological approach for investigating causal relations in personality science, combining path analysis and search algorithms in graphical acyclic modeling. While path analysis and structural equation modeling are good techniques for testing and comparing models guided by hypothesis testing, search algorithms are optimal for discovering causal relationships in a system of variables adopting an exploratory-driven strategy.

METHOD

Dataset

We analyzed a dataset with 716 subjects and 27 items (Gomes & Golino, 2012).

Instrument

The Personality Characteristics Inventory (Gomes & Golino, 2012) is a self-report instrument written in Brazilian Portuguese that measures eight polarities polarities of the Big Five factors: *Extraversion* and *Introversion* (Extraversion), *Mutability* and *Stability* (Neuroticism), *Focus on Human Relations* and *Focus on Objects* (Agreeableness), *Focus on Objective* (Conscientiousness), and *Openness to New Experiences* (Openness).

Search algorithms

Three search algorithms were explored using the software **TETRAD** (Glymour et al., 2015): Peter-Clark (**PC**), greedy equivalent search (**GES**), and linear non-Gaussian acyclic model (**LiNGAM**). All of them actively search for conditional independences in a system of variables – in this study we consider the factor scores extracted from exploratory structural equation modeling of items as the system. We compared the resulting search algorithm models with a path analysis model from a previous study with the same dataset (Gomes & Golino, 2012).

RESULTS

Table 1. *Comparing the four models of the study: BIC, CFI, RMSEA and its differences in relation of the best solution (LiNGAM)*

Models	BIC	CFI	RMSEA	Δ BIC	Δ CFI	Δ RMSEA
Path analysis	12647.15	.973	.102	1876.72	.017	.056
PC	12680.70	.927	.099	1910.27	.063	.053
GES	12617.34	.955	.076	1846.91	.035	.030
LiNGAM	10770.43	.990	.046			

Note. BIC = bayesian information criterion, CFI = comparative fit index, RMSEA = root mean square error of approximation.
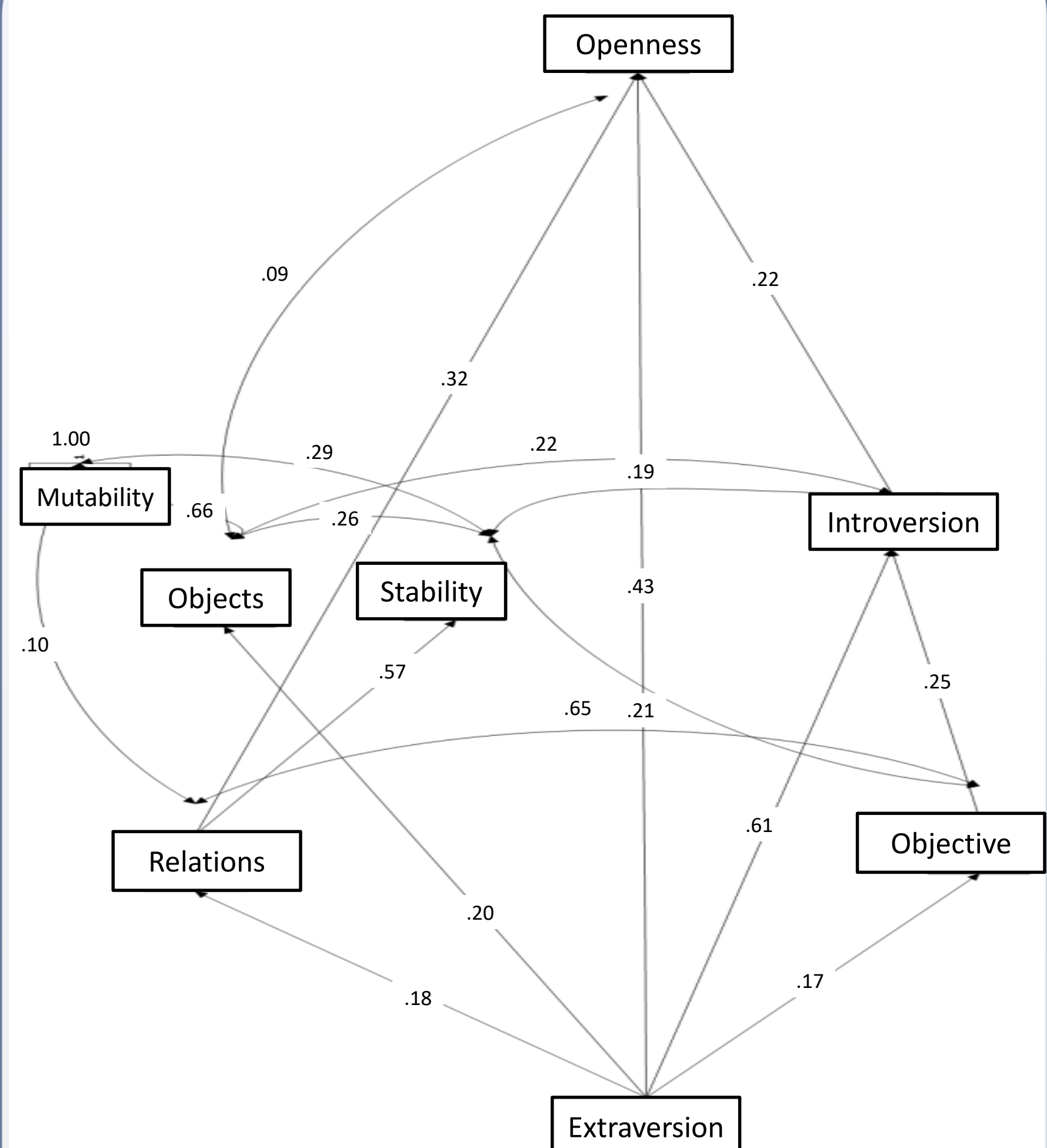

Figure 1. LiNGAM model and loadings.

DISCUSSION

- The search algorithm LiNGAM not only has a considerable better fit, but also accounted for a number of causal relations not explored in the path analysis model.
- We conjointly approached a model guided by hypothesis and explored new possibilities, searching for causal relations beyond our first theoretical hypothesis.
- Results indicated a causal structure with four levels.
- Extraversion is the principal polarity, since it is in the base (i.e., the 4th level) of the causal relations of the system.
- Extraversion is the unique independent variable in the model and was not explained by any other polarity.
- The final or distal polarity is Openness to New Experiences.

REFERENCES

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