TPM

EDITORIAL

This special issue offers a range, although limited in number, of papers which show the way researchers use formal models to guide their theoretical and experimental investigations in contemporary psychology. The timing for offering this contribute is quite appropriate, since psychology is at a time when the development and application of formal modeling is growing consistently in different research areas (e.g., Bonnefon, 2013; Evans, 2012; Marevski & Olsson, 2009; Musau, 2014; Townsend, 2008). In the articles here reported modeling is concerned with visual perception, space knowledge, category identification, multidimensional classification techniques and measurement. All contributions offer new theoretical developments and innovative applications in psychology.

At the beginning, two contributions to this special issue address specific important problems of how to model visual perception. The paper by Jürgen Heller deals with the perception of achromatic colors and on the basis of a generalized Fechnerian representation explores the theoretical consequences of various psychophysical invariances. It is shown that Wallach's ratio principle and illumination invariance as well as generalizations that may be conceived as near-misses to these conditions, constrain the possible form of the psychophysical functions. Reanalyzing classical data in the light of these theoretical results leads to a re-examination of the empirical evidence. Within a probabilistic framework the article by Martin Lages draws the attention on geometric constraints for the perception of three-dimensional (3D) binocular motion. Bayesian models of binocular integration, are considered to explain perceptual bias under uncertainty. Results from computer simulations and model selection support the idea that disparity processing rather than motion processing introduces perceptual bias in 3D motion.

Lombardi, Bazzanella, and Calcagnì in their contribution propose a new Bayesian model to efficiently capture the relative importance of possibly dependent semantic features in the process of category identification. Unlike the so called naive Bayesian identifier, the new model does not require independence between cues and uses a simple property, called strong stochastic dependence (SSD), to efficiently represent dependence-type patterns in semantic features. Results show that the new Bayesian model is consistently superior to the naive Bayes identifier in predicting the distribution of the participants' responses in the empirical semantic task.

The article by Robusto and Stefanutti finds its context in the Knowledge Space Theory. In this contribute a procedure for extracting knowledge structures from data is proposed, which is based on the construction of a chain of knowledge structures of increasing size. In each step of the procedure an updating rule is applied, which is based on the residuals of the response pattern's frequencies obtained by an application of the basic local independence model. The results obtained in two simulation studies and in an empirical application indicate the superiority of the proposed procedure in a number of different conditions.

The fifth contribution to this special issue finds its theoretical context in the field of categorical data classification analysis techniques and is in line with a number of studies conducted by its authors in past and recent years, as cited in the references to the paper. In this special issue H. Bacelar-Nicolau, Nicolau, Sousa, and L. Bacelar-Nicolau propose an extension of classical multivariate analysis methods for grouping data, to generalized three-way data representations and in particular to classification of intervals variables. In so doing they provide a very useful tool for model selection in complex data sets. The proposed method is illustrated on a real data example concerned with a measure of stress in parent-child relationships.

Finally, two contributions to this special issue address the important problem of measurement in psychology. In both articles a latent trait approach is used by applying specific generalizations of the Rasch model. In their article Boffo, Mannarini, Pronk, and Wiers explore the applicability of the Many-Facet Rasch Measurement (MFRM) model to an Approach Avoidance Task (AAT) for the assessment of automatic approach tendencies toward alcohol. The MFRM model is here proposed as a formal model for the analysis of the AAT within an experimental context in a longitudinal perspective. Due to its mathematical properties, the authors consider such model particularly useful as an analytical strategy to examine the occurrence of change; the effect of experimental conditions; the measurement status of the AAT. The applicability of the formal modeling approach and the methodological and clinical implications of the results here obtained are discussed. Roccato, Rosato, Mosso, and Russo in their study analyze the measurement properties of the System Justification Scale (SJS) using the Partial Credit Model (PCM). The authors show how the specific mathematical features of the model allow to criticize and to modify the original scaling system of the SJS. The results demonstrate that the optimal number of categories of the System Justification Scale is four and that using wider formats would lead to the inclusion of non-discriminant categories.

The articles in this special issue offer an overview of the nature and role of formal models in some fields of contemporary psychology and describe researches that are based on them. Psychologists can develop their own formal models, suited to their specific needs; they may rely on mathematical and statistical models for capturing individual differences and similarities; and they often draw on Bayesian formalisms in order to model everyday reasoning, behaviors and other variables in study areas relevant in psychology. We hope that endeavors such as this special issue hold the promise to strengthen the role of formal modeling both from a theoretical and an applicative point of view in psychology research.

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