Intention and behavior: a Bayesian meta-analysis with focus on the Ajzen–Fishbein Model in the field of environmental behavior

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Abstract We employ a Bayesian normal hierarchical model to investigate the relationship between intention and behavior as it is posited by Ajzen and Fishbein’s theory of planned behavior (TPB). Area of application is the field of environmental behavior. Eleven studies reporting correlations between intention and behavior were identified. Our Bayesian hierarchical model expects a correlation of $r_{xy} = 0.54$ between those variables. This effect size is above average with regard to meta-analyses, which include other, non-environmental areas of application.

Keywords Bayesian hierarchical model · Meta-analysis · Theory of planned behavior · Ajzen–Fishbein

1 Introduction

Ajzen’s “theory of planned behavior” (Ajzen 1991), which is also known as the “Ajzen/Fishbein Model”, is today’s dominant attitude theory and has been applied in literally thousands of studies. The focus of this meta-analysis is to investigate how accurately the theory predicts actual behavior. We will concentrate on environmental behavior in particular, since our work emerged against the background of a project in environmental psychology. Furthermore, we will apply a Bayesian method of knowledge synthesis, the so-called “Bayesian Hierarchical Normal Model” (compare Gelman et al. 1995 and Spiegelhalter et al. 2003). In doing this, we hope to provide the reader with a comfortably traceable demonstration of this very general method.
The theory of planned behavior tries to explain the relationship between an individual’s attitudes and behavior. Here, three different classes of beliefs are linearly combined towards a behavioral intention, which is assumed to be the immediate cause of behavior. Paraphrasing Ajzen, the three classes are behavioral beliefs, normative beliefs and control beliefs. Behavioral beliefs are about the likely outcomes of the behavior and the evaluation of these outcomes. Normative beliefs are about the normative expectations of others and motivation to comply with these expectations. Control beliefs are about the presence of factors that may facilitate or impede performance of the behavior and the perceived power of these factors. Although intention is assumed to cause behavior, perceived behavioral control is often modeled with direct influence on the latter (compare Schulze and Wittmann 2003), serving as a proxy for effective behavior control.

As implied, behavioral intention is a central concept of Ajzen/Fishbein theory. Since it represents the combined attitudinal evaluation, it essentially channels the causal impact of individual attitudes on behavior. An analysis of the empirical relation of intention and behavior could therefore be considered to be a shorthand test of the complete theory.

2 Problem formulation

The above consideration leads directly to the formulation of our research question: Is there a relationship between intention and behavior in environmental behavior (like recycling or choice of mode of travel) as postulated by the theory of planned behavior? More exactly, how strong is the expected correlation between intention and behavior, as indicated by relevant studies in the field of environmental behavior?

3 Modeling methodology

As stated before, we employ a Bayesian approach for our analysis. Since this methodology is still uncommon in the social sciences (while it is broadly recognized in the natural sciences, including the fields of medicine, bioinformatics, machine learning and statistical physics), we want to provide the reader with a brief discussion of its characteristics and benefits. For a detailed introduction to the method the reader may refer to Baldi and Brunak (2001); Gelman et al. (1995), and Jaynes (1974). Exemplary and rather sophisticated Bayesian meta-analyses from the field of medical research are Higgins and Spiegelhalter (2002), and Warn et al. (2002).

One principal difference between standard statistics and Bayesian statistics is that the latter assumes probabilities to be measures of some subjective belief of plausibility. This does not rule out the massive use of frequency information as the main operationalization of probabilities; it rather results in the probabilistic expression of all unobserved quantities of a model.

For example, in Bayesian statistics, there is no assumption of a “true value” which would serve as expectation of a sampling distribution. The methodology instead provides a probability distribution of such expectations, given the data at hand. As a result, tests of hypotheses are not applied, since uncertainty of inferences is then better (and more directly) addressed by evaluation of the latent (“true”) parameter’s probability distribution. Given the personal experience of the authors, it is exactly this feature which often offends practitioners of the standard approach. To resolve this situation we want to emphasize that Bayesian statistics is about plausible inference on random processes and not the real or true processes themselves.