Incorporating threshold theory into the cultural consensus theory for ordinal categorical data: A simulation study

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Introduction

Cultural consensus theory (CCT)

- A cognitively-driven information-pooling approach to assess informants' consensus (Batchelder et al., 2018).
- The "culturally correct" answers are unknown a priori.
- Originally aims at analyzing data consisting of binary responses (Batchelder & Romney, 1988; Romney et al., 1986).

Threshold theory

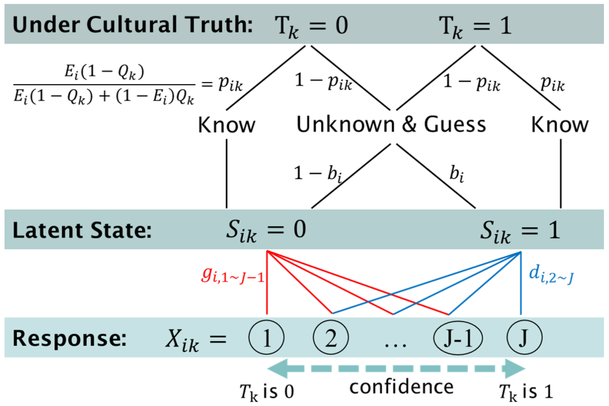
- Distinguish between sensory-based thresholds and decision-based response biases (Krantz, 1969; Luce, 1963).

Objectives

1. Incorperate threshold theory into the CCT framework for ordinal categorical responses.
2. Estimate items' and informants' parameters by using hierarchical Bayesian modeling.
3. Check the single (consensus) truth assumption.

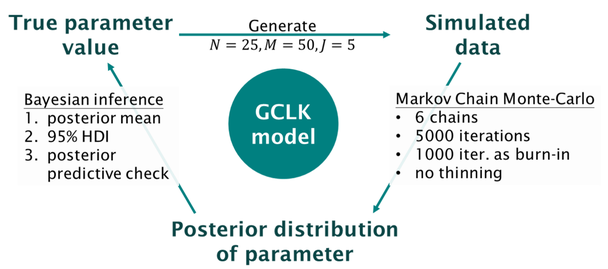
General-Condorcet-Luce-Krantz (GCLK) Model

$X_{ik} = j$: the ith informant answers the jth confident response on the kth item. $(i \in \{1, \ldots, N\}, j \in \{1, \ldots, J\}, k \in \{1, \ldots, M\})$

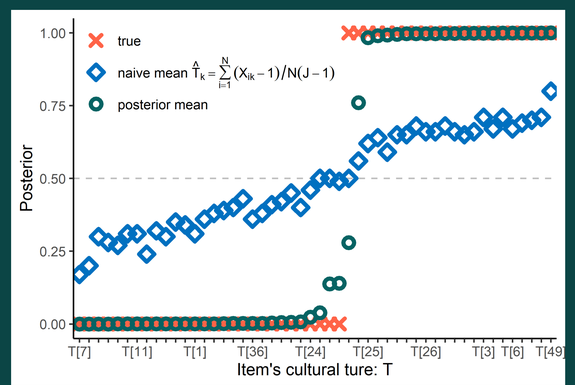


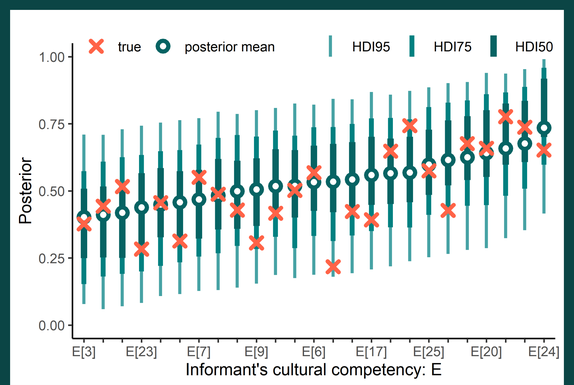
where p_{ik}, the probability of knowing the answer, is a function of item's difficulty Q_k and informant's competence E_i; b_i is a sensory bias; $\boldsymbol{g}_i$ & $\boldsymbol{d}_i$ are response criteria (resp.) at different latent states S_{ik}.

Simulation Procedure



Test theory without an answer key

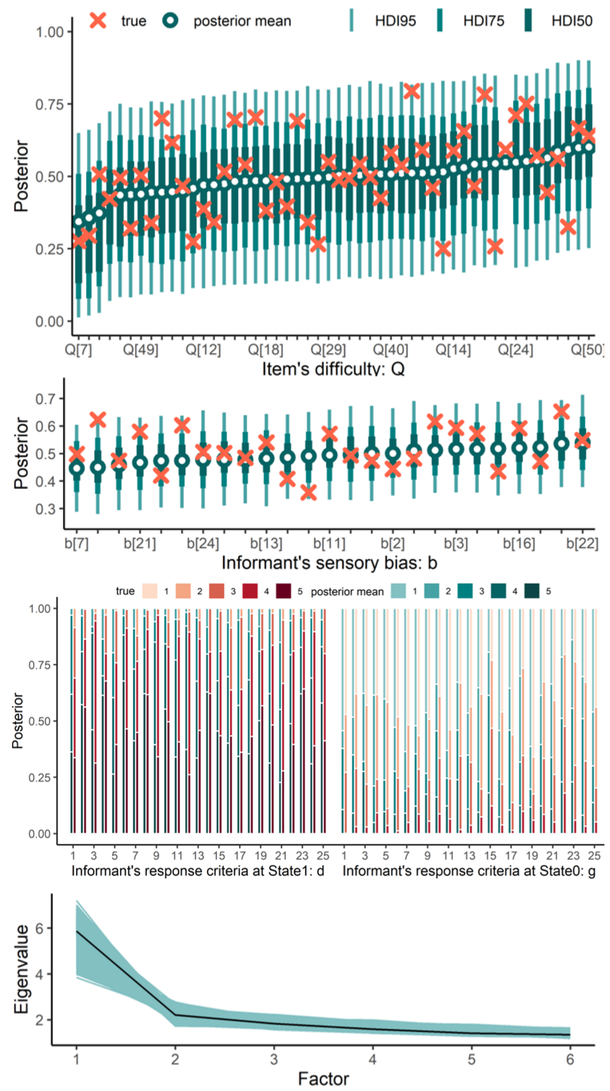




Our model can estimate the correct answers much more accurately by weighting on the informants' responses.

MORE INFORMATION

Results



Discussion

- The GCLK model is developed for analyzing informant-by-item ordinal response data where items' consensus truth is unknown a priori.
- Our simulation results show that the hierarchical Bayesian approach can get a strong recovery for the true parameters in the GCLK model.
- The consensus answers estimated by the GCLK model are more close to the true values than simply calculating the average over individual responses for each item.
- Follow-up study: Apply the GCLK model to real data (e.g. Likert-type questionnaire).

References

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