Causes and effects in Dichotomous Comparative Judgments: a plausible information-theoretical system of mechanism

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Abstract

Dichotomous Comparative Judgment (DCJ, Pollitt (2012a), Pollitt (2012b)) requires judges to evaluate the relative manifestation of traits between pairs of stimuli, resulting in a dichotomous outcome indicating which stimulus exhibits the trait more strongly. Research has demonstrated DCJ’s effectiveness and reliability in various domains (Pollitt 2012b; Bartholomew et al. 2018; van Daal et al. 2019; Lesterhuis 2018; Bartholomew and Williams 2020; Boonen, Kloots, and Gillis 2020). However, the literature lacks a clear and transparent depiction of the plausible mechanisms underlying DCJ data. Specifically, there is no detail explanation of how the different assessment factors can potentially influence the observed DCJ data. This study aims to fill this gap by applying the framework of causal analysis and Directed Acyclic Graphs (DAG; Pearl (2009)). Using this framework, the study will construct a scientific model to elucidate the causal assumptions and mechanisms inherent the system. This model will enable researchers to draw inferences about causal relationships from DCJ data. Subsequently, the study will translate this model into a probabilistic statistical model, aiming to derive statistical estimands for different targets of inference. The outcomes of this study will inform the planning of DCJ experiments and hold significance for researchers or analysts involved in education and assessment procedures who implement the DCJ methodology.

## Introduction

## Theoretical framework

### Research questions and their estimands

### A scientific model for the DCJ procedure

### From the scientific to the Bradley-Terry-Luce model

## Discussion

### Limitations and further research

## Conclusion

## Declarations

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**Consent for publication:** All authors have read and agreed to the published version of the manuscript.

**Availability of data and materials:** No data was utilized in this study

**Code availability:** All the code utilized in this research is available in the different notebooks and CODE LINKS referenced in the digital document. The digital document is located at: <https://jriveraespejo.github.io/paper2_manuscript/>.

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