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Conjunctive Causal Judgement using Categorical and Continuous Variables

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The conjunctive causal power *PC* theory (Novick & Cheng, 2004) proposes that when people have to make a judgement about whether or not two causal candidates acting together produce an effect, they take into account several hypotheses. These hypotheses state that the effect will occur due to the: a) influence of a candidate A; b) influence of a candidate B; c) conjunctive influence of both A and B and; d) influence of alternative causes.

This way, the estimation of causal influence exerted by a conjunctive candidate over an effect, depends not only on the covariation between causal candidates and the effect (as proposed by the purely covariational models, e.g. ΔP_{ij}) but also on the baseline of the effect. In other words, people adjust their causal judgements according to the information about the error. However, this theory is applied only to causal judgement using categorical outcomes.

Recent studies have shown that when people reason about continuous distributions to draw causal conclusions, they also take into account information about several forms of error (Masnick & Klahr, 2003). However, these studies only analyze situations where the causal candidates are single. The purpose of the present study was to analyze how people use information about experimental error to make conjunctive judgements using categorical and continuous outcomes.

Method

Seventy-one freshmen students participated in this study for extra class credit. All participants were shown a cover story adapted from Clifford and Cheng (2000) stating that they should evaluate whether or not new medicines or a combination of medicines produce, as a side-effect, changes in body weight. Then, ten datasets containing experimental results were presented to the participants. These datasets showed the changes in body weight for four different groups: one received one medicine (A), one received a second medicine (B), one that received both medicines A and B, and a control group. Then, participants were asked to judge if each causal candidate (single or conjunctive) had changes in weight as a side-effect, and to estimate the magnitude of the causal influence in a scale from 1 to 100.

In addition, the datasets varied in terms of two factors: the kind of dependent variable (categorical or continuous) and the error in the data. In the categorical datasets, the error was manipulated by varying the baseline. In the continuous datasets, the error was manipulated by the systematic variation of the control group mean (baseline) and the

within group variance of the conjunctive group. It is important to mention that only the conjunctive candidate group showed a real effect on the outcomes.

Results & Conclusions

Participants' performance with categorical datasets replicated the main findings of Clifford and Cheng (2000). Judgements of candidates with identical ΔP_{ij} but different baselines increased in value, with an increasing base rate of *e*. On the other hand, there were not significant differences between judgement values for candidates with equal causal power but different ΔP_{ij} values.

In all datasets including continuous variables distributions, the conjunctive candidates' judgements were greater than those of single candidates. However, when comparing causal judgements of datasets where standard deviation of the conjunctive candidate was manipulated, there were no significant differences. These results suggest that participants were sensitive to statistically significant differences on the mean of the distributions, but did not adjust their judgements as a function of within group variation of the distributions.

On the other hand, there were no significant differences on the causal judgements when the baseline was systematically changed. These results suggest that participants took into account variation due to error and adjusted their judgements using within groups variance.

Despite the fact that data distributions of single causal candidates had means and standard deviations not statistically different from those of their respective control groups, in all datasets a high proportion of participants (between 73.2% and 88.7%, varying according to causal candidates) attributed causal influence to single causal candidates. These results suggest that participants' causal judgements are sensitive to variations due to chance.

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Main References

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