Modulating the coherence effect in causal-based processing

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Background

Causal cognition offers researchers an alternative to associationist and similarity-based theories (Waldmann, et al., 2006). Currently, the most accepted proposal regarding the mechanism by which causal knowledge becomes relevant for categorization is Rehder's Generative Model (GM; Rehder, 2003; Rehder & Hastie, 2001).

A crucial prediction of the GM is the coherence effect (Rehder, 2017; Rehder & Kim, 2010, which is an interaction between two causaly-related features. Imagine that subjects learn that in a given category A causes B. Imagine, also, that those subjects are shown all possible present and absent cause and effect combinations (i.e., AB, ¬AB, A¬B, ¬A¬B), and asked to rate each combination's category membership. The coherence effect prediction holds that, given that if a cause is not observed, then its effect is also likely not to be observed, people should judge an exemplar showing the ¬A¬B pattern to be a good category member because it preserves the learned causal structure (i.e., A → B) even better than the ¬AB or A¬B feature combinations

Note that models that use a multiplicative similarity metric (Nosofsky, 1984; 1986) can also predict a coherence effect, albeit a small one.

Hypotheses:

The coherence effect should be modulated by the way in which people framed their task.

Participants will engage in similarity-based processing or causal-based processing.

Framing the task as categorization, would engage most participants in similarity-based processing.

Framing the task as consistency, would engage most participants in causal-based processing.

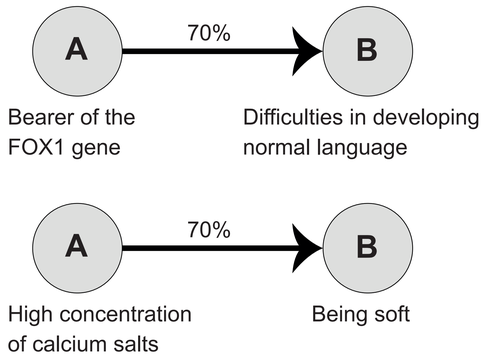
Our proposal is that we can use the size of the coherence effect to distinguish between both type of processing.

Method

We set up a 2 (Condition: categorization and consistency) x 4 (feature combination: AB, ¬AB, A¬B, ¬A¬B) mixed design experiment. Participants learned about a simple A → B causal model and then used a rating scale (from 1 t o7) to categorize all possible feature combinations.

Participants: Forty-eight university undergraduate students. Participants were randomly assigned to experimental or control conditions.

Materials



Results

Analysis showed a main effect of question type ($F(1, 46) = 22.46$, $MSe = .40$, $p < .001$, $\eta p2 = .33$, power = .97), a main effect of feature combination ($F(3,138) = 46.48$, $MSe = 2.68$, $p < .001$, $\eta p2 = .50$, power > .99) and a significant interaction ($F(3, 138) = 12.51$, $MSe = 2.68$, $p < .001$, $\eta p2 = .21$, power > .99). See fig. 1.

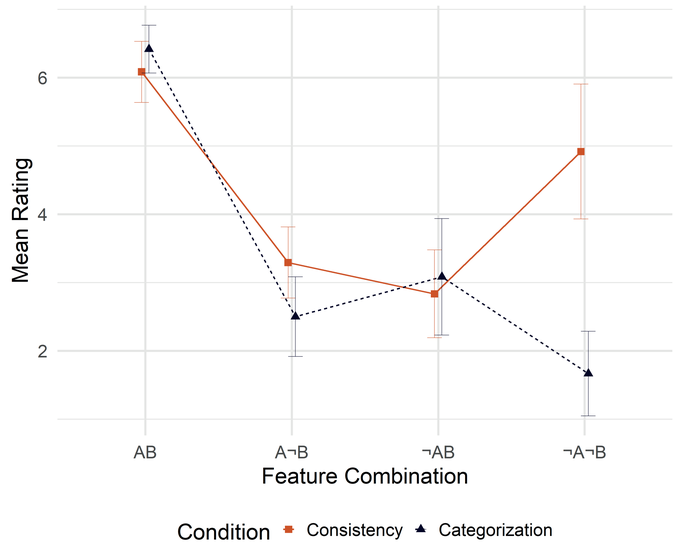


Fig. 1. Mean rating plot for each feature combination. Black line categorization condition and orange line consistency condition.

Fig. 2 illustrates the effect analysis that showed a significant difference for the ¬A¬B combination across conditions ($F(1, 46) = 33.29$, $MSe = 3.81$, $p < .001$, power > .99).

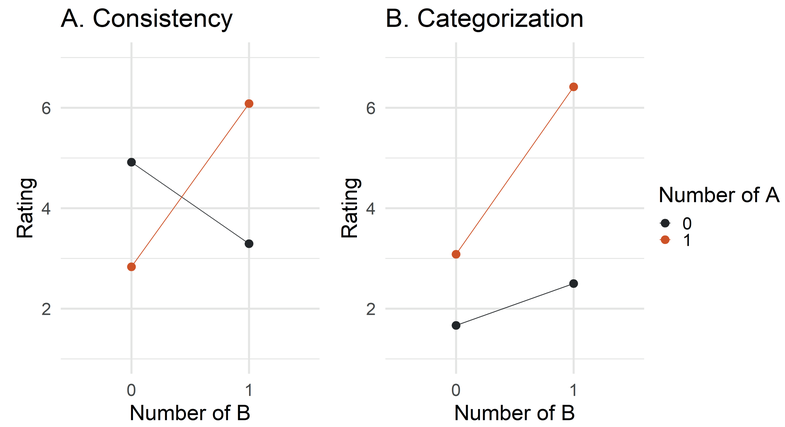


Fig. 2. Crossover interaction plots for ecery condition. (A) Consistency and (B) Categorization.

Discussion

In our experiment, we showed that the size of the coherence effect is modulated depending on the type of rating question subject are considering.

A small coherence, such as we find in the categorization condition, might reflect similarity-based processing. A large coherence effect, such as we find in the consistency condition, can only be explained as causal-based processing.

In conclusion, our experiment offers evidence that the way in which the rating task is framed, can affect the size of the coherence effect.

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