

Improving Your Chance to Discover an Interaction Effect by Changing the Inquiry Goal

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Previous research on scientific reasoning has shown that adults and children are poor at discovering interaction effects in inquiry tasks that involve multi-cause structures. Lack of a relevant causal framework and relevant reasoning skills have often been proposed to explain the failure rate. In this study we aimed to demonstrate that participants' performance finding interaction effects could be greatly improved by changing the inquiry goal even when the relevant abilities and task were kept the same. Three experiments with a self-directed experiment (SDE) paradigm were conducted to test the hypothesis at different levels of inquiry task complexity. With the SDE paradigm, participants could change the values of candidate variables in each test trial and observe the effect (i.e., the speed of toy racing cars) in order to figure out the underlying causal structure. Undergraduate participants were randomly assigned to two groups that only differed by the inquiry goal. In the causal-status group, participants were instructed to determine which variables could influence the effect of concern and how, as previous studies usually did; in the causal-rule group, participants were instead told to find a causal rule to predict the effect. In addition, participants' abilities at inferring an interaction effect from a set of double-controlled experiments (changing the value of a variable at each level of the other variable while keeping other variables constant) and designing experiments to test a target interaction hypothesis were also measured. As predicted, the success rate at finding a target interaction between two candidate causes for casual-rule group was twice as much as for casual-status group in all three experiments. The causal-status group performed poorly as previous studies reported, even though their abilities of inferring and testing interactive hypothesis were as good as the other group's. Moreover, the causal-rule group tested more interactive hypotheses, less single-variable hypotheses, and thus had more chances to gather evidence about interaction with the same amount of testing trials. These results, for the first time show that adults' performance on finding interactive effects can be influenced by a top-down contextual factor, i.e., the inquiry goal, via changing the availability of interactive hypotheses in the reasoner's mind. Implications for science education are discussed.

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