

## **Using systems models for causal inference: a data-assumption trade-off**

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Systems models, such as agent-based models, individual-level simulation models, or state-transition models, are a common analytic tool in decision science. Simulating the results of these models under perturbations of the system allows users to estimate counterfactual contrasts that may inform decision-making. However, systems models are only useful for evidence-based decision-making if at least some model conditions result in counterfactual outcome distributions that match those observed in the real world. Causal inference methods developed using statistical models can be extended to assess whether this is ever true for systems models, and show that systems models can be used to obtain unbiased estimates of causal effects under additional strong assumptions. Here, I describe theoretical and applied results demonstrating some conditions under which systems models can be used for causal inference, explain the required assumptions, discuss several common scenarios under which these assumptions cannot be expected to hold, and present some suggestions for uncertainty analyses when assumptions are violated.