Causal Analysis in Theory and Practice

Causal Diagrams - a threat to correctness?

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Causal Diagrams - a threat to correctness?

Our attention was called to a new attack on graphical models and structural equation models (SEM), this time in the name of "correctness"..

The article in question is: Cloak and DAG: A response to the comments on our comment by Martin A. Lindquist and Michael E. Sobel (L&S) Forthcoming , NeuroImage http://www.sciencedirect.com/science/article/pii/S1053811911013085

The advice that L&S give to NeuroImaging researchers reads as follows:

"For if fMRI researchers continue to use their "familiar approach", drawing diagrams and fitting SEMs without realizing the assumptions they are making, many of the causal inferences thereby generated will be incorrect, and the development and use of alternative ways of studying effective connectivity will be stifled."

L&S's warning of the importance of scrutinizing assumptions is admirable. Yet readers of NeuroImage will have difficulty understanding why they are judged incapable of scrutinizing causal assumptions in the one language that makes these assumptions transparent, i.e., diagrams or SEM, and why they are threatened with "incorrect inferences" for not rushing to translate meaningful assumptions into a language where they can no longer be recognized, let alone justified.

For a simple example, consider the causal chain Z--->X--->Y.

S&L calls on researchers to explicate the assumptions of this model in the language of "ignorability," where they read:

i. $Y(0,x) = Y(1,x)$

ii. $X=X(Z), Y(Z) = Y(Z, X(Z))$

iii. $\{Y(z,x),X(z)\}$ _||_ Z for all z,x

iv. $Y(z,x)$ _||_ X | Z for all z,x

(with _||_ standing for "independence")

For comparison, in the language of SEM these same assumptions read:

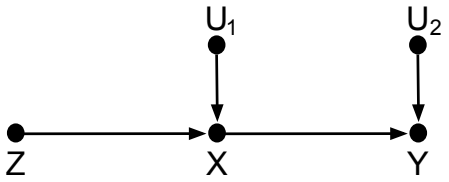
$x = f1(z,u_1)$

$y = f2(x,u_2)$

$Z \perp \{u_1, u_2\}, u_1 \perp u_2$

(where the u's stand for omitted factors)

Finally, in the language of diagrams, these assumptions read



with no algebra needed.

(Translation between these three languages are given in Causality page 101.)

We solicit readers' answers to the following questions:

1. In what language are these causal assumptions more meaningfully and clearly displayed?

2. How can members of the Arrow-Phobic Society be lured into a dispassionate examination of the comparison above?

======Judea