Title: Identifying classical Markovian causal models from generalized observation

Speakers: Isaac Friend

Series: Quantum Foundations, Quantum Information

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Identifying classical Markovian causal models from generalized observation

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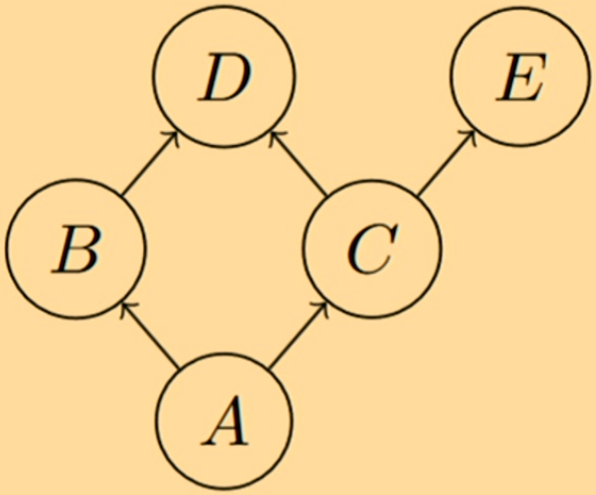
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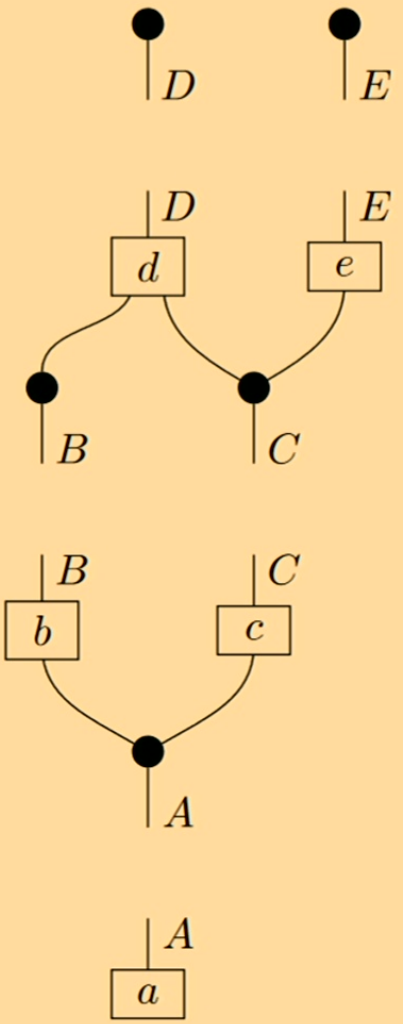
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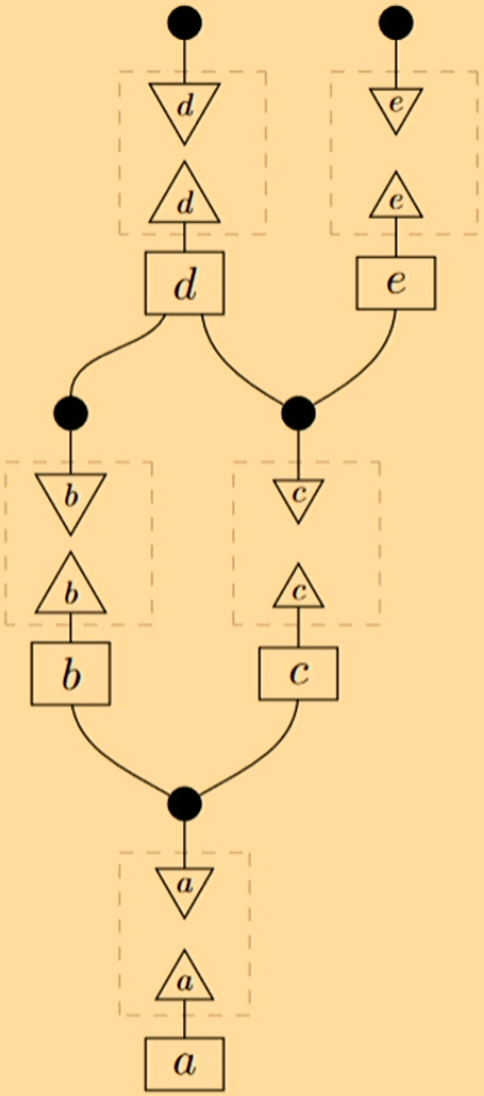
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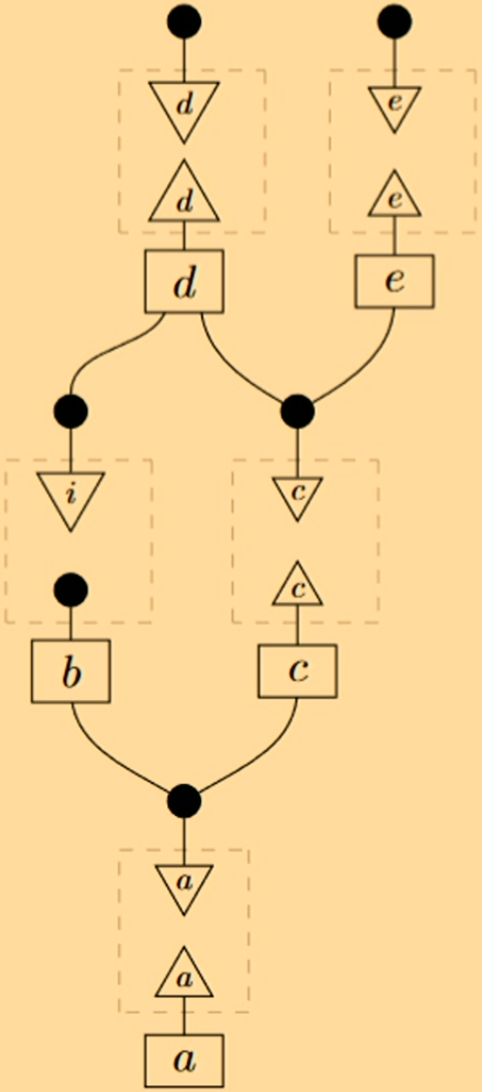
a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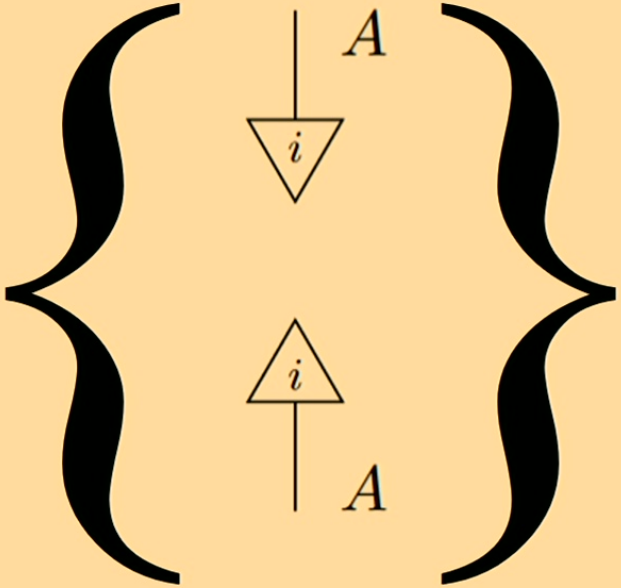
a

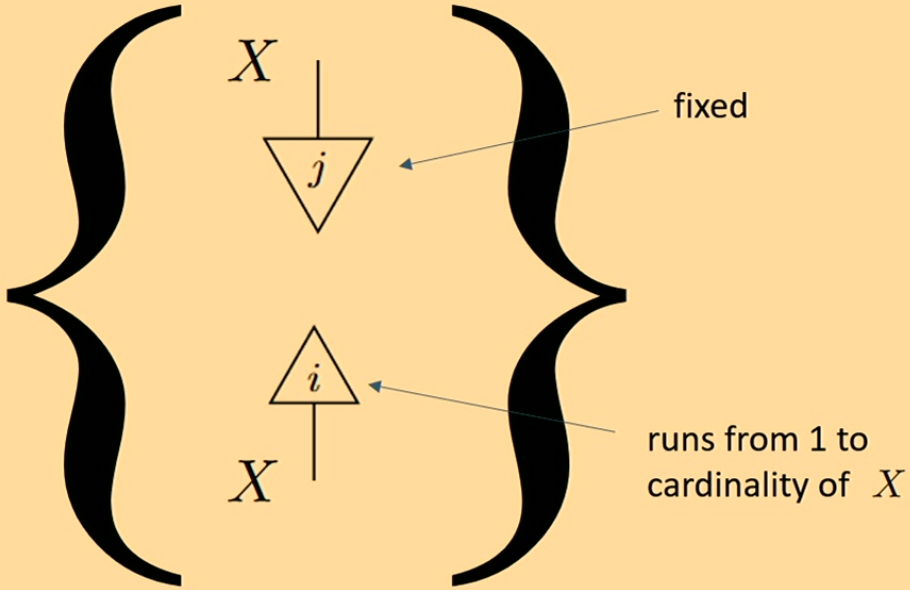
Perfect passive observation instrument

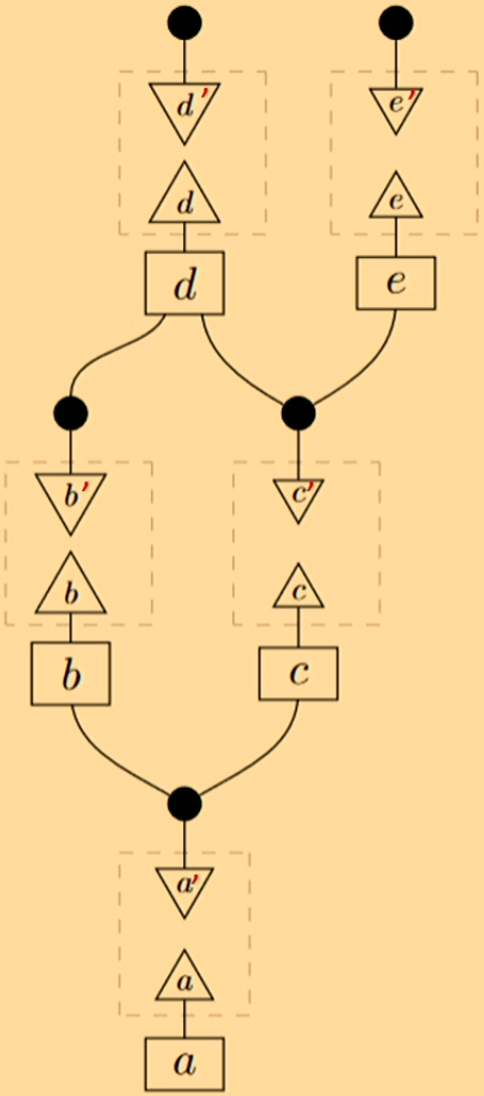


Single-branch discard-and-prepare instrument

IF & AK, *Identification of causal influences in quantum processes,* Phys. Rev. A **109**, 042214

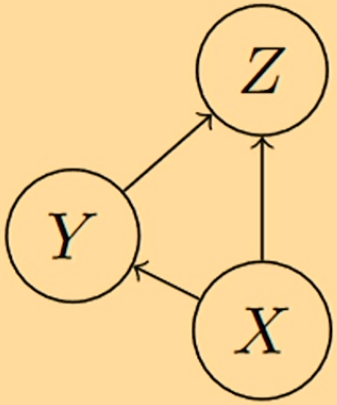
“Learn-*X*-and-do-X=*j*” instrument

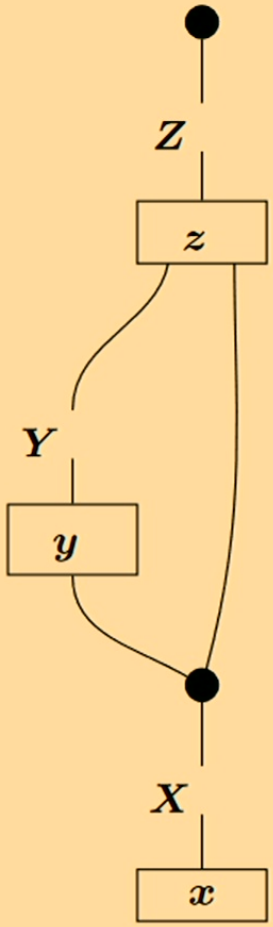


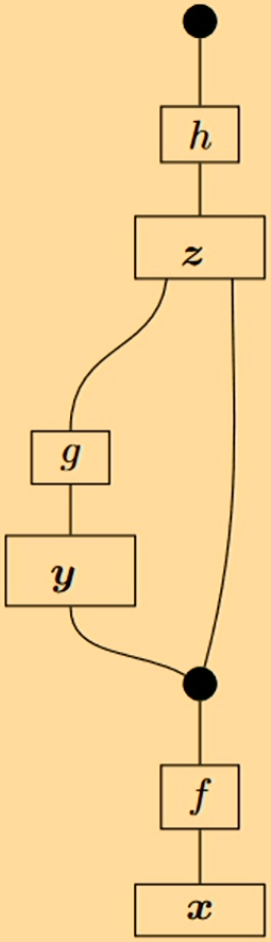

d′
e′
d
e
d
e
b′
c′
b
c
b
c
a′
a
a

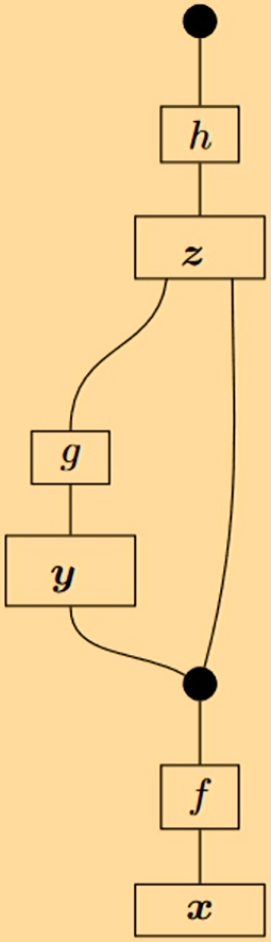
Two-branch instrument for system-type *2*

$$\left\{ \begin{bmatrix} .9 \\ .1 \end{bmatrix} \circ \begin{bmatrix} 1 & 0 \end{bmatrix}, \qquad \begin{bmatrix} .1 \\ .9 \end{bmatrix} \circ \begin{bmatrix} 0 & 1 \end{bmatrix} \right\}$$

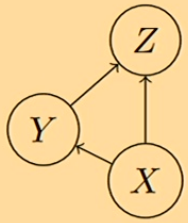

Z
Y
X


Z
z
Y
y
X
x


h
z
g
y
f
x



Distribution not Markov for



Contributions

- Formulate causal Bayesian networks as second-order processes, allowing unified study of many kinds of data extraction, and hence many kinds of causal inference problem
- Identify Markovian models from unsharp and disturbing observations satisfying abstract process-theoretic criteria

Related recordings of Isaac:

Quantum Physics and Logic 2022 (qplconference.org)

Applied Category Theory 2023 (www.youtube.com/@appliedcategorytheory5517)