



# AN INTERVENTIONIST'S GUIDE TO EXOTIC CHOICE

REUBEN STERN (LMU MUNICH – MCMP)

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# PLAN

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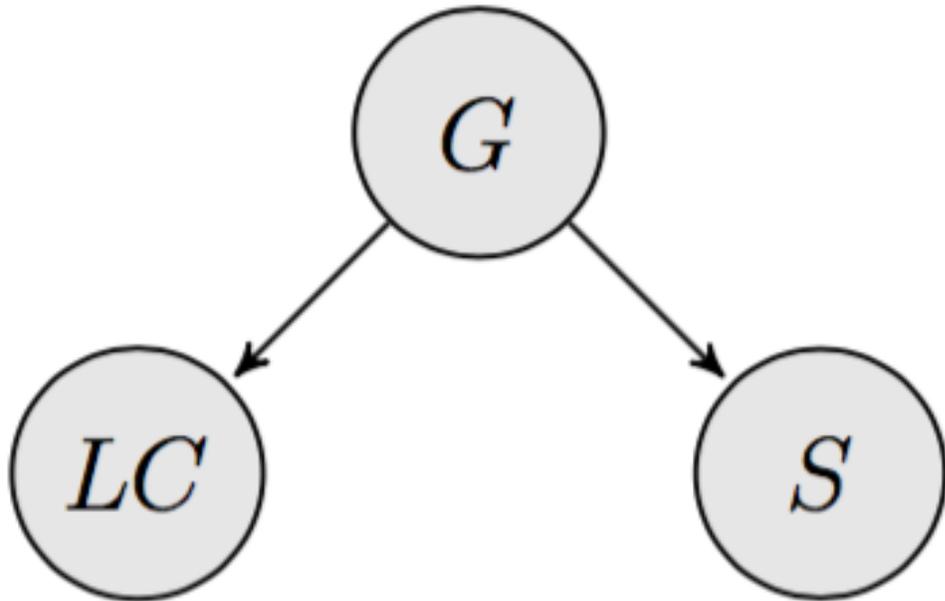


# EVIDENTIAL DECISION THEORY VS. CAUSAL DECISION THEORY

# THE SMOKING GENE

Though you would hate to get lung cancer, you know that you would enjoy every other possible consequence of smoking, and are considering taking up the habit. An oracle tells you that the association between smoking and lung cancer is fully explained by some genetic condition that causes people to smoke and get lung cancer. The oracle also tells you that smoking does not cause lung cancer. Should you smoke?

## THE SMOKING GENE CONTD.



$S = \{\text{smokes, abstains}\}$

$G = \{\text{genetic condition, no genetic condition}\}$

$LC = \{\text{lung cancer, no lung cancer}\}$

# EVIDENTIAL DECISION THEORY

Evidential decision theory says that the agent should opt for whatever action maximizes expected utility when defined as follows:

$$U(a) = \sum_{s_i} P(s_i | a) V(s_i, a)$$

## EVIDENTIAL DECISION THEORY CONTD.

Because  $P(\text{lung cancer}|\text{smoking}) > P(\text{lung cancer})$ , evidential decision theory says that there is (defeasible) reason to abstain from smoking (provided that the correlation persists given everything that you know).

# CAUSAL DECISION THEORY

Causal decision theorists disagree and develop their own formal machinery with the purpose of delivering the result that there is no reason not to smoke when smoking doesn't cause lung cancer.

## AN EXAMPLE

Gibbard and Harper (1978) argue that the agent should opt for whatever action maximizes expected utility when defined as follows, where  $a > s_i$  is a counterfactual conditional:

$$U(a) = \sum_{s_i} P(a > s_i) V(s, a_i)$$



# THE INTERVENTIONIST TURN

## MEEK AND GLYMOUR'S REMARKABLE INSIGHT

Given the (independently justified) axioms to the graphical approach to causal modeling, we can recover causal-decision-theoretic verdicts simply by applying evidential decision theory and treating the agent's influence over what she does as uncaused by the variables under consideration.

## IN THEIR OWN WORDS

“The difference in the two recommendations does not turn on any difference in normative principles, but on a substantive difference about the causal processes at work in the context of decision making—the causal decision theorist thinks that when someone decides to smoke, an intervention occurs, and the evidential decision theorist thinks otherwise... *The conditional probabilities differ because different events have been conditioned on.*” (Meek and Glymour 1994, p. 1009)

# MEEK AND GLYMOUR'S CDT

Causal-decision-theoretic verdicts are attained by maximizing expected utility when defined as follows:

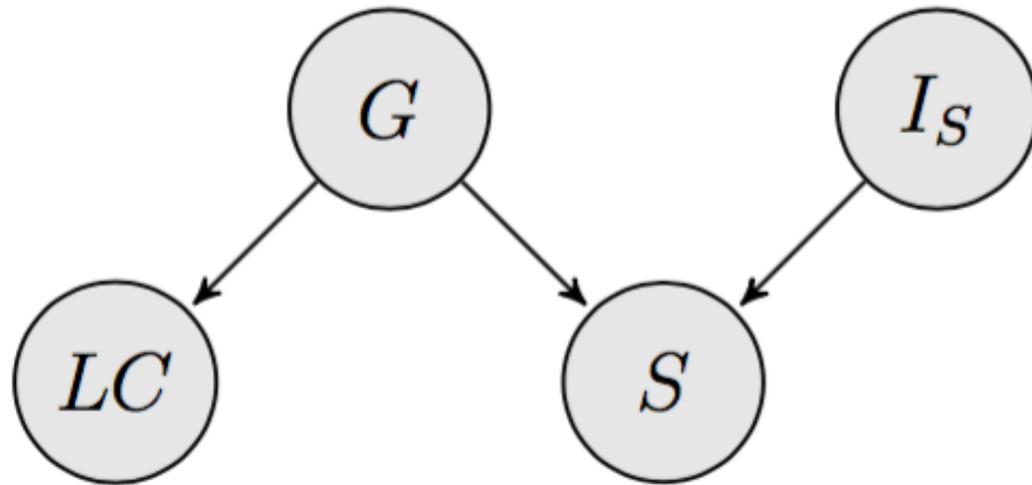
$$U(a) = \sum_{s_i} P(s_i \mid do(a)) V(s_i, do(a))$$

# INTERVENTIONS

When we **intervene** on  $X$ , we use some exogenous cause of  $X$  (i.e., some cause of  $X$  that has no causes in  $\mathbf{V}$  and that is not a direct cause of any variable in  $\mathbf{V}$  other than  $X$ ) to set  $X$  to  $x$ .

- Given the Causal Markov Condition, any intervention on  $X$  must be probabilistically independent from any of  $X$ 's non-descendants in  $\mathbf{V}$  (including its causal predecessors).
- The agent can therefore limit her consideration to causal correlations by modeling the probabilistic effect of  $x$ -ing as the probabilistic effect of intervening to make oneself  $x$ —i.e.,  $do(x)$ .

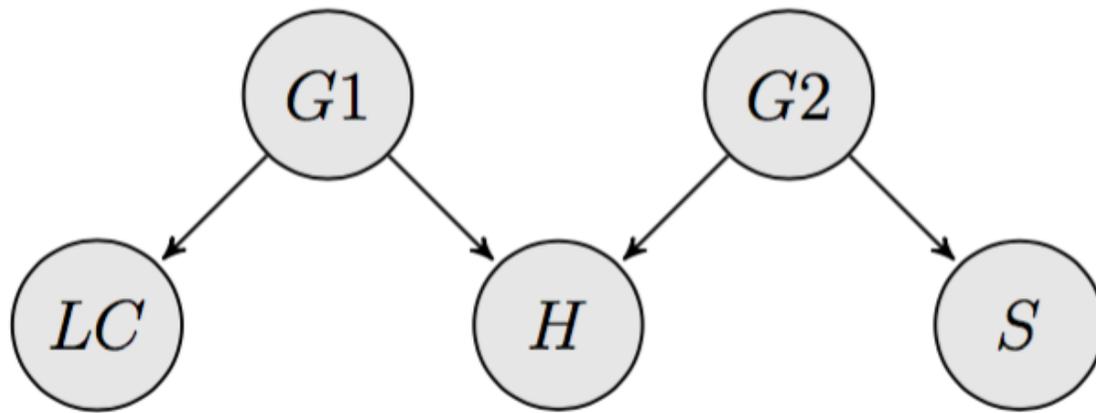
# INTERVENING TO SMOKE



## THE SMOKING GENES

There are two separate genetic conditions that cause shortness – one that also disposes people to smoke, and another that also disposes people to get lung cancer. Since you know that you're short, if you become more confident that you have one of these genetic conditions, you should become less confident that you have the other. (When your shortness is accounted for by the presence of one gene, there's less reason to believe that you have the other.) You would find smoking unpleasant, but since smoking raises the probability that you have the genetic condition that promotes smoking, it is evidence that you lack the genetic condition that promotes lung cancer. Is there any reason to smoke?

## THE SMOKING GENES CONTD.



$S = \{\text{smokes, abstains}\}$

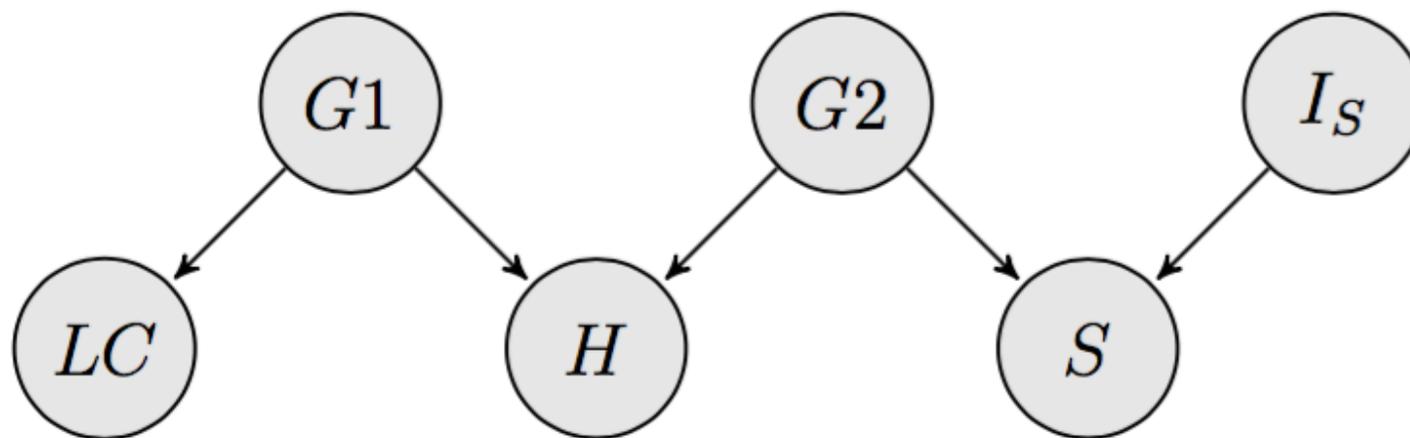
$G1 = \{\text{genetic condition 1, no genetic condition 1}\}$

$G2 = \{\text{genetic condition 2, no genetic condition 2}\}$

$LC = \{\text{lung cancer, no lung cancer}\}$

$H = \{\text{short, tall}\}$

## THE SMOKING GENES CONTD.



## SMOKING VS. INTERVENING TO SMOKE

1. Since  $P(\text{lung cancer}|\text{smokes}, \text{short}) < P(\text{lung cancer}|\text{short})$ , whether you smoke is evidentially relevant to whether you get lung cancer.
2. But since  $I_s$  is not correlated with  $LC$  even when  $H = \text{short}$ , whether you intervene to smoke isn't evidentially relevant to whether you get lung cancer.



# EXOTIC CHOICE

## WHAT MAKES A CHOICE EXOTIC?

$S$ 's choice whether to  $a$  is **exotic** exactly when  $S$  has evidence about something that she takes to be causally downstream from whether she  $a$ 's.

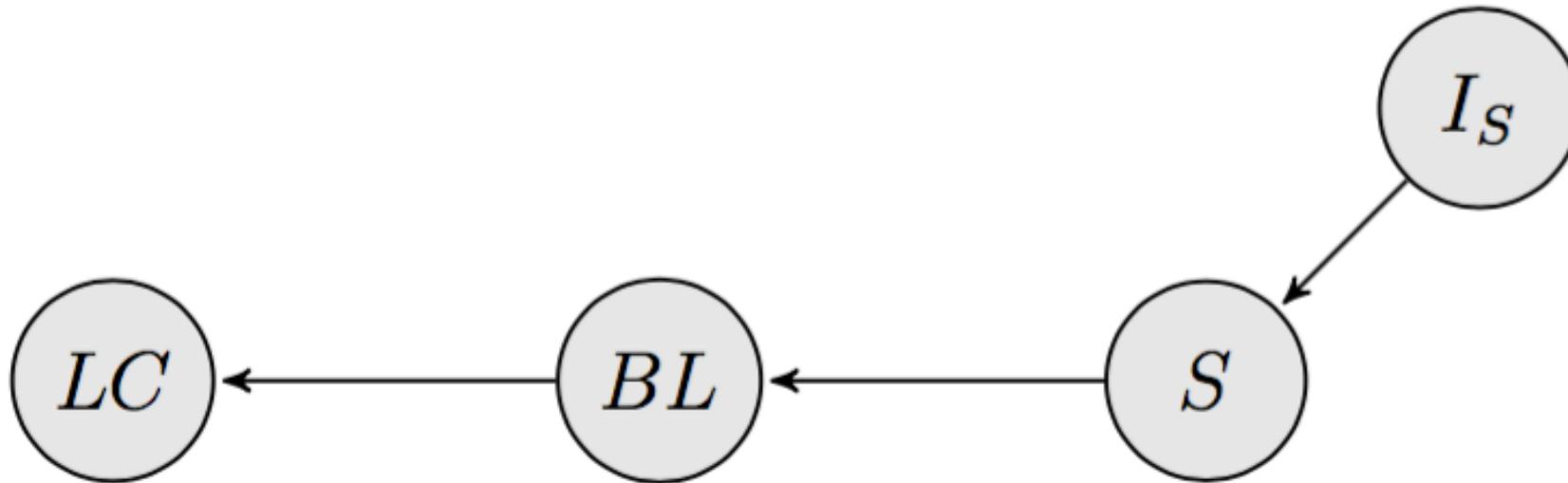
## MEDICAL RESULTS FROM THE FUTURE

Though you would hate to get lung cancer, you know that you would enjoy every other possible consequence of smoking, and are considering taking up the habit. An oracle tells you that smoking causes lung cancer by causing your lungs to blacken, but that the effect of smoking on lung cancer is entirely mediated by whether your lungs blacken. The oracle also gives you the results of a future medical test, revealing that your lungs will unfortunately blacken. Should you smoke?

## TROUBLE FOR CDT?

1. It is intuitive that you should smoke since you know that your lungs will blacken no matter what you do, and you know you'll enjoy smoking.
2. But many versions of causal decision theory say that there is reason not to smoke because the future counterfactually depends on the present.

## MEDICAL RESULTS FROM THE FUTURE CONTD.



# HITCHCOCK'S INTERVENTIONIST FIX

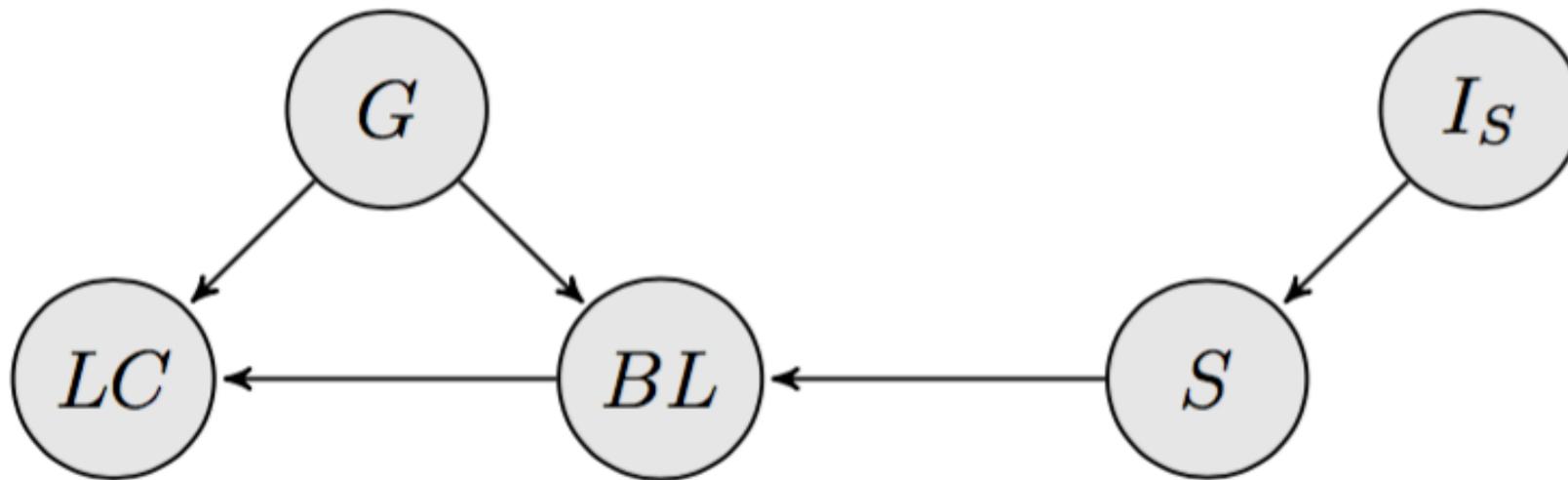
Hitchcock argues that interventionists can adequately address exotic decision-making scenarios by conditioning on any inadmissible evidence.

- Since whether you intervene to smoke or abstain is evidentially irrelevant to whether you get lung cancer when  $BL = \textit{blackened lungs}$ , Meek and Glymour's CDT capably delivers the result that there is no reason not to smoke.

## WHEN GENES AND FUTURE MEDICAL RESULTS MIX

Though you would hate to get lung cancer, you know that you would enjoy every other possible consequence of smoking, and are considering taking up the habit. An oracle tells you that smoking causes lung cancer by causing your lungs to blacken, but that the effect of smoking on lung cancer is entirely mediated by whether your lungs blacken. She also mentions that there is a genetic condition that disposes people's lungs to blacken, while (via a direct causal path) making them less susceptible to lung cancer. Finally, the oracle gives you the results of a future medical test, revealing that your lungs will unfortunately blacken. Is there any reason not to smoke?

## GENES AND FUTURE MEDICAL RESULTS CONTD.



# CDT VS. EDT

## Conjectures:

- Evidential decision theorists will say that there is reason not to smoke, provided that the correlation between  $S$  and  $LC$  persists given all of the agent's evidence.
- Causal decision theorists will say there is no reason not to smoke.

## HITCHCOCK'S FIX TO CDT?

When  $BL = \textit{blackened lungs}$ , intervening to smoke raises the probability that you will get lung cancer (by decreasing the probability that you have the genetic condition that makes people impervious to lung cancer).

- Hitchcock's fix doesn't square with causal-decision-theoretic reasoning.
- Another fix is needed.



# ANOTHER INTERVENTIONIST TURN

## REVISITING MEEK AND GLYMOUR'S INSIGHT

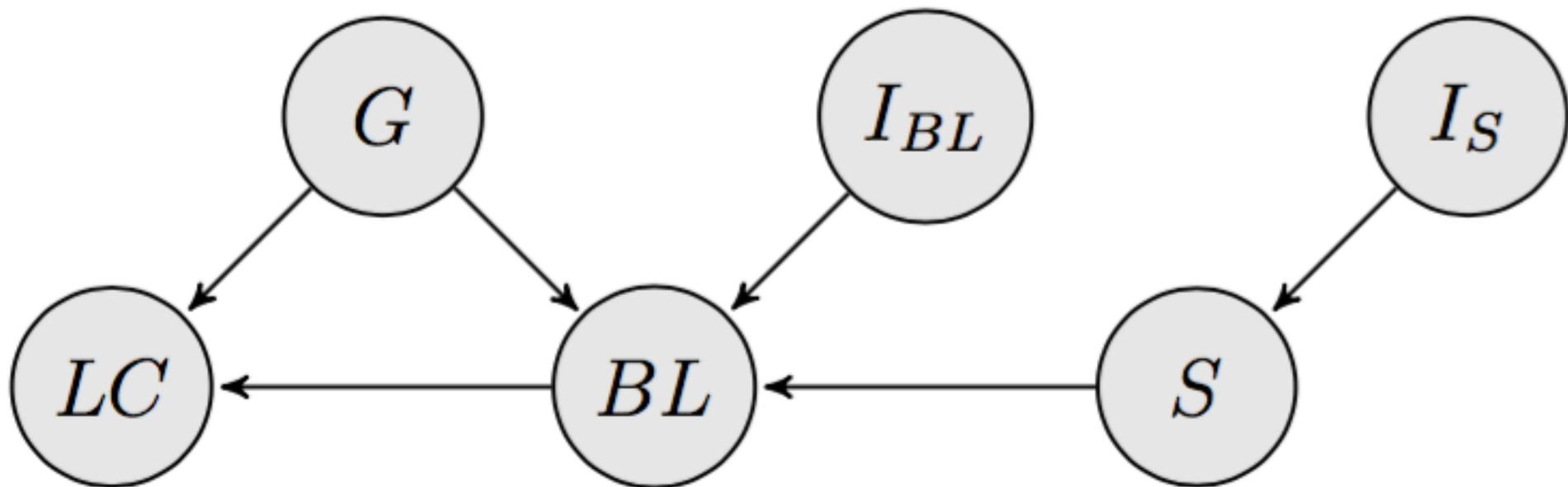
When choice is ordinary, modeling the agent as intervening by itself guarantees causal-decision-theoretic verdicts because it is impossible to induce a spurious correlation between the intervention and something else by conditioning on admissible evidence.

# REVISITING MEEK AND GLYMOUR'S INSIGHT

In contexts of exotic choice, modeling the agent as intervening doesn't by itself guarantee causal-decision-theoretic verdicts because spurious correlations can arise when the agent conditions on evidence about a downstream collider.

- When choice is exotic, the dispute between causal decision theorists and evidential decision theorists turns on more than whether the agent is modeled as intervening.
- But might interventions still be the path to causal-decision-theoretic verdicts?

## INTERVENING ON INADMISSIBLE EVIDENCE



# CONDITIONING VS. INTERVENING

We can remedy Hitchcock's approach to dealing with inadmissible so that it guarantees causal-decision-theoretic verdicts by *intervening* on any inadmissible evidence.

- Though  $do(smoke)$  is evidentially relevant to  $LC$  on the supposition that  $BL = blackened\ lungs$ ,  $do(smoke)$  is *not* evidentially relevant to  $LC$  on the supposition that  $do(BL = blackened\ lungs)$ .
- But why update on  $do(BL = blackened\ lungs)$  rather than  $BL = blackened\ lungs$ ?

# IS INTERVENING ON INADMISSIBLE EVIDENCE PRINCIPLED?

Though we can secure causal-decision-theoretic verdicts by intervening on inadmissible evidence, it *prima facie* seems unprincipled.

- When we receive the future test results, we learn that our lungs will be black, but not that they will be black for reasons that are independent from whether we smoke.
- Why should we make our choice on the basis of the latter?



# EVIDENTIAL AUTONOMY



## RAMSEY ON AGENCY AND TIME'S ARROW

“The past, we think, is settled; if this means more than that it is past, it might mean that it is settled *for us*, that nothing now could change our opinion for us of any past event. But that is plainly untrue. What is true is this, that any possible present volition of ours is (for us) irrelevant to any past event. To another (or to ourselves in the future) it can serve as a sign of the past, but to us now what we do affects only the probability of the future.”

# RAMSEY AND ORDINARY CHOICE

When choice isn't exotic, the probabilistic irrelevance between our present volitions and the past is secured by modeling our volitions as interventions (because the causal character of an intervention entails that the intervention to act must be uncorrelated with any of the variables in the graph that are not causally downstream from the action variable).

## RAMSEY AND EXOTIC CHOICE

When choice is exotic, we treat some aspect of the future as settled (in the relevant sense). Ramsey's line of thought suggests that we should treat present volitions as irrelevant to these future aspects.

- We can't secure this irrelevance while updating on  $BL = \textit{blackened lungs}$ .
- But we can secure this irrelevance by updating instead on  $do(\textit{blackened lungs})$ .
- If we must view our volitions as evidentially irrelevant to what's settled, then when choice is exotic, this pushes us towards representing inadmissible evidence in terms of interventions.

## RAMSEY AND EXOTIC CHOICE CONTD.

When choice is exotic, the probabilistic irrelevance between present volitions and the past is not guaranteed by modeling volitions as interventions (e.g., because  $G$  could be temporally prior to the intervention to smoke), but it *is* secured by modeling volitions and inadmissible evidence as interventions.

# EVIDENTIAL AUTONOMY THESIS

Joyce (2007) and Velleman (1989) argue that “a deliberating agent who regards herself as free need not proportion her beliefs about her own acts to the antecedent evidence that she has for thinking that she will perform them.”

# EVIDENTIAL AUTONOMY & ORDINARY CHOICE

When choice is ordinary, evidential autonomy is secured by modeling the agent as intervening.

- The same goes for causal-decision-theoretic verdicts.

# EVIDENTIAL AUTONOMY & EXOTIC CHOICE

When choice is exotic, evidential autonomy is secured only by (i) modeling the agent as intervening and (ii) intervening to incorporate any inadmissible evidence into the decision.

- The same goes for causal-decision-theoretic verdicts.

# UPSHOT

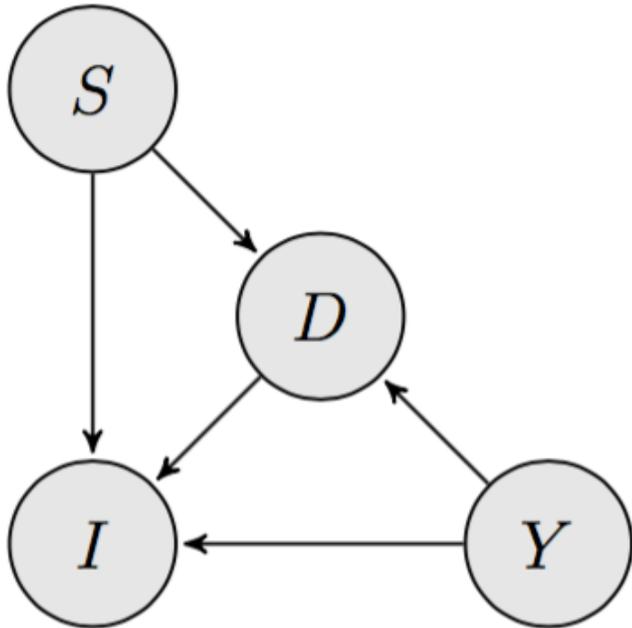
The fundamental dispute between causal decision theorists and evidential decision theorists may turn on whether agents must represent themselves as evidentially autonomous when making choices.

- When choice is ordinary, this boils down to representing the agent's volition as an intervention.
- When choice is exotic, this also requires intervening to incorporate inadmissible evidence.

# OPEN QUESTIONS

1. Should agents represent themselves as evidentially autonomous?
2. Who wins the CDT/EDT debate?
3. Does the advice provided in this interventionist guide conflict with other requirements of rationality (e.g., Bayesian conditionalization)?
4. How should uncertain inadmissible evidence be integrated into decisions?

# ORDINARY EXOTIC CHOICE



$S = \{\text{high future salary, low future salary}\}$

$D = \{\text{healthy diet, unhealthy diet}\}$

$Y = \{\text{yoga, no yoga}\}$

$I = \{\text{injury, no injury}\}$



THANKS!