Events and Times: A Case Study in Means-ends Metaphysics

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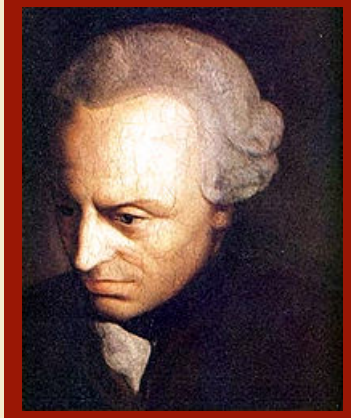
Three Themes

- Metaphysics:
  - The nature of events
  - The relation between events and time
- Methodology
  - How to construct appropriate causal models
- Metametaphysics
  - Problems of the first kind can be fruitfully recast as problems of the second kind

A Historical Tradition

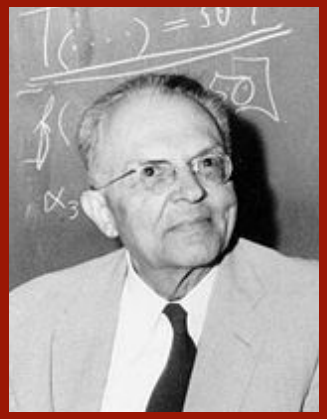
- Recasting metaphysical problems as problems about the utility of certain concepts for achieving certain epistemological goals

Immanuel Kant



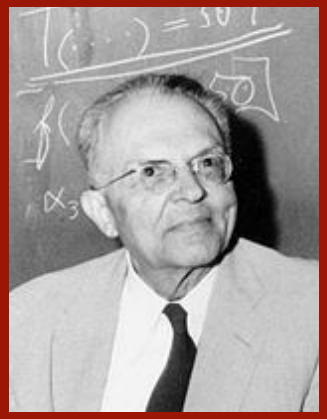
- Metaphysics is not distinguished by its peculiar subject matter
- Metaphysics concerns the necessary pre-conditions for empirical knowledge
- Justified by the 'Transcendental Deduction'

Rudolf Carnap



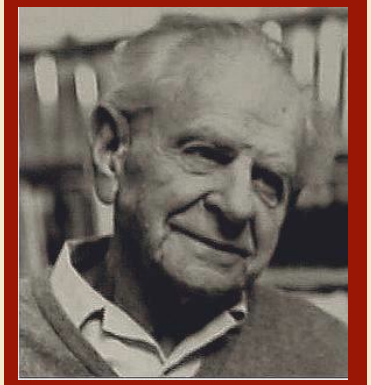
- Project of 'explication'
- Contrasted with analysis in the ordinary language tradition
- Replace an ordinary concept with a new one
- Captures some features of the original
- More precise
- Better suited to some type of inquiry

Rudolf Carnap



- Inquiry is always carried out within a linguistic framework
- Two kinds of questions: internal and external
- Internal questions are answered using the rules of the linguistic framework
- Answers to such questions are analytic
- External questions concern which linguistic framework to use
- Answered on broadly pragmatic grounds

Karl Popper



- Replace Metaphysical Theses with Methodological Rules
- These Rules have the status of conventions, defining a form of inquiry
- Justify the rules by demonstrating that the resulting form of inquiry has various desirable features

Means-Ends Epistemology

- Apt phrase coined by Oliver Schulte (1999) to describe a certain approach to epistemology
- Consider epistemological goals
- Demonstrate that certain methods will achieve those goals

Hans Reichenbach

- End: Converge to the limiting relative frequency in a sequence of trials (if it exists)
- Means: Straight rule of induction

  (If there have been *m* successes in *n* trials, posit *m/n*)

Means-Ends Metaphysics

- Replace metaphysical questions with methodological ones
- Justify answers in means-end fashion
- Define goals; show that methodological rules will meet those goals

Metaphysical Questions

Events and Times

- Is the time at which an event occurs an *essential* property of the event?
- If this talk had taken place March 22, would it have been the same talk?
- Does an event that hastens or delays another event count as a *cause* of that event?
- Is the time of an event's occurrence different from other properties of an event – e.g. whether I talk loudly or softly?
- It is hard to gain traction on these issues by conventional means – i.e., consulting intuitions

Framework

Causal Models

- An updated version of Carnap's external question – which linguistic framework should we adopt:
- How should we *model* various phenomena of interest
- I will work within a causal modeling framework that has been successful at facilitating causal inference
- But also natural for representing simple causal systems

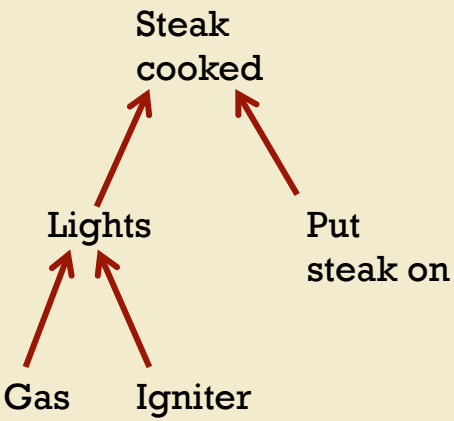
Causal Models

An Illustration

A Simple Causal System

My gas grill

Causal Models



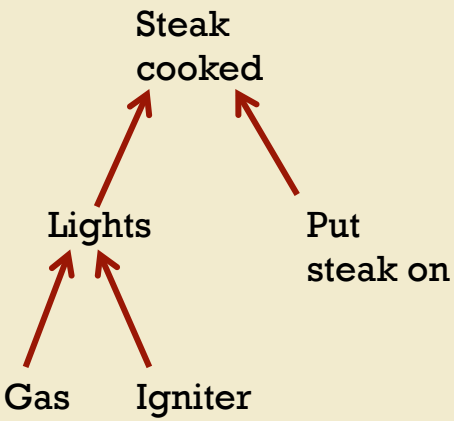
Steak cooked

= Lights X Steak on

Lights = Gas X Igniter

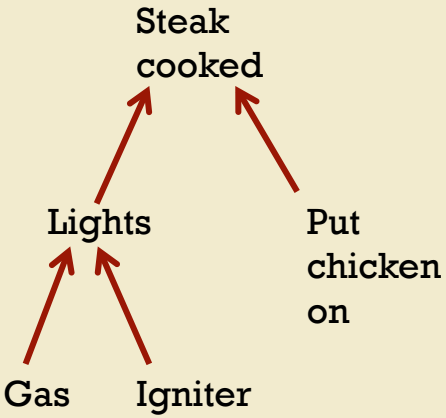
- The model yields a unique solution for every setting of the exogenous variables

Causal Models



- We could also use more fine-grained variables
- Gas could be off (0), low (1), medium (2), high(3)
- Steak could be raw (o), rare (1), medium (2), well-done (3)

Interventions & Counterfactuals



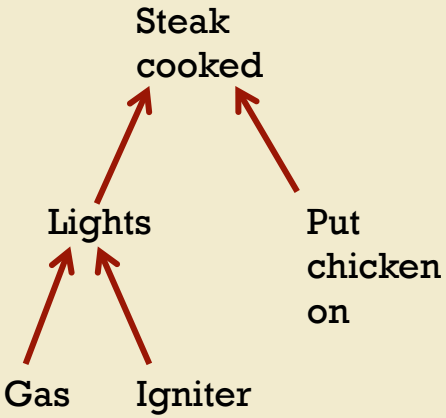
Steak cooked

= Lights X Steak on

~~Lights = Gas X Igniter~~

Lights = no

Interventions & Counterfactuals



- Hypothetical changes only propagate forward through the model
- No 'backtracking'

Metaphysics to Methodology

- We can now recast our metaphysical questions about events and times as methodological questions
- How should we model events that can occur at different times?
- What kinds of variables should we use?

Means-Ends Metaphysics

End:

- Consistently and accurately represent the results of possible interventions

Illustration

Based loosely on an example from Jonathan Bennett

- The 'careless camper' (CC) is planning a camping trip in early May
- He will go camping unless there is a forest fire in April
- If he goes camping, he will leave a fire unattended
- If the forest has not already been burned, the unattended fire will cause a forest fire in May
- In fact, there is forest fire in April and he does not go camping

Illustration

- How should we model this scenario?
- Variables:

  CCC – CC goes camping in early May (0 or 1)

  UF – unattended fire in early May (0 or 1)
- Equation:

  UF = CCC

  There will be an unattended fire just in case CC goes camping

Illustration

- How should we model the forest fire?
- What kind of variable(s) should we use?
- Three options

Option 1

- One variable, FF

  FF = 1 if there is a forest fire

  FF = 0 if there is not

Option 1

- Since CC will go camping just in case there is no fire (in April), we need an equation like:

  CCC = 1 – FF

- Since there will be a forest fire (in May) just in case there is an unattended fire, we need an equation like:

  FF = UF

- Putting this together with our other equations…

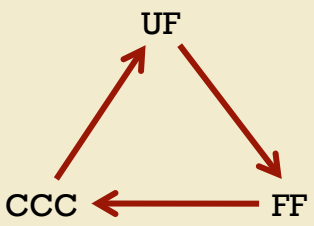
Option 1

CCC = 1 – FF

UF = CCC

FF = UF

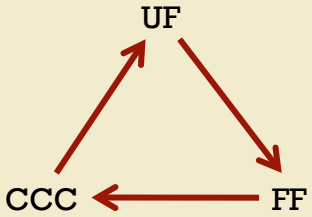
- Cycle
- No consistent solution to these equations



Option 1

Diagnosis:

- This representation does not allow us to distinguish between a fire in April and a fire in May
- The former prevents CC from camping, the latter is caused by CC camping



Option 2

- One variable, FFt

  FFt = 1 if there is a forest fire in April

  FFt = 2 if there is a forest fire in May

  FFt = 0 if there is no forest fire

- This is more promising, since it allows us to distinguish between a fire in April and a fire in May

Option 2

- CC will go camping unless there is a forest fire in April, so:

  CCC = 0 if FFt = 1

  CCC = 1 if FFt = 0 or 2

Option 2

- What is the right equation for FFt?
- Recall that there was in fact a fire in April
- Suppose FFt = f(CCC, UF), where f is a non-trivial function of at least one argument
- Then, the equation says that intervening on whether CC camps in *May*, and/or on whether there is an unattended fire in *May*, could affect whether there is a forest fire in *April*
- This is clearly wrong

Option 2

- Since the forest fire would have occurred in April regardless of whether CC camps, or there is an unattended fire in May
- The equation must just be:

  FFt = 1

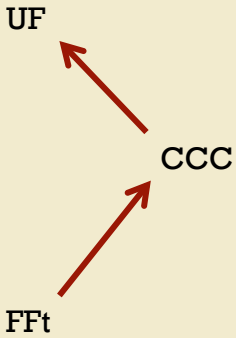
Option 2

FFt = 1

CCC = 0 if FFt = 1

= 1 if FFt = 0, 2

UF = CCC



Option 2

FFt = 1

CCC = 0 if FFt = 1

= 1 if FFt = 0, 2

UF = CCC

- These equations have consistent solutions:
- FFt = 1, CCC = 0, UF = 0

Option 2

FFt = 1

CCC = 0 if FFt = 1

= 1 if FFt = 0, 2

UF = CCC

- But they do not correctly tell us what will happen if we intervene to prevent a fire in April

Option 2

FFt = 1

CCC = 0 if FFt = 1

= 1 if FFt = 0, 2

UF = CCC

- They tell CC would go camping
- And leave an unattended fire
- But then they stop

Option 2

FFt = 1

CCC = 0 if FFt = 1

= 1 if FFt = 0, 2

UF = CCC

- They do not tell us that the unattended fire will cause a forest fire in May
- Or that if there is no fire in April, we can influence whether there is a fire in May by intervening on CCC or UF

Option 3

- Two variables: FFa and FFm

  Ffa = 1 if there is a forest fire in April

  = 0 if there is not

  FFm = 1 if there is a forest fire in May

  = 0 if there is not

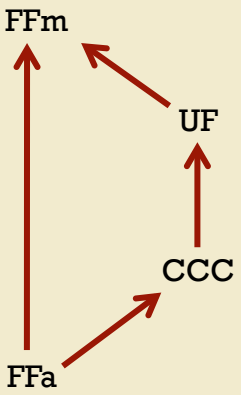
Option 3

CCC = 1 – FFa

UF = CCC

FFm = UF X (1 – Ffa)

- No cycles
- Consistent solutions
- Captures intervention relations



Moral

The right way to model this scenario is with two separate variables corresponding to the two separate times

Generalization

- There is a general principle at work here
- Fire in April and fire in May stand in causal relations: a fire in April *prevents* a fire in May
- We can only capture this if we represent these as values of different variables

Generalization

- In general, events that potentially stand in causal relations must be represented as values of *different* variables
- Distinct values of the *same* variable represent events that are incompatible on *logical or conceptual* grounds
- This is general methodological rule for constructing causal models
- It can be justified by the goal of accurately representing results of interventions

Why Time is Special

- 'Alterations' of an event that differ with respect to their time of occurrence are different from 'alterations' that differ along other dimensions
- E.g. the gas on my grill being set to low, medium, or high
- Alterations that occur at different times have the potential to stand in *causal* relations