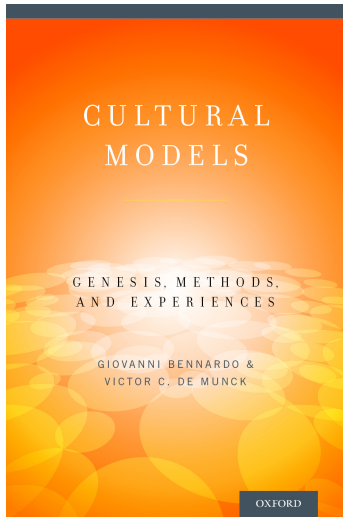# The Fundamental Role of Causal Models in Cultural Models of Nature

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Causal models are used to represent causality in a variety of domains. In this brief presentation I suggest possible causal models for what could represent a fundamental aspect of cultural models of nature.

Cultural Models are
Assemblages of Mental Knowledge
(i.e., Representations of the World)
<u>shared</u> within a population

Cultural Models function as mental lenses used
in <u>*understanding*</u>, in <u>*reasoning*</u>,
in <u>*planning actions*</u>,
and they may <u>*motivate/generate action*</u> as well

CULTURAL MODELS

GENESIS, METHODS, AND EXPERIENCES

GIOVANNI BENNARDO &
VICTOR C. DE MUNCK

OXFORD
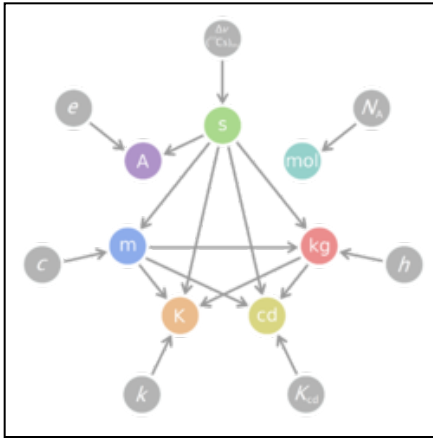
Cultural Models are systems.
That is, they are constituted by:

- **Units** (e.g., concepts, cultural model, etc.); and
- **Relationships** among these units.

Relationships among units can be of different types.
For example:

- **Sequential**
- **Taxonomic** (also Partonomic)
- **Causal**

Causality and Cultural Models (or Schemas)

Then, Causality is 'Part and Parcel' of Cultural Models

"… [O]ur ability to infer cause from event co-occurrence seems to depend heavily on higher-level beliefs about what sorts of events can cause others, on beliefs about how events interact mechanistically, and on pragmatic pressures concerning what needs to be explained" (Rips, 2011: 150).

"Identifying causes requires a healthy dose of theory to direct our search. We can't understand these abstract matters unless the appropriate schemas are already in place" (Rips, 2011: 123).

One way in which causality is described and explained
is by the use of **Causal Models**

Now, I briefly

- Introduce Causal Models

- Introduce a research project about Cultural Models of Nature

- Propose three Causal Models in three CMs of Nature

Causality as Representation

"[**T**]**he invariant** that guides human reasoning and learning about events is causal structure. **Causal relations hold across space, time, and individuals**; therefore, the logic of causality is the best guide to prediction, explanation, and action. And not only is it the best guide around; it is the guide that people use. People are designed to learn and to reason with causal models" [my bold and underlining] (Sloman, 2009: 20).

What is a Cause?

"A causal relation suggests a mechanism unfolding over time … so the notion of cause involves change over time … One general temporal constraint on causation is that effects cannot precede their causes." (2009: 21)

"… [C]ausal relations relate entities that exist in and therefore are bounded in time. I will refer to such entities as *events* or *classes of events* … Causal relations … associate events with other events" [original italics] (ib.: 22).
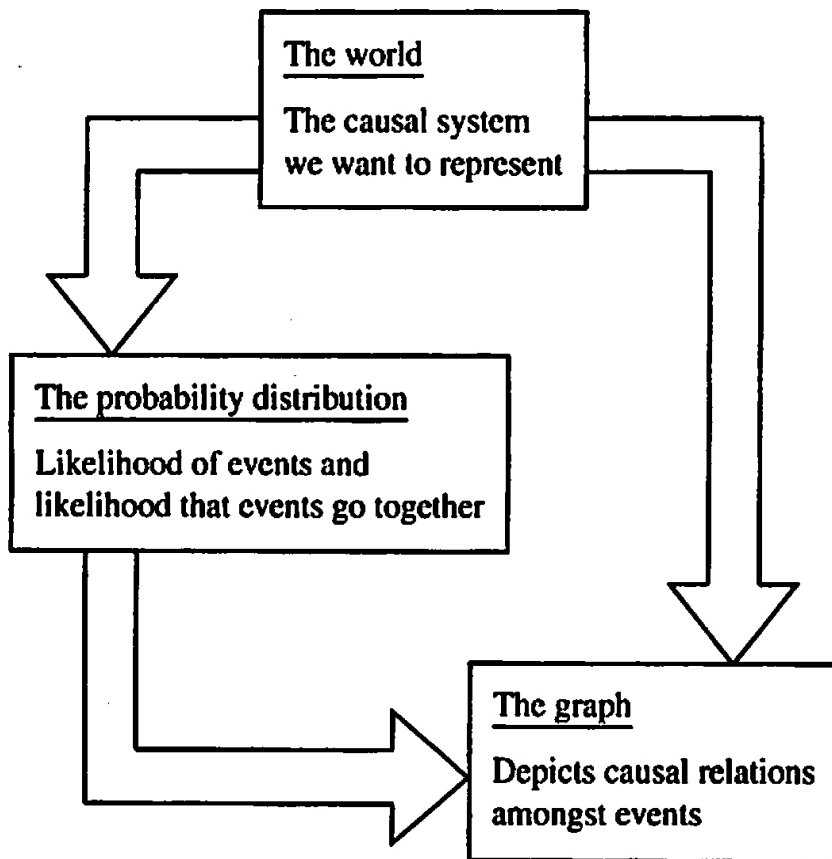
A Causal Model

The world
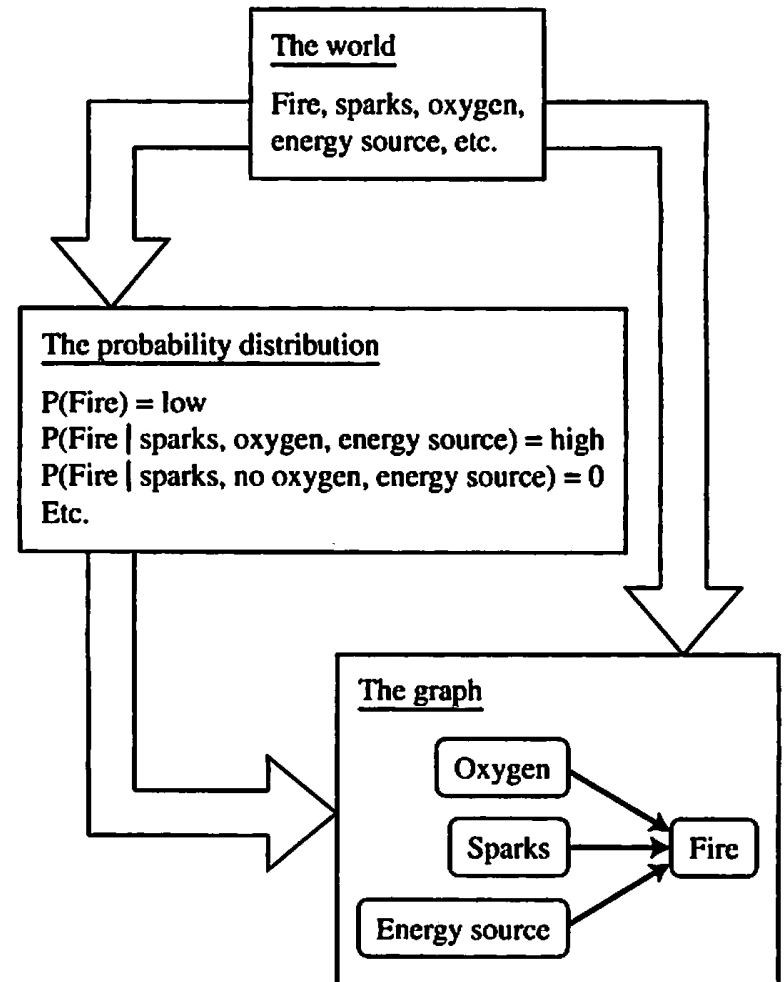
The causal system we want to represent

The probability distribution

Likelihood of events and likelihood that events go together

The graph

Depicts causal relations amongst events

Figure 4.1

The world

Fire, sparks, oxygen, energy source, etc.

The probability distribution

P(Fire) = low
P(Fire | sparks, oxygen, energy source) = high
P(Fire | sparks, no oxygen, energy source) = 0
Etc.

The graph

Oxygen

Sparks → Fire

Energy source

Figure 4.2

Causal Models in Cognition

Causal Models are suggested to play a role in:
- Reasoning
- Decision making
- Judgments
- Conceptual Structure
- Categorical Induction
- Language
- Learning

I now present a very brief discussion of
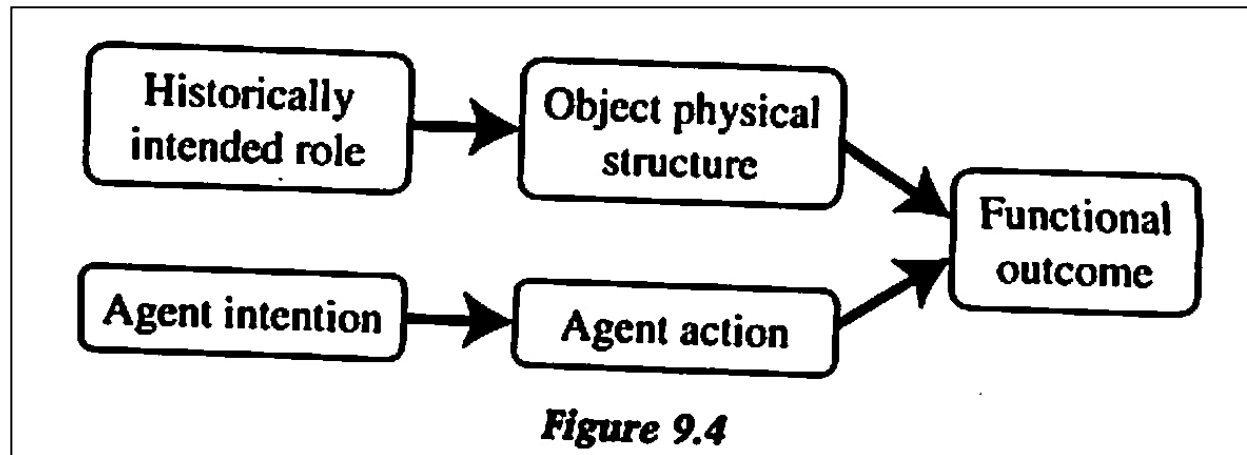the role of Causal Models in Conceptual Structure
(as found in Sloman, 2009).

"A concept … must represent not merely a set of objects in the world but a set of possibilities … The fact that concepts represent both actual and counterfactual objects is reminiscent of causal models … The close relation between causal models and possible worlds suggest that causal relations might be critical for categorization" (Sloman, 2009: 119)

"It might therefore be worth extending the interpretation of causal models … so that they relate not just events but the properties of objects as well" (2009: 120).

The HIPE theory of function for artifacts (Chaigneau, Barsalou, and Sloman, 2004): "suggests that an object's function is related to other aspects of the object: its **H**istorical role, the **I**ntentions of an agent using the object, its **P**hysical structure, and the **E**vents that occur when it is used … All these pieces of knowledge are related via a causal model" [bold in original] (Sloman, 2009: 122).


Figure 9.4

Artifact

Causality and Conceptual Structure

"… the idea of a causal model theory of conceptual structure assumes two parts to the process of categorization. First, there is some sensory experience, and, second, this sensory experience is used as a cue to retrieve conceptual knowledge from memory in the form of a causal model" (Sloman, 2009: 125).

Ex. You look at the sky and you see what you interpret as wings and a body, plus you hear a roaring sound.

Figure 9.7

Figure 9.9

Figure 9.8
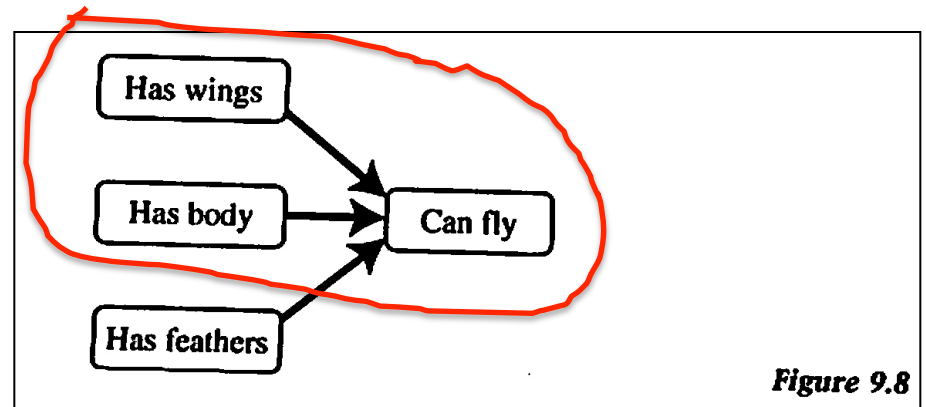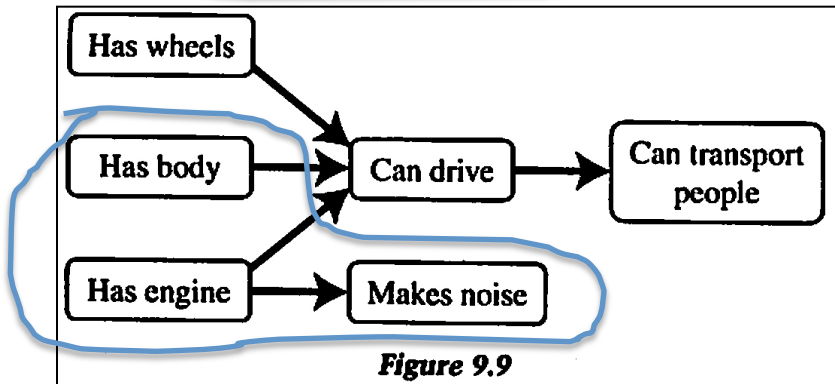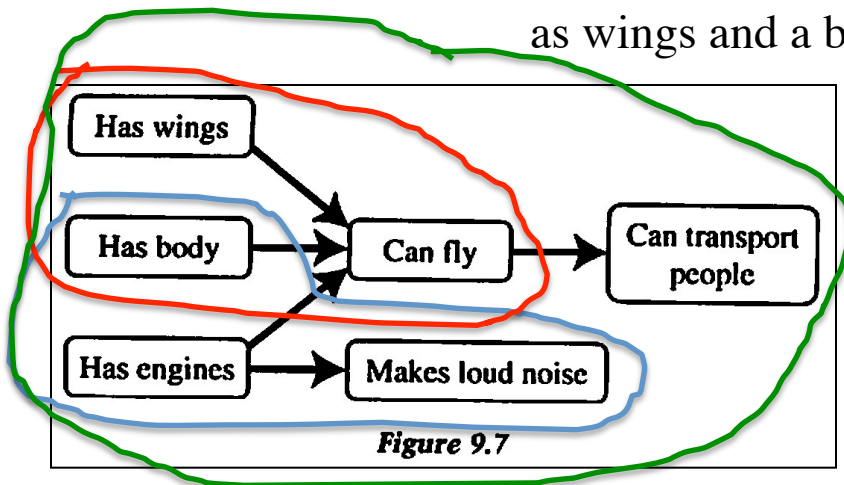
Causality and Conceptual Structure

"[N]ot … every object is associated with a single causal model […] People have different intentions when dealing with an object, and the causal model at issue will depend on the current situation […]
The take-home lesson should be … that, whatever one's intention in a particular context, the relevant knowledge will be organized around a causal model"
[my bold and italics] (Sloman, 2009: 128).

"Categorization serves multiple purposes, and not all those purposes are served by referring to causally central properties.
Causal models are most important when the purpose of categorization is to reveal why an object exists, what it is for, where it comes from, and how it works"
[my bold and italics] (2009: 129).

Causal Models in Cultural Models of Nature

I am currently working with a group on a research project (sponsored by NSF) in which we intend to discover the cultural models of nature held by members of 14 communities of primary food producers located in 6 continents.

We have prepared a methodological protocol that will be used by all of us to collect and analyze data (Bennardo, 2012).

As a way of closing this presentation,
I am introducing three 'hypotheses' of cultural models
of nature that are structured to include causal models.
In other words,
The three cultural models of nature*
are presented as including
three different types of causal models.

*Examples of cultural models of nature are taken from
Kempton, Boster, and Hartley (1995),
Selin (2003), and Atran and Medin (2008).

Causal Model of Nature 1

World

Humans
Animals
Plants
Physical Environment
Weather
Supernatural

The Probability Distribution:
P(nature) = high
P(nature | humans, animals) = low
P(nature | supernatural, humans, animals) = medium
P(nature | supernatural, humans, animals, plants) = high
P(nature | supernatural, humans, animals, no plants) = 0
P(nature | supernatural, humans, no animals, plants) = 0
Etc.

The Graph

Humans
Animals
Plants
Physical Environment
Weather
Supernatural

NATURE

Causal Model of Nature 2

World

Humans
Animals
Plants
Physical Environment
Weather
Supernatural

The Probability Distribution:
P(nature) = low
P(nature | supernatural) = high
P(nature | no supernatural, humans) = 0
P(nature | no supernatural, humans, animals) = 0
Etc.

The Graph

Supernatural

Humans
Animals
Plants
Physical Environment
Weather

NATURE

World

Humans
Animals
Plants
Physical Environment
Weather
Supernatural

Causal Model of Nature 3

The Probability Distribution:
P(nature) = low
P(nature | supernatural) = high
P(nature | supernatural, humans) = high
P(nature | no supernatural, humans) = 0
P(nature | supernatural, no humans) = 0
P(nature | supernatural, humans, animals) = high
Etc.

The Graph

Humans

Supernatural

Animals
Plants
Physical Environment
Weather

NATURE
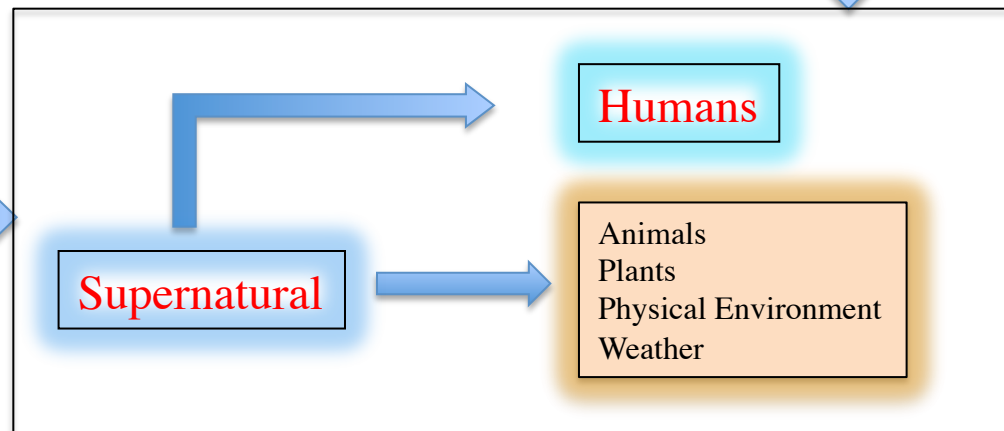
These are only three out of many possibilities

At the 'probability distribution' level
culture plays a very important role

Soon, we hope to be able to fill in some of the missing data
and consequent models
(both cultural and causal)

THANK YOU!