

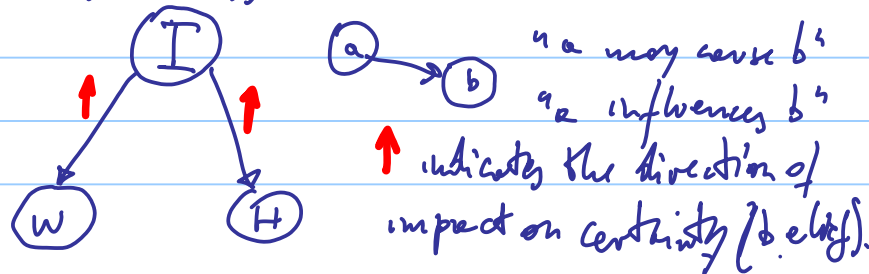
582 2014-01-16 (includes 01-14)

Note Title

2014-01-14

Icy roads
example. Three variables, with states yes, no:

I, icy roads; W, Watson crashes;
H, Holmes crashes



So, the graph tells us that an increased belief in the roads being icy increases inspector Smith's belief that both Holmes and Watson have crashed.

Smith starts from some initial belief in I, W, H. When he hears that W = yes (Watson has crashed), he reasons in the evidential direction (against the arrow of causality).

and his belief (certainty) in I increases.

This is reasoning from effect to cause:
the presence of the effect justifies the cause
(or makes us believe more strongly in the cause).

Inspector Smith's increased belief in Icy Roads
increases his belief in Holmes having crashed.

This is an example of causal reasoning;
increased belief in the cause makes its effect
more credible.

When Smith's belief in I is changed ($I = \text{no}$), then the state of W has no longer an effect on H , because the information that Watson has crashed can no longer change the belief in I , and therefore the belief in H .

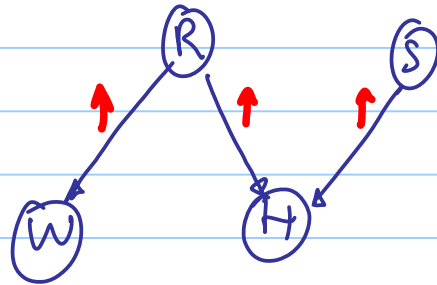
Here we see that dependence/independence changes with evidence: In the absence of

evidence on I , W and H are dependent,
but in the presence of evidence on I ,
 W and H are independent,

2nd example, Wet grass

H: Holmes' lawn is wet, W: Watson's lawn is wet

R: it rained; S: Holmes's sprinkler was on



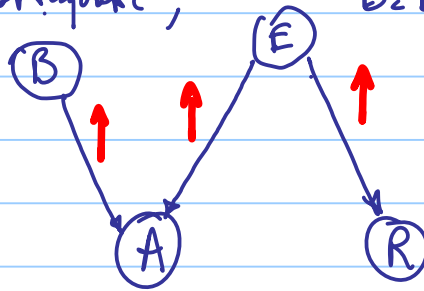
"Explaining away" is a kind of interaction

reasoning that occurs when the common effect of two or more causes holds.

2014-01-16

Earthquake or burglary example

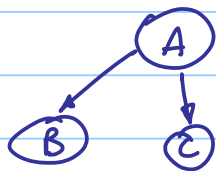
A: Holmes's alarm, R: radio report of earthquake,
E: small earthquake, B: burglary



The reasoning in this example is very similar
to that of the wet lawn example

From these examples, we can distinguish different kinds of transmission of evidence:

2. Diverging influence

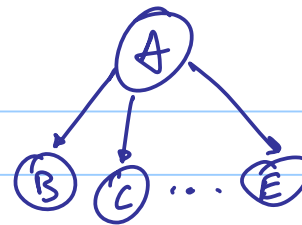


B may pass influence to C (influence may pass between B and C) if

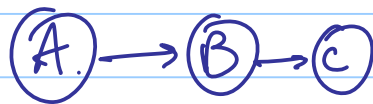
A is not known; if A is known, no influence

passes between B and C.

This may be generalized to



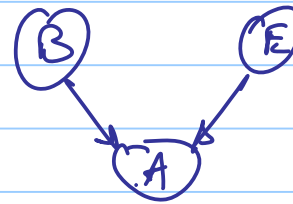
1. Pipelined (serial) influence



If B is not known, influence may pass between A and C. If B is known, no influence

passes between A and C.

3. Converging influence



If A is not known,
influence does not pass between B and E.

If A is known, influence may pass between B and E.

Need: defn. of causal graph. (Directed graph as in the stories.) network (directional)

Definition 2.1 [T] (d-separation) (p. 30)

Two distinct variables A and B in a causal network are d-separated if for all paths between A and B there is an intermediate variable V [Note: therefore two adjacent variables may not be d-separated.]

such that either

- the connection is serial or diverging and V is instantiated ("is known")

or

- the connection is converging and neither V nor any of V 's descendants has received evidence ("is known").

If A and B are not d -separated, we call them d -connected.

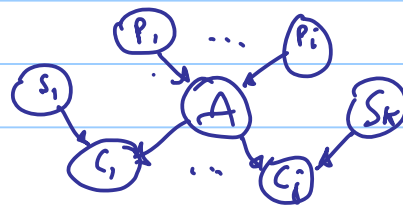
D -separation is taken to be a requirement for transmission of evidence.

Claim (p. 30 [J]): If A and B are d -separated,
then changes in the certainty of A have no
impact on the certainty of B .

Defn. The Markov blanket of a
variable A is the set consisting of
the parents of A , the children of A ,
and the variables sharing a child with A .

Claim ^{HW 1: exercise 2.8 due Tuesday,} (will be an exercise) 9/21

Let A be a variable in a causal network.
Assume that all variables in A 's Markov blanket are instantiated. Then, A is d-separated from the remaining uninstantiated variables.



Prove by cases,
List each type of path starting at A ,