Lecture 35
Woodward on Total and Direct Causes

Patrick Maher

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Last time we saw:

Woodward's basic idea (40)

The claim that X causes Y means that for at least some individuals, there is a possible manipulation of some value of X that they possess, which, given other appropriate conditions . . . will change the value of Y or the probability distribution of Y for those individuals.

Today we'll refine that in two ways:

- The manipulation needs to be of the special kind that Woodward calls an *intervention*.
- We need to specify what other variables are held fixed when X is varied; different possibilities give different concepts of causation.

Interventions

We may think of an intervention on X with respect to Y as an exogenous causal process that changes X in such a way and under conditions such that if any change occurs in Y, it occurs only in virtue of Y's relationship to X and not in any other way. (47)

Example (46–47)

A=atmospheric pressure, $B =$ barometer reading, $S =$ whether there is a storm.

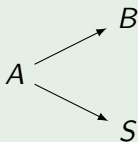$$A \nearrow^{B}_{\searrow_{S}}$$
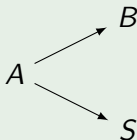
- Changing B by turning the adjustment screw in the barometer is an intervention on B with respect to S.
- Changing B by changing A is not an intervention on B with respect to S.

An intervention can be represented by a new variable I and its introduction changes the causal structure.

Example

In the barometer example, the original causal structure is:

$$A \nearrow^{B}_{\searrow S}$$

When the barometer reading is set by turning the adjustment screw in the barometer, the structure becomes:

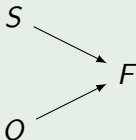$$I \longrightarrow B$$
$$A \longrightarrow S$$

Total cause

$p(Y) =$ the probability distribution of Y.

Definition (51, supplemented by me)

X is a total cause of Y if there is a possible intervention on X with respect to Y that would change $p(Y)$, for some values of other variables that aren't descendants of X.
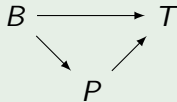
Example (76)

$S =$ whether there is a short circuit, $O =$ whether oxygen is present, $F =$ whether there is a fire.

S is a total cause of F; so is O.

Thrombosis example (49–50)

Suppose birth control pills (B) directly cause an increased probability of thrombosis (T), but also lower the probability of pregnancy (P), which itself increases the probability of thrombosis.

$$B \longrightarrow T$$
$$\searrow \quad \nearrow$$
$$P$$

Suppose the influence of B on T along the two paths cancels out, so that taking birth control pills doesn't alter the probability of thrombosis; then B isn't a total cause of T.

Definition (55)

X is a direct cause of Y with respect to variable set **V** if there is a possible intervention on X with respect to Y that would change $p(Y)$ when all other variables in **V** are held fixed at some values.
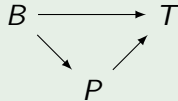
Drunk driving example (not Woodward's)

$D =$ whether a driver is drunk, $C =$ whether the driver has a collision, $N =$ whether someone is injured.

$$D \longrightarrow C \longrightarrow N$$

- D is a total cause of N: Intervening on D with respect to N changes $p(N)$.
- D is not a direct cause of N with respect to $\{D, C, N\}$: If we hold C fixed, then changing D won't change $p(N)$.

$$B \longrightarrow T$$
$$B \searrow \quad \nearrow T$$
$$P$$

- We've seen that B is not a total cause of T, assuming the influences along the two paths cancel out.
- *B is a direct cause of T with respect to* $\{B, P, T\}$: If we intervene to ensure that a woman doesn't get pregnant, then an intervention that changes whether she takes birth control pills will change her probability of thrombosis.

So:

- A total cause need not be a direct cause.
- A direct cause need not be a total cause.

Fit with the manipulability conception

- The manipulability conception of causation says X causes Y if Y can be changed by changing or manipulating X.
- If X causes Y in either of the above senses, then Y can be changed by changing X.
- The difference consists in what is held fixed when X is changed.

Type of cause	What is held fixed
total	all other variables not descendants of X
direct	all variables other than X and Y

1. Explain what Woodward means by:
   (a) I is an intervention on X with respect to Y.
   (b) X is a total cause of Y.
   (c) X is a direct cause of Y with respect to variable set **V**.

2. A flagpole of height H is standing on level ground, the sun is at an angle A above the horizon, and the flagpole's shadow has length L. For each of the following, say whether it is true and justify your answer using Woodward's definitions.
   (a) H is a total cause of L.
   (b) L is a total cause of H.
   (c) A is a total cause of L.

3. Suppose it is known that X, Y, and Z are related in one of the following two ways:

   $$X \longrightarrow Y \longrightarrow Z \qquad\qquad \begin{array}{c} X \longrightarrow Z \\ \searrow \nearrow \\ Y \end{array}$$
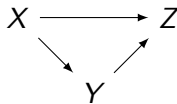
   Describe how to determine experimentally which is correct.

James Woodward.
Making Things Happen.
Oxford University Press, 2003.
Online at Questia.
Numbers in parentheses are page numbers of this book.