

Reading Notes of *Actual Causality*

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Chapter 1. Introduction and Overview

There are two notions of causality:

- *type causality*: Also called *general causality*. Type causality contains general statements, and allows people to make predictions (*forward-looking*).
- *actual causality*: Also called *token causality* or *specific causality*. Actual causality focus on particular events, and related to words such as "responsibility" and "blame".

Roughly speaking, reasoning about type causality is equivalent to reasoning about *effects of causes* (possible effects of a given event), whereas reasoning about actual causality is equivalent to reasoning about *causes of effects* (possible causes of a particular outcome).

"But-for" definition of causality: A is a cause of B if, but for A, B would not have happened. However, it is not always enough to determine causality, and *Halpern-Pearl definition* solve some problems where but-for test fails.

Chapter 2. The HP Definition of Causality

Definition: A *causal model* M is a pair $(\mathcal{S}, \mathcal{F})$:

- \mathcal{S} : A *signature*, explicitly lists the endogenous and exogenous variables and characterizes their possible values. A signature \mathcal{S} is a tuple $(\mathcal{U}, \mathcal{V}, \mathcal{R})$:
 - \mathcal{U} : A set of exogenous variables
 - \mathcal{V} : A set of endogenous variables
 - \mathcal{R} : \mathcal{R} maps variables in \mathcal{U} or \mathcal{V} into possible values for them (i.e., the set of values over which the variable ranges).
- \mathcal{F} : A set of *structural equations*. \mathcal{F} associates with each endogenous variable $X \in \mathcal{V}$ a function denoted F_X maps $\times_{Z \in (\mathcal{U} \cup \mathcal{V} - \{X\})} \mathcal{R}(Z)$ to $\mathcal{R}(X)$. That means, function F_X captures a relation between all variables but for X and X . F_X determines the value of X , given the values of all the other variables in $\mathcal{U} \cup \mathcal{V}$.