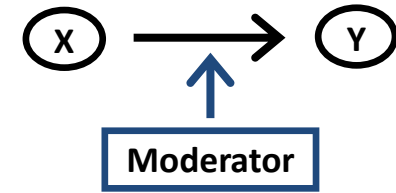
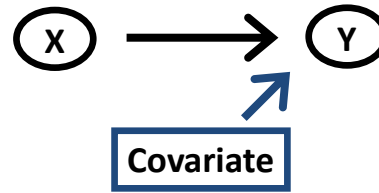
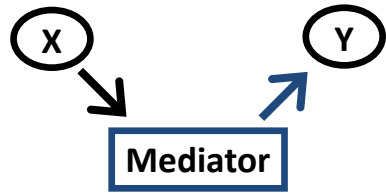


Testing for Third Variables



A mechanism or explanation for how or why there is a relationship.

- * Related to both X and Y
- * Explains an existing $X \rightarrow Y$ relationship
- * *aka* Intervening or chained

For more information see:

www.davidakenny.net/cm/mediate.htm

How to Test:

First, show the basic relationship ($X \rightarrow Y$)

- * X must be significant

Next, test the mediator ($X \rightarrow M, M \rightarrow Y$)

- * Both predictors must be significant

Finally, test the whole model ($X + M \rightarrow Y$)

- * M must be significant
- * X is typically not significant (if it is, but less so, M may be a *partial* mediator)

An unrelated source of variation in the response variable.

- * Related to Y, but *not* X
- * Typically not of interest
- * *aka* Control, Random Factor

A covariate, by definition, is a continuous (interval/ratio) control variable. However, it sometimes is used to refer to categorical variables. Control variables are statistically no different from predictors, but reduce the unexplained variation in the response.

How to Test:

Simply include the covariate as another predictor in the basic analyses ($X + C \rightarrow Y$).

- * C typically must be significant
- * The effect of X is then “controlling for C”

A factor that influences the strength or direction of a relationship, or when it exists.

- * Not related to X or Y
- * Changes the nature of $X \rightarrow Y$
- * *aka* Interacting or conditional

A moderator can reveal or suppress a relationship. So, even if there is no initial relationship ($X \rightarrow Y$), accounting for potential moderators might show, under some circumstances, a relationship.

How to Test:

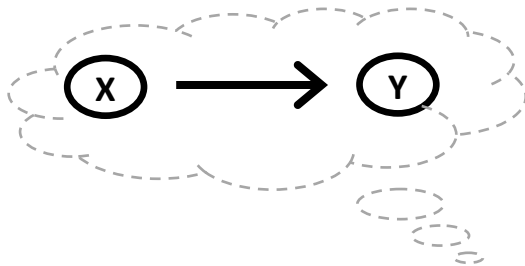
Add the moderator and its interaction with X to your analysis ($X + M + X*M \rightarrow Y$).

- * The interaction term must be significant
- * You must include X and M if you have $X*M$, even if they are not significant

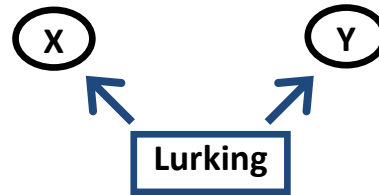
Examples:	X	Y	Mediator	Covariate	Moderator
	Playing Guitar	→ Earning Money	Practice	Intelligence	Aptitude
	Socio-economic Status	→ Cancer Screening	Education	Risk Factors	Insurance
	Age	→ Safe Driving	Wisdom	Reaction Time	Passengers

Possibilities when X predicts Y

Imagined



Spurious



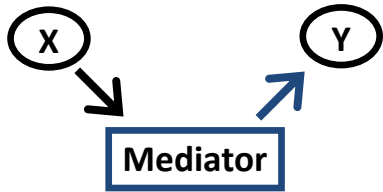
A classic case with no real X-Y relationship.

Reverse Causality



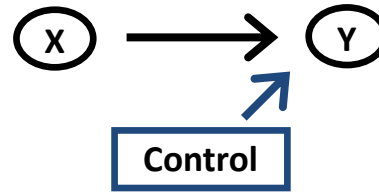
The direction of influence cannot be shown statistically. Manipulating X is the best and sometimes only way to determine causality.

Mediation



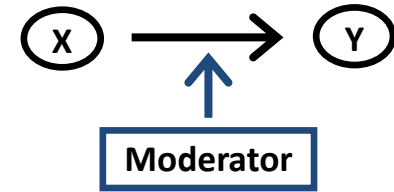
X may have an *indirect* effect on Y through a mediator (which may not be observed). It may be partial or full. *aka* Intervening.

Concomitant



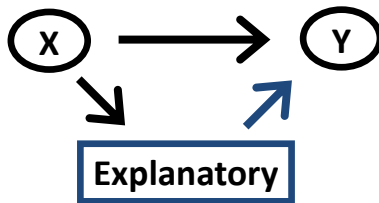
Variables that create variation in Y, whether or not they relate to X, are often controlled for to improve prediction. *aka* Covariate

Moderation



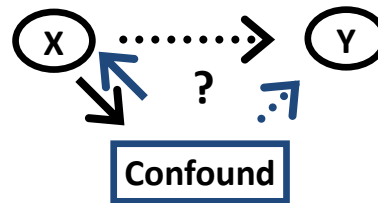
Moderators change the relationship. For example, a suppressor would hide the relationship when present. *aka* Interacting.

Partial Mediation



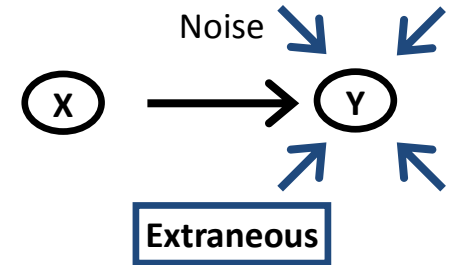
X has both a *direct* and an *indirect* effect on Y. Controlling for the third variable lessens, but does not eliminate, the X-Y relationship.

Uncertain



A confound is [almost] perfectly associated with X and is difficult to separate. It is hard or impossible to tell their effects apart.

Noise



Residuals are the combined effects of all other unidentified variables, which should not be related to X. *aka* Nuisance