

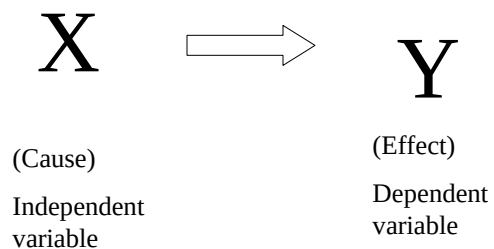
Logic of Causation

- Cause and effect
- Determinism vs. free will
- Explanation:

Why?

Causality

Bivariate relationship (2 variables)



Causality

Multivariate relationship
(3+ variables)

X

Y

Z

(Causes)

(Effect)

Independent
variables

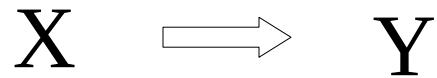
Dependent
variable

Types of causes (n=2)

- Necessary cause: X must happen for Y to happen
“Need X to get Y”
- Sufficient cause: Y always happens when X happens
“Always get Y when you have X”

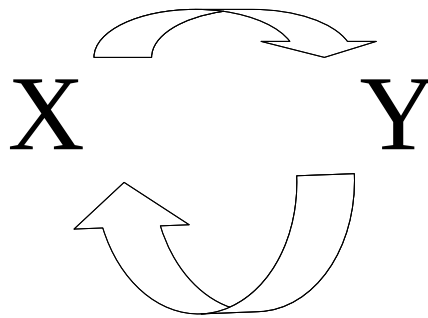
Criteria for Causality (n=3)

1) Cause must precede effect:



Criteria for Causality

2) The two variables must be empirically associated



Criteria for Causality

- 3) Observed association cannot be explained away by a third variable (test for spuriousness)

X = # firefighters

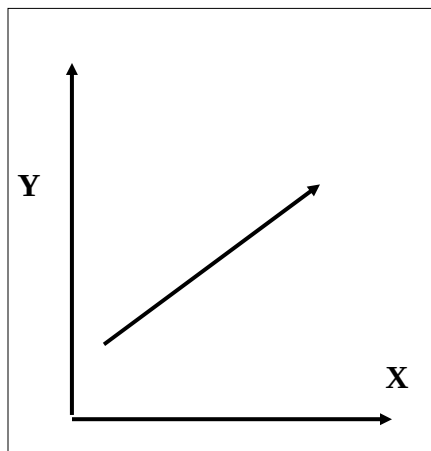
Y = amt. of damage

Criteria for Causality

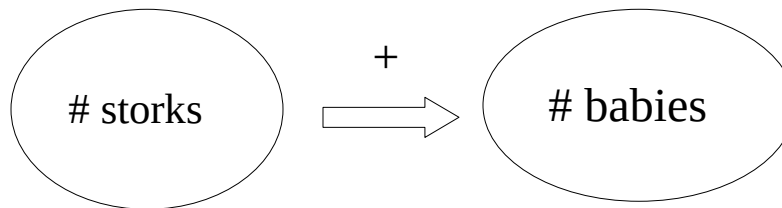
X $\xrightarrow{+}$ **Y**

X = # firefighters

Y = amt. of damage



Spurious relationship?



Elaboration Paradigm

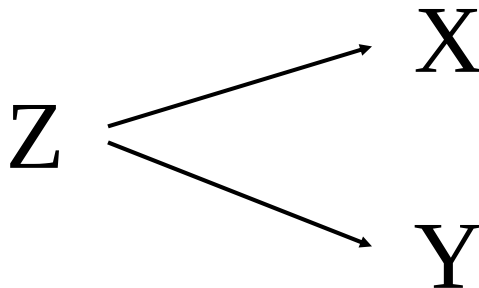
- Purpose: to understand nature of observed relationships
- Test: for spuriousness
- Move: from bivariate table to trivariate table
- Evaluate for possible outcomes: replication, explanation, interpretation, specification

Elaboration Paradigm

<u>Partial relationships compared with original</u>	<u>Test variable is:</u>	
	<u>Antecedent</u>	<u>Intervening</u>
Same relationship	Replication	
Less or none	Explanation	Interpretation
Split (one is same or greater, other is less or none)	Specification	

Earl Babbie, 2004, The Practice of Social Research, Ch. 15

Explanation:



Interpretation:

$$X \longrightarrow Z \longrightarrow Y$$

Rules for creating tables

- ✓ Percentage down (in the direction of causality)
- ✓ Dependent variable on the side
- ✓ Independent variable(s) on the top
- ✓ Compare across
- ✓ Watch for small Ns in columns
- ✓ Collapse on theoretical grounds

Elaboration Paradigm

Percentage receiving Ph.D. by marriage in grad school (hypothetical)		
	<u>Got married in grad school</u>	
<u>Got Ph.D.</u>	<u>Yes</u>	<u>No</u>
Yes	65.0	80.0
No	<u>35.0</u>	<u>20.0</u>
Total	100.0	100.0
N	(200)	(200)

Elaboration Paradigm

Percentage receiving Ph.D. by marriage in grad school (hypothetical)		
	<u>Got married in grad school</u>	
<u>Got Ph.D.</u>	<u>Yes</u>	<u>No</u>
Yes	65.0	80.0
N	(200)	(200)

Succinct table reduces redundancy

Elaboration Paradigm

Percentage receiving Ph.D. by getting married by sex (hypothetical)

	<u>Sex</u>			
	<u>Men</u>		<u>Women</u>	
<u>Got Ph.D.</u>	<u>Married</u>	<u>Didn't marry</u>	<u>Married</u>	<u>Didn't marry</u>
Yes	80.0	80.0	50.0	80.0
No	<u>20.0</u>	<u>20.0</u>	<u>50.0</u>	<u>20.0</u>
Total	100.0	100.0	100.0	100.0
N	(100)	(100)	(100)	(100)

Elaboration Paradigm

Percentage receiving Ph.D. by getting married by sex (hypothetical)

	<u>Sex</u>			
	<u>Men</u>		<u>Women</u>	
<u>Got Ph.D.</u>	<u>Married</u>	<u>Didn't marry</u>	<u>Married</u>	<u>Didn't marry</u>
Yes	80.0	80.0	50.0	80.0
N	(100)	(100)	(100)	(100)

Make it succinct!

Elaboration Paradigm

What happens to the original relationship within categories of the test variable?

Elaboration Paradigm

<u>Percent delinquent by suitability of supervision</u>		
	<u>Suitability of supervision</u>	
	<u>Suitable</u>	<u>Unsuitable</u>
% Delinquent	30.3	83.7
N	(628)	(375)

Source: Eleanor Maccoby 1960 data (reprinted in Travis Hirschi and Hanan Selvin, 1967, Delinquency Research: An Appraisal of Analytic Methods, New York: Free Press, p. 240)

Elaboration Paradigm

Percent delinquent by suitability of supervision by mother's employment

	<u>Housewife</u>		<u>Occasionally Employed</u>		<u>Regularly employed</u>	
	<u>Suitable</u>	<u>Un-suitable</u>	<u>Suitable</u>	<u>Un-Suitable</u>	<u>Suitable</u>	<u>Un-Suitable</u>
% Delinquent	31.9	84.6	31.5	88.8	19.5	77.3
N	(457)	(149)	(89)	(116)	(82)	(110)

Source: Eleanor Maccoby 1960 data (reprinted in Travis Hirschi and Hanan Selvin, 1967, Delinquency Research: An Appraisal of Analytic Methods, New York: Free Press, p. 240)

Elaboration Paradigm

Percentage delinquent by mother's employment

	<u>Housewife</u>	<u>Occasionally employed</u>	<u>Regularly employed</u>
% Delinquent	44.9	63.9	52.6
N	(606)	(205)	(192)

Source: Eleanor Maccoby 1960 data (reprinted in Travis Hirschi and Hanan Selvin, 1967, Delinquency Research: An Appraisal of Analytic Methods, New York: Free Press, p. 240)

Elaboration Paradigm

Percent delinquent by suitability of supervision by mother's employment

	<u>Housewife</u>		<u>Occasionally Employed</u>		<u>Regularly employed</u>	
	<u>Suitable</u>	<u>Un-suitable</u>	<u>Suitable</u>	<u>Un-Suitable</u>	<u>Suitable</u>	<u>Un-Suitable</u>
% Delinquent	31.9	84.6	31.5	88.8	19.5	77.3
N	(457)	(149)	(89)	(116)	(82)	(110)

Source: Eleanor Maccoby 1960 data (reprinted in Travis Hirschi and Hanan Selvin, 1967, Delinquency Research: An Appraisal of Analytic Methods, New York: Free Press, p. 240)

Elaboration Paradigm

Percent delinquent by church attendance (hypothetical)

	<u>Church attendance</u>	
	<u>Regular/often</u>	<u>Seldom/never</u>
% Delinquent	44.0	56.0
N	(150)	(150)

Elaboration Paradigm

Percent delinquent by church attendance by age

	<u><=14 years</u>		<u>>=15 years</u>	
	<u>Regular/ often</u>	<u>Seldom/ never</u>	<u>Regular/ often</u>	<u>Seldom/ never</u>
% Delinquent	33.0	33.0	67.0	67.0
N	(100)	(50)	(50)	(100)

Testing hypotheses

Raw data: predicting traffic accidents

<u>Sex</u>	<u>Miles driven</u>	<u>Traffic accidents</u>	<u>N</u>
Women	Few	Many	20
Women	Few	Few	180
Women	Many	Many	80
Women	Many	Few	20
Men	Few	Many	5
Men	Few	Few	45
Men	Many	Many	160
Men	Many	Few	40

Testing hypotheses

Hypothesis:

“Men are more accident prone than women”

$$X = ?$$

$$Y = ?$$

Original bivariate relationship

<u>Percentage of traffic accidents by sex (hypothetical)</u>		
<u>Accidents</u>	<u>Men</u>	<u>Women</u>
Few	34.0	66.7
Many	<u>66.0</u>	<u>33.3</u>
Total	100.0	100.0
N	(250)	(300)

Trivariate relationship

<u>Percentage of traffic accidents by miles driven by sex</u> (hypothetical)				
	<u>Sex</u>			
	<u>Men</u>		<u>Women</u>	
<u>Accidents</u>	<u>Few</u>	<u>Many</u>	<u>Few</u>	<u>Many</u>
Few	90.0	20.0	90.0	20.0
Many	<u>10.0</u>	<u>80.0</u>	<u>10.0</u>	<u>80.0</u>
Total	100.0	100.0	100.0	100.0
N	(50)	(200)	(200)	(100)

Refinements to elaboration paradigm: suppressor and distorter variables

- Suppressor variable (relationship emerges):
 - bivariate = no relationship
 - trivariate = positive or negative relationship
- Distorter variable (relationship switches):
 - bivariate = positive relationship
 - trivariate = negative relationship
(or negative to positive)

3 dimensional tables: basic table

Percentage believing abortion should be available by educational degree and religion, 1977-78

	<u>Educational degree</u>							
	<u>LT HS</u>		<u>HS grad/Jr. coll.</u>		<u>BA degree</u>		<u>Grad degree</u>	
<u>Abortion belief</u>	<u>Prot.</u>	<u>Cath.</u>	<u>Prot.</u>	<u>Cath.</u>	<u>Prot.</u>	<u>Cath.</u>	<u>Prot.</u>	<u>Cath.</u>
Should Be available	22.8	30.2	35.4	28.1	49.4	27.5	55.0	34.8
N	(666)	(232)	(1008)	(409)	(160)	(69)	(80)	(23)

General Social Survey, 1977-78

3-D table: statistical interaction

Percent believing abortion should be available by educational degree and religion, 1977-78

	<u>Educational degree</u>			
<u>Religion</u>	<u>LT HS</u>	<u>HS grad/Jr. coll</u>	<u>BA degree</u>	<u>Grad degree</u>
Protestant	22.8 (666)	35.4 (1008)	49.4 (160)	55.0 (80)
Catholic	30.2 (232)	28.1 (409)	27.5 (69)	34.8 (23)

General Social Survey, 1977-78

Additive relationship (hypothetical)

	<u>Educational degree</u>			
<u>Religion</u>	<u>LT HS</u>	<u>HS</u> <u>grad/Jr.</u> <u>coll.</u>	<u>BA</u> <u>degree</u>	<u>Grad</u> <u>degree</u>
Protestants	40.0	45.0	55.0	75.0
Catholic	30.0	35.0	45.0	65.0

Statistical interaction

Question to ask:

“Does the effect of one variable (X) on another (Y) remain the same for all groups of the third (Z) variable?”