

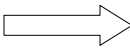
Logic of Causation

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

Why?

Causality

Bivariate relationship (2 variables)

X  **Y**

(Cause)
Independent
variable

(Effect)
Dependent
variable

Causality

Multivariate relationship
(3+ variables)

X

Y

Z

(Causes)

(Effect)

Independent
variables

Dependent
variable

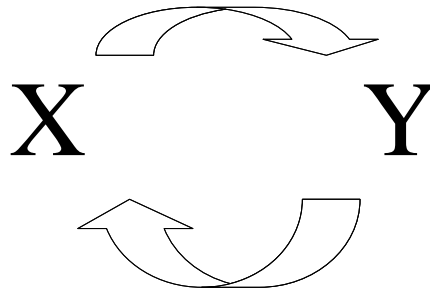
Criteria for Causality (n=3)

1) Cause must precede effect:

X \Rightarrow **Y**

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)

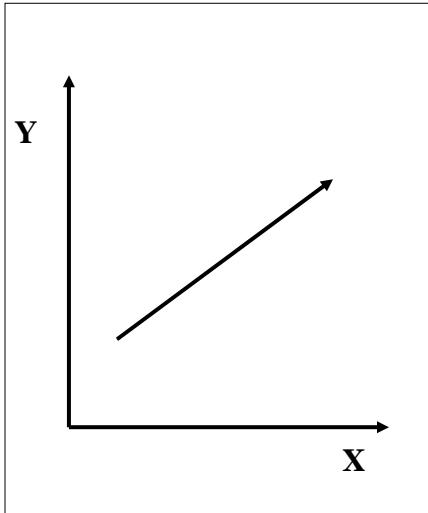
X = # firefighters

Y = amt. of damage

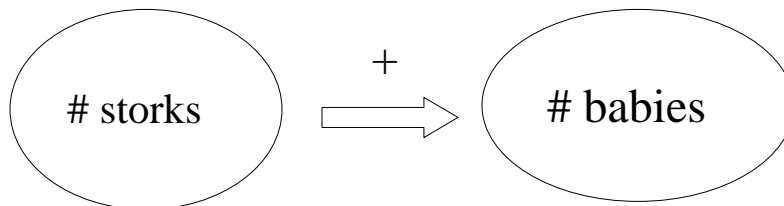
Criteria for Causality

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

X = # firefighters
Y = amt. of damage



Spurious relationship?



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”

Elaboration Paradigm

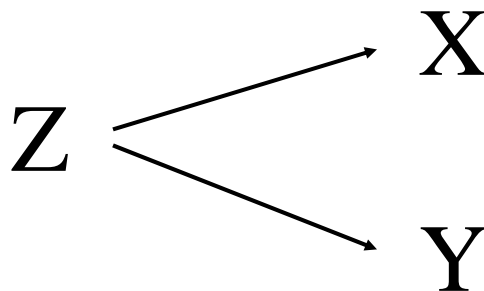
- Purpose: to understand nature of observed relationships
- Test: for spuriousness
- Move: from bivariate table to trivariate table
- Evaluate for possible outcomes: replication, explanation, interpretation, specification

Elaboration Paradigm

| | | |
|--|--------------------------|--------------------|
| <u>Partial relationships</u> compared with <u>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:



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) |

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 |
| 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)

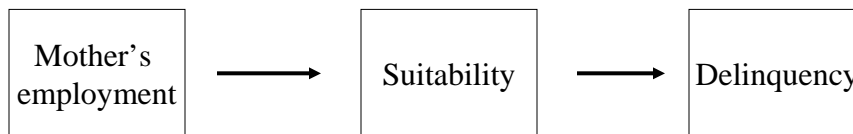
Elaboration Paradigm

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 |
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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)

Interpretation



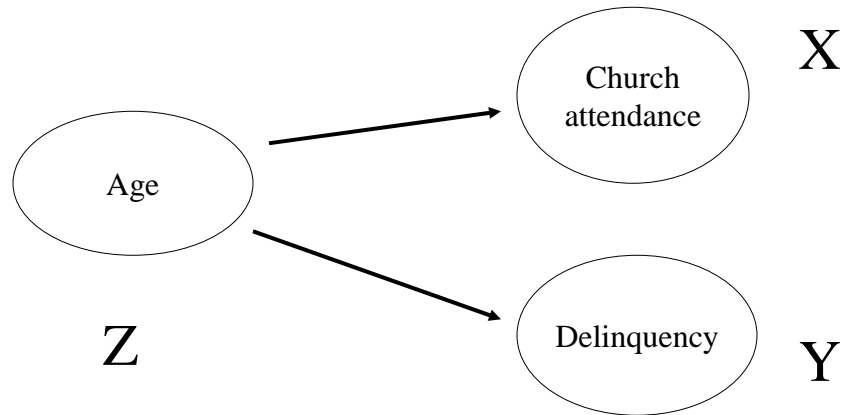
Elaboration Paradigm

| <u>Percent delinquent by church attendance (hypothetical)</u> | | |
|---|--------------------------|---------------------|
| | <u>Church attendance</u> | |
| | <u>Regular/often</u> | <u>Seldom/never</u> |
| % Delinquent | 44.0 | 56.0 |
| N | (150) | (150) |

Elaboration Paradigm

| <u>Percent delinquent by church attendance by age</u> | | | | |
|---|---------------------------|--------------------------|---------------------------|--------------------------|
| | <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) |

Explanation



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”

$$X = ?$$

$$Y = ?$$

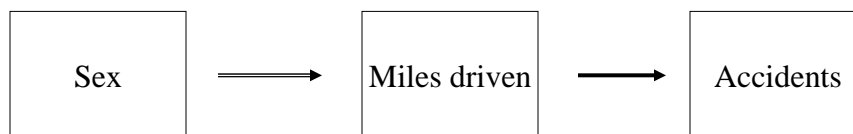
Original bivariate relationship

| <u>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

| Percentage of traffic accidents by miles driven by sex (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) |

Interpretation



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

| <u>Percentage believing abortion should be available by education and religion</u> | | | | | | | | |
|--|--------------------|--------------|------------------|--------------|------------------|--------------|-----------------|--------------|
| | <u>Education</u> | | | | | | | |
| | <u><=8 yrs.</u> | | <u>9-11 yrs.</u> | | <u>H.S. grad</u> | | <u>College+</u> | |
| <u>Abortion belief</u> | <u>Cath.</u> | <u>Prot.</u> | <u>Cath.</u> | <u>Prot.</u> | <u>Cath.</u> | <u>Prot.</u> | <u>Cath.</u> | <u>Prot.</u> |
| Should Be available | 31.0 | 29.0 | 33.0 | 36.0 | 33.0 | 43.0 | 31.0 | 51.0 |
| N | (90) | (287) | (96) | (250) | (89) | (256) | (75) | (225) |

3-D table: statistical interaction

| Percent believing abortion should be available by education and religion | | | | |
|--|--------------------|-----------------|------------------|-----------------|
| | <u>Education</u> | | | |
| <u>Religion</u> | <u><=8 yrs.</u> | <u>9-11 yrs</u> | <u>H.S. grad</u> | <u>College+</u> |
| Catholic | 31.0 (90) | 33.0 (96) | 33.0 (89) | 31.0 (75) |
| Protestant | 29.0 (287) | 36.0 (250) | 43.0 (256) | 51.0 (225) |

Additive relationship (hypothetical)

| | <u>Education</u> | | | |
|-----------------|--------------------|-------------|------------------|-----------------|
| <u>Religion</u> | <u><=8 yrs.</u> | <u>9-11</u> | <u>H.S. grad</u> | <u>College+</u> |
| Catholic | 30.0 | 35.0 | 45.0 | 65.0 |
| Protestants | 40.0 | 45.0 | 55.0 | 75.0 |

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?”