

The Elaboration Model



Edouard Manet: The Railway, 1873.



The Elaboration Model

Introduction

- The elaboration model refers to a protocol for analyzing relationships among variables for the purpose of testing theories.
- This protocol is common to all sciences.
- In some ways it is applied differently in the social sciences compared with the life and physical sciences because the social sciences:
 - work more with abstract variables.
 - cannot physically control social variables to analyze their effects on other variables.



The Elaboration Model

Introduction (Continued)

- Earl Babbie uses the term, “Elaboration Model,” to refer to this protocol for investigating cause and effect among variables.
- Other names:
 - Interpretation model.
 - Lazarsfeld method.
 - Columbia school.
 - or simply, Scientific Method.



The Elaboration Model

Introduction (Continued)

This presentation will:

1. Describe the origin of the elaboration model.
2. Explain the rationale for using the model.
3. Explain the steps in using the model.
4. Explain each type of relationship between variables that should be investigated with the model.
5. Provide an example of an application of the model.



Origin of the Model

The American Soldier

- Stouffer et al. sought to understand how to increase the motivation and morale of soldiers in the U.S. Army.
- The researchers sought ways to explain seemingly non-rational behavior among U.S. soldiers during their training for duty during WWII.



Origin of the Model

The American Soldier (Continued)

Consider these three hypotheses:

1. The greater the promotions, the greater the morale.
2. African-American soldiers trained in northern camps are more likely to have high morale than African-American soldiers trained in southern camps.
3. Soldiers with more education are more likely to resent being drafted than soldiers with low education.



Origin of the Model

The American Soldier (Continued)

- Although each hypothesis seems intuitively reasonable, each one is not supported by observation.
- Therefore, research scientists require a protocol for finding indications of true cause or no cause and rejecting false indications of cause or no cause.



Rationale for the Elaboration Model

1. Introduction

- Scientists must be very careful when investigating cause and effect to accurately identify the correct cause of an outcome.
- Relying upon misleading results:
 - wastes money.
 - influences the development of flawed technologies or policies.
 - might result in harm to individuals or societies.



Rationale for the Elaboration Model

2. Experimental Control

- In the physical and life sciences, it is possible to physically control most variables.
- In the social sciences, one cannot physically control variables (e.g., one cannot “take out” religious beliefs from a person to isolate the effects of education on income, controlling for religious beliefs).
- Therefore, the social sciences rely more so than the life and physical sciences upon statistical control.



Rationale for the Elaboration Model

3. Aggregated Data

- Social science research often must rely upon aggregated data because of cost constraints and issues of confidentiality.
- Analysis of aggregated data can yield misleading results.
- Disaggregation of data examines how results vary when changing the unit of analysis to the individual level.



Rationale for the Elaboration Model

4. Summary

- Scientists seek to understand cause and effect to improve human well-being.
- They use the elaboration model to accurately identify cause and effect.
- Because social scientists often cannot physically control their variables of interest, and because they must rely upon aggregated data more so than they would like to do, they must be especially careful about using the elaboration model to statistically control their variables of interest.



Steps in the Elaboration Model

1. A relationship is observed to exist between two variables.
 - The researcher begins by examining frequencies and bivariate relationships (e.g., the greater education, the greater the income).
2. A third variable is held constant by subdividing the cases according to the attributes of this third variable.
 - The cases are divided into the groupings of the third variable (e.g., education and income are divided by males and females).



Steps in the Elaboration Model

3. The original two-variable relationship is recomputed within each of the subgroups.
 - What is the relationship between education and income for males and what is this relationship for females?
4. The comparison of the original relationship with the relationships found within each subgroup provides a fuller understanding of the original relationship itself.
 - Does the relationship between education and income differ between males and females?



Steps in the Elaboration Model

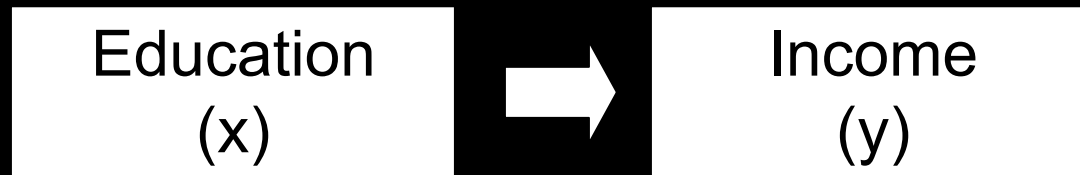
5. Example of Steps

- Consider this simplistic example of how the elaboration model can be used to gain a better understanding of cause and effect.
- We will examine hypothetical relationships among three variables:
 - education.
 - income.
 - sex of the subject.

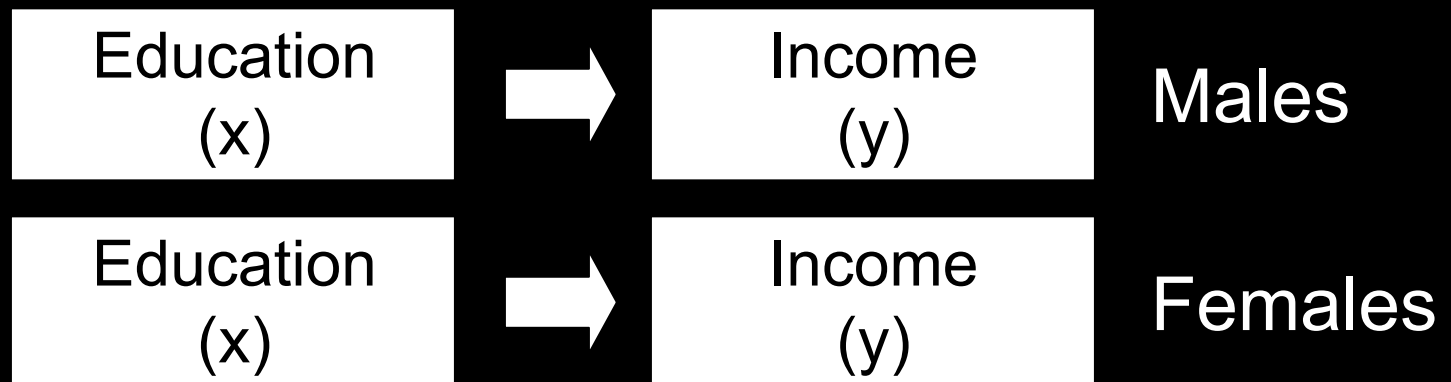
Steps in the Elaboration Model

5. Example of Steps (Continued)

- Step 1, Examine a bivariate relationship:



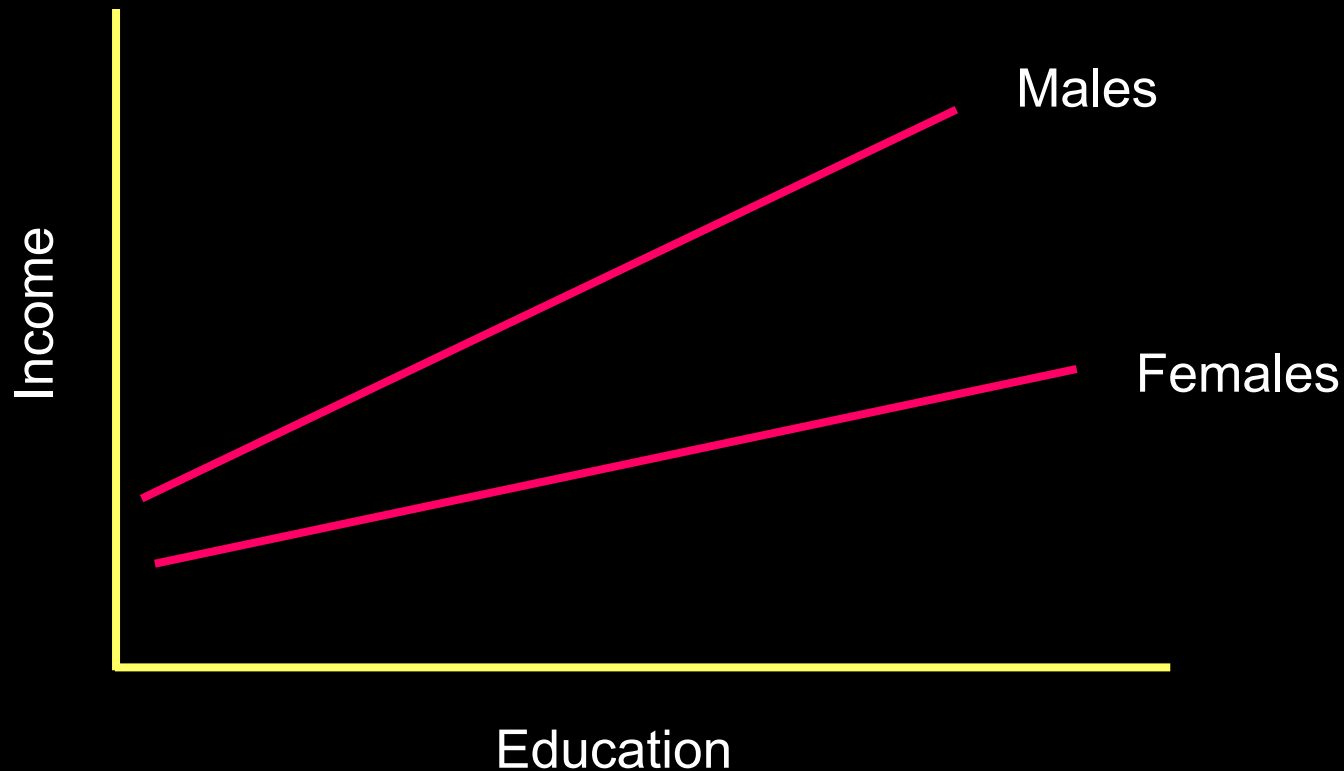
- Step 2: Examine this relationship within categories of a third variable:



Steps in the Elaboration Model

5. Example of Steps (Continued)

- Step 3, Re-examine the original relationship:





Steps in the Elaboration Model

5. Example of Steps (Continued)

- When the relationship between education and income is examined with respect to a third variable—sex of the subject—then one can obtain a more accurate understanding of cause and effect.
- The use of the elaboration model can thereby clarify cause and effect as well as alert the scientist to the need for further research.



Application of the Elaboration Model

1. Introduction

- The purpose of the elaboration model is to obtain, as accurately as possible, an understanding of cause and effect among variables.
- The elaboration procedure is to attempt to find either a false indication of causality or a better understanding of causality by examining the effect of a third variable on a relationship between two variables.



Application of the Elaboration Model

1. Introduction (Continued)

- When an attempt to reveal a different understanding of causality fails, that is, when the original relationship between the two variables of interest is not altered by the introduction of a third variable, then the original relationship is **replicated**.
- A replication of the original relationship, despite attempts to elaborate upon or discredit it, gives the researcher a sense of confidence that it is not a false indication of causality.



Application of the Elaboration Model

1. Introduction (Continued)

- When the attempt to elaborate upon or discredit causality succeeds, then the researcher:
 - gains a better understanding of cause and effect among variables.
 - learns more about the social problem being investigated.
 - gains awareness about avenues for future research.



Application of the Elaboration Model

1. Introduction (Continued)

- We will review six kinds of relationships among variables that can hinder accurate interpretations of causality:
 - Aggregation bias.
 - Ecological fallacy.
 - Explanation (Moderating):
 - Spurious relationship.
 - Suppressor relationship.
 - Misspecified relationship.
 - Interpretation (Mediating).



Application of the Elaboration Model

1. Aggregation Bias

- Aggregation bias occurs when aggregated data do not accurately reflect the underlying causal conditions between the independent variable (x) and the dependent variable (y).
- The following example shows how aggregated data can distort the real relationship between two variables.



Application of the Elaboration Model

1. Aggregation Bias: Example

- **Theory:** The greater the human capital investment, the greater the achievement.
- **Hypothesis:** The greater the amount of teacher attention given to students, the greater their academic achievement.
- Note how one gains a different interpretation of the hypothesis with two sets of data collected at different levels of analysis.



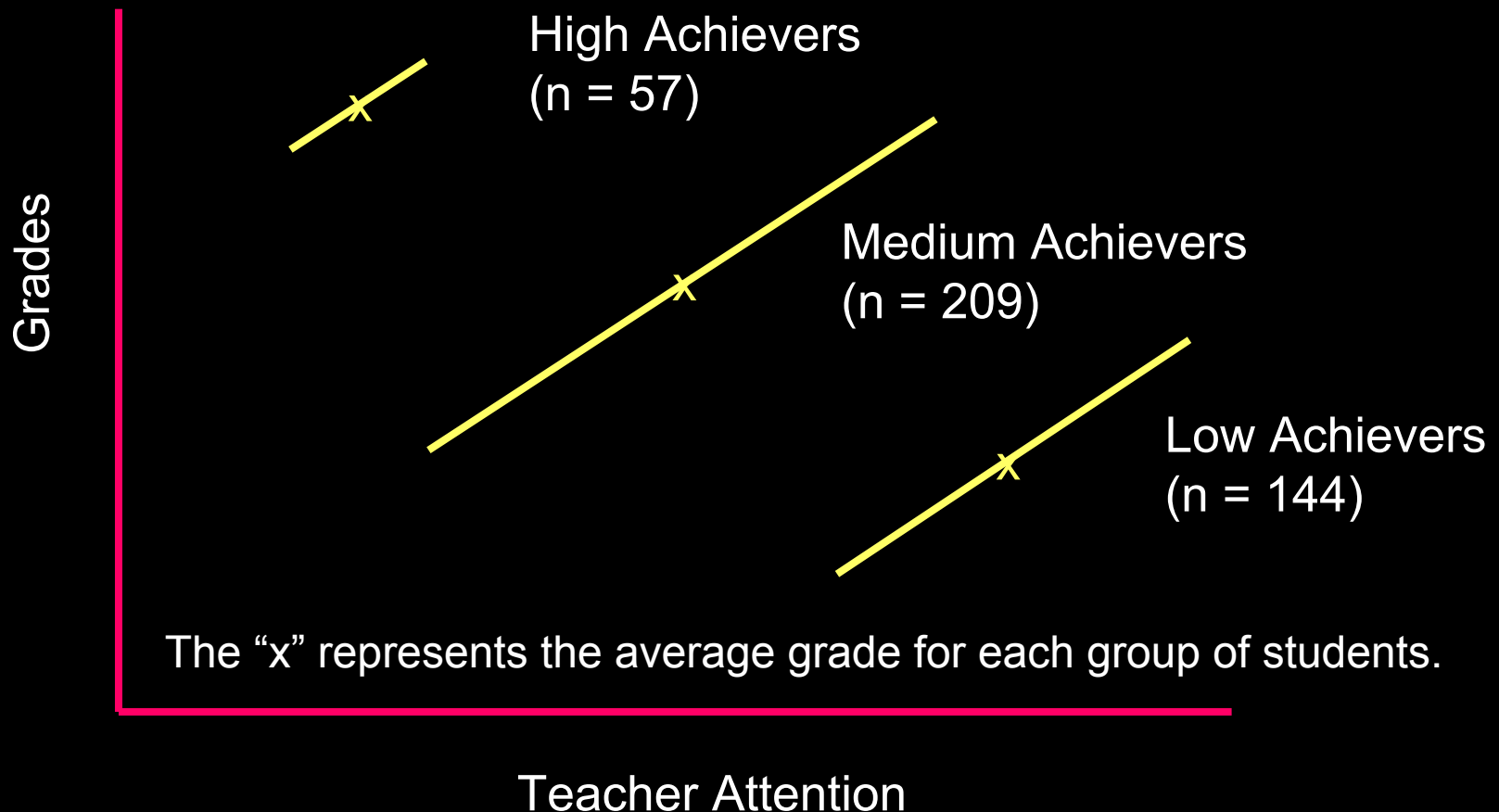
Application of the Elaboration Model

1. Aggregation Bias: Example

- If data are collected at the individual level, then one observes the true relationship between teacher attention and student performance.
- If only aggregated data are available (i.e., average performance of high, medium, and low achievers) then one observes the opposite and incorrect relationship between attention and performance.

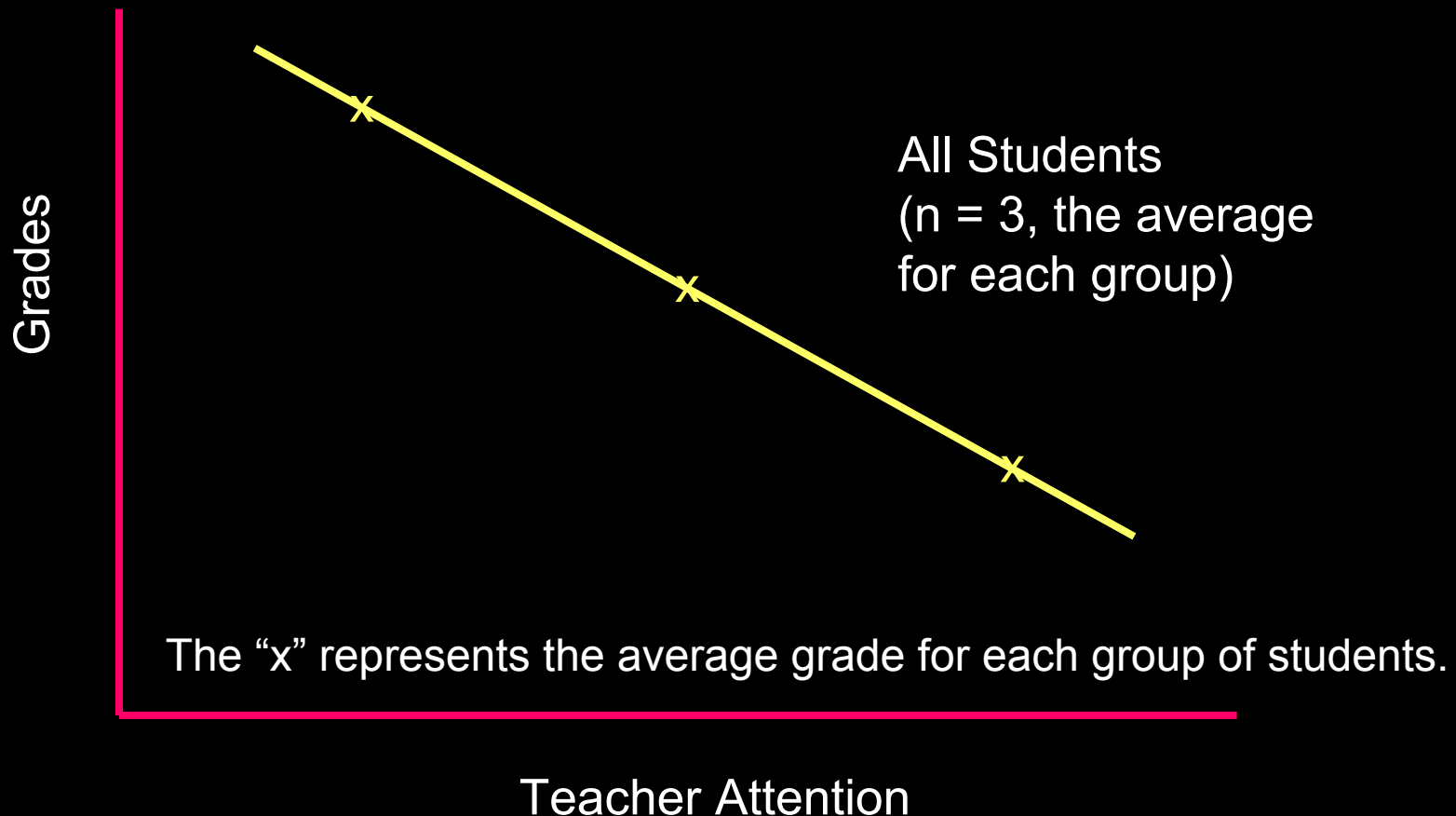
Application of the Elaboration Model

1. Aggregation Bias: Complete Data



Application of the Elaboration Model

1. Aggregation Bias: Aggregated Data





Application of the Elaboration Model

2. Ecological Fallacy

- One commits an ecological fallacy when one assumes that statistics calculated using aggregated data reflect individual traits.
- That is, one mistakenly assumes that all individuals in a group behave in the same manner as the group average.
- Consider the following example about the racial composition of classrooms and student performance.



Application of the Elaboration Model

2. Ecological Fallacy: Example

Theory: The greater the human capital investment, the greater the achievement.

Hypothesis: The greater the percentage of whites compared with blacks in a classroom, the greater the academic achievement.

This hypothesis assumes that whites will have more human capital (e.g., background education, motivation to succeed) than will black students and therefore will perform better academically.



Application of the Elaboration Model

2. Ecological Fallacy: Example

Classroom A (n = 10 students)

- White students = 80%
- Students with a GPA of 3.5+ = 30%

Classroom B (n = 10 students)

- White Students = 50%
- Students with a GPA of 3.5+ = 20%



Application of the Elaboration Model

2. Ecological Fallacy: Example

Consider the potential explanations of these data and the social policy implications of each:

1. Black students are less well prepared.
2. Black students are more disruptive.
3. Black people and white people are not meant to associate with one another.
4. Students might perform better if black students and white students attended different schools.



Application of the Elaboration Model

2. Ecological Fallacy: Example

Suppose we look at the data at the individual level.

Classroom A (n = 10; White = 80%)

- Students with a GPA of 3.4 or less:
W, W, W, W, W, W, W
- Students with a GPA of 3.5+:
B, B, W

Classroom B (n = 10; White = 50%)

- Students with a GPA of 3.4 or less:
B, B, B, B, W, W, W, W
- Students with a GPA of 3.5+:
B, W



Application of the Elaboration Model

2. Ecological Fallacy: Example

All Students

- Black students with a GPA of 3.5+ = 42.9%
- White students with a GPA of 3.5+ = 15.4%



Application of the Elaboration Model

2. Ecological Fallacy: Example

- From the aggregated data, we conclude that the greater the percent of black students in the classroom, the lower the GPA.
- From the disaggregated data, we learn that the few black students in the classroom are the ones who are making the best grades.
- This explanation implies different social policies than the ones inferred from analysis of the aggregated data.



Application of the Elaboration Model

Explanation (Moderating Relationship)

- A moderating variable can alter the relationship between two variables such that:
 1. The original relationship is shown to be a false indication of causality (i.e., spurious relationship).
 2. The original relationship is shown to be a false indication of no causality (i.e., suppressor relationship).



Application of the Elaboration Model

Explanation (Moderating Relationship)

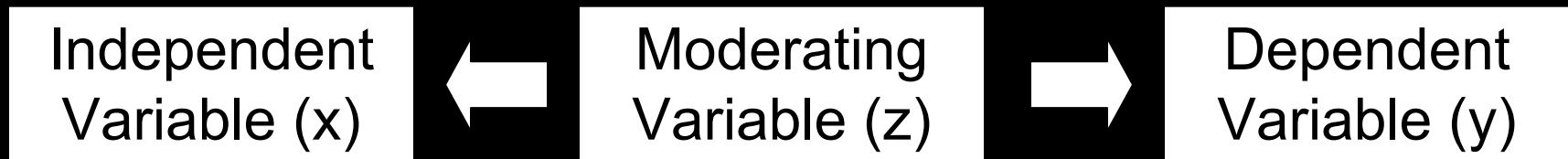
3. The strength of the relationship differs across categories of a third variable (i.e., misspecified relationship).
4. The direction of causality in the original relationship is reversed (i.e., distorted relationship).

Steps in the Elaboration Model

Moderating Relationship (Continued)

A third variable (z) moderates (or causally affects) both the independent variable (x) and the dependent variable (y).

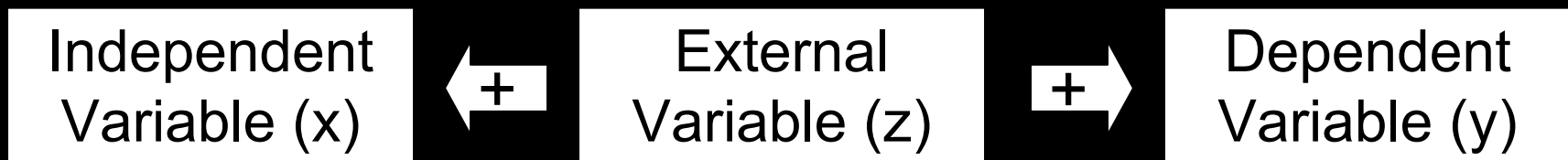
Note: X might or might not cause Y, depending upon the pattern of causality related to Z.



Application of the Elaboration Model

3. Spurious Relationship

- A spurious relationship is a false indication of causality between x (the independent variable) and y (the dependent variable).
- A third, external, variable causes both x and y .
- The x and y variables appear to be causally related, but they are not.

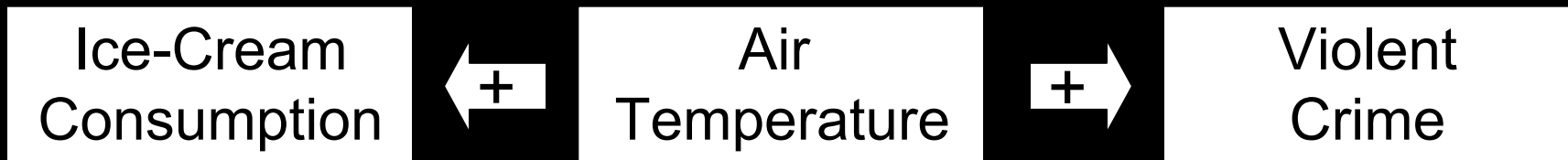


Application of the Elaboration Model

3. Spurious Relationship: Silly Example

The greater the rate of ice cream consumption, the higher the rate of violent crime.

- External variable: Air Temperature.





Application of the Elaboration Model

3. Spurious Relationship: Actual Example

Theory: The greater the available resources, the greater the productivity.

Hypothesis: The greater the expenditures per pupil, the greater the academic achievement.

Independent variable (x): Expenditures per pupil.

Dependent variable (y): Academic achievement.

Moderating variable (z): Educated parents.

Application of the Elaboration Model

3. Spurious Relationship: Actual Example

Explanation: Educated parents, who value education, have higher incomes and therefore contribute more to schools. They also motivate their children to perform well academically.





Application of the Elaboration Model

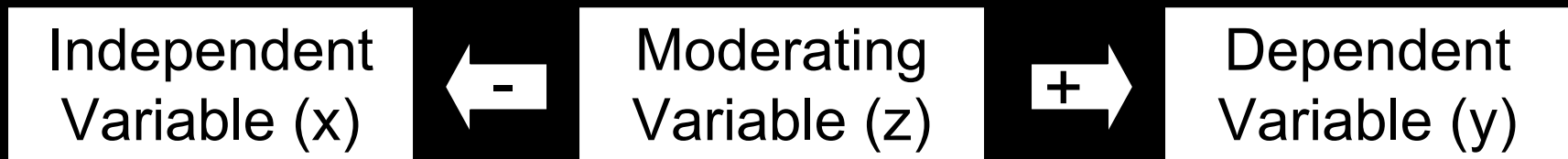
4. Suppressor Relationship

- A false indication of no causality between x (the independent variable) and y (the dependent variable).
- A third, moderating, variable has, for example, a negative effect on x and a positive effect on y .
- These two relationships “cancel out” the indication of causality between x and y .
- The x and y variables appear not to be causally related, but they are.

Application of the Elaboration Model

4. Suppressor Relationship (Continued)

- A third variable (z) moderates (or causally affects) both the independent variable (x) and the dependent variable (y).
- X does not appear to cause Y, but it does.





Application of the Elaboration Model

4. Suppressor Relationship: Example

Theory: The greater the self-actualization, the greater the life satisfaction.

Hypothesis: The greater the marital satisfaction, the greater the life satisfaction.

Independent variable (x): Marital satisfaction.

Dependent variable (y): Life satisfaction.

Moderating variable (z): Presence of children.

Application of the Elaboration Model

4. Suppressor Relationship: Example

Explanation: The presence of children can decrease marital satisfaction but increase life satisfaction, making it appear that marital satisfaction is not related to life satisfaction.





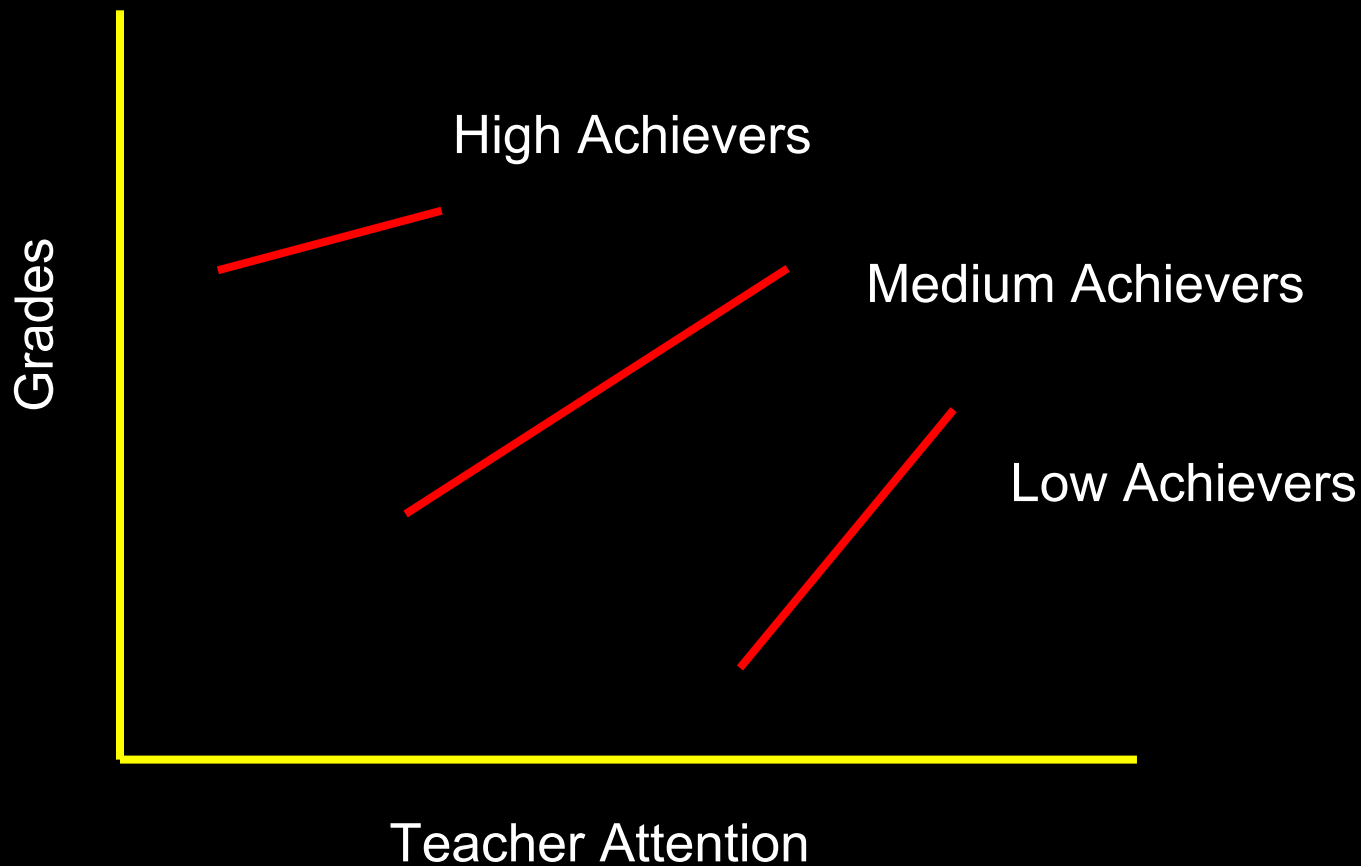
Application of the Elaboration Model

5. Misspecified Relationship

- After the introduction of a third variable:
 - The causality between two variables is supported by the analysis and the direction of causality remains the same.
 - But the strength of the causality varies across levels of the third variable.
- Example: When examining the effects of teacher attention on student performance, we might find that the positive relationship varies in strength among high, medium, and low performing students.

Application of the Elaboration Model

Example of Specification





Application of the Elaboration Model

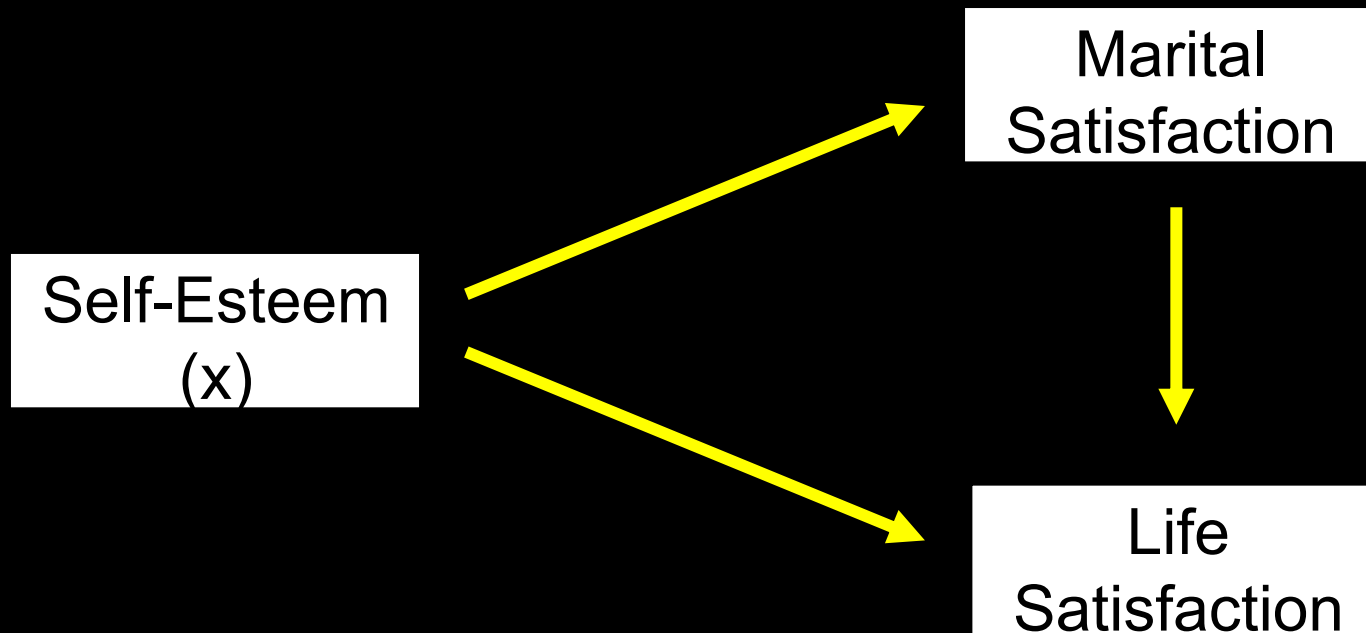
7. Mediating Relationship

- The causal sequence goes from x to z to y .
- Thus, x has an “indirect effect” on y .
- The independent variable might also have a direct effect on y .
- In interpretation, the relationship between x and y is mediated by the third variable, z .

Application of the Elaboration Model

7. Mediating Relationship: Example

- Self-esteem (x) might have a direct effect on marital satisfaction (z) and both a direct and indirect effect on life satisfaction (y).





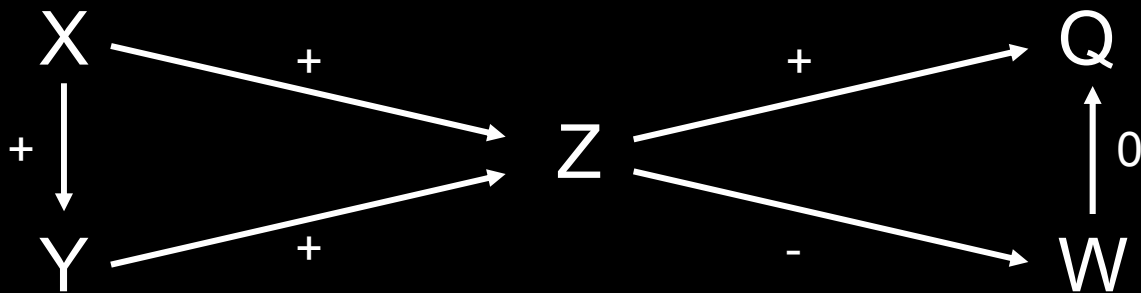
Rationale for the Elaboration Model

4. Summary

- Scientists use the elaboration model to accurately identify cause and effect.
- Social scientists must be especially careful about using the elaboration model to statistically control their variables of interest.
- In practice, scientists often work with many variables, with many different potential misinterpretations of causality, within a large model that contains many variables.

Practice in Using the Elaboration Model

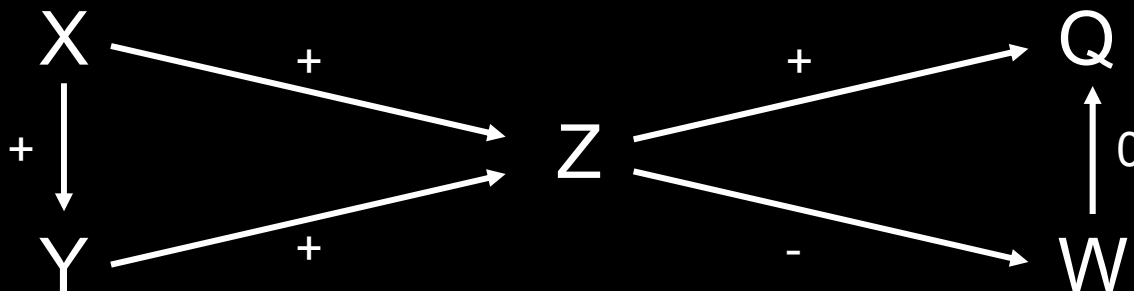
- Consider this diagram of a series of possible causal relationships among a set of variables:



- The arrows represent proposed causal relationships among the variables. The + and – signs indicate the direction of the zero-order correlations among the variables. The “0” represents a very weak correlation.

Practice in Using the Elaboration Model

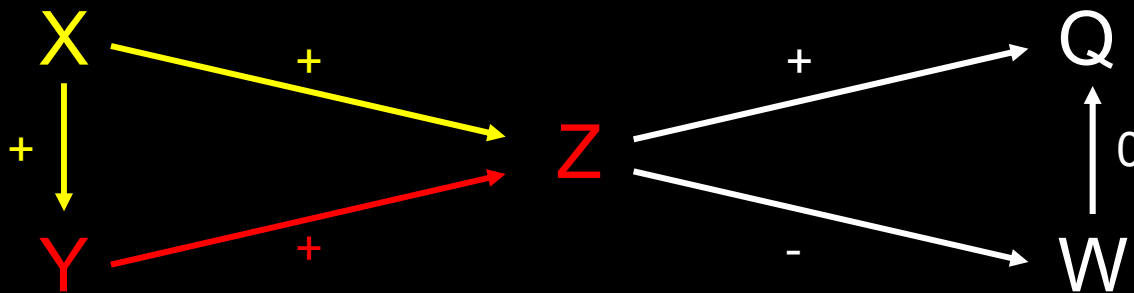
- Which set of relationships might be spurious?



- Which set of three variables might have zero-order correlations and causal links that result in a spurious relationship? What is the “external” or “spurious” variable that creates the potential spurious relationship?

Practice in Using the Elaboration Model

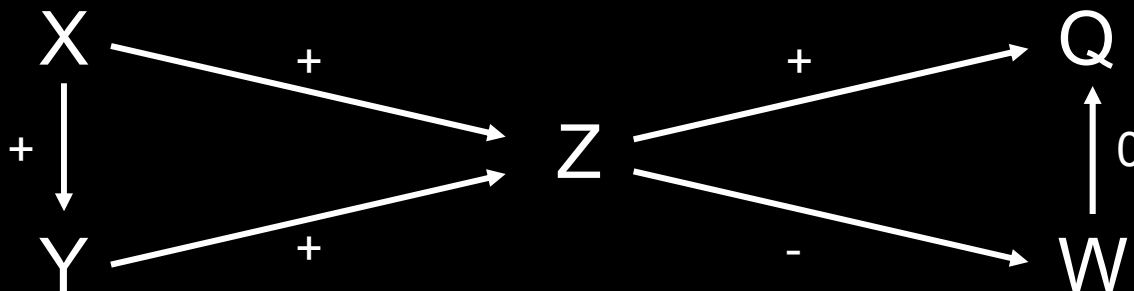
- Which set of relationships might be spurious?



- The relationship between Y and Z might be spurious—a false indication of causality—because all three zero-order correlations are in the same direction and X (the external variable) causes Y and Z.

Practice in Using the Elaboration Model

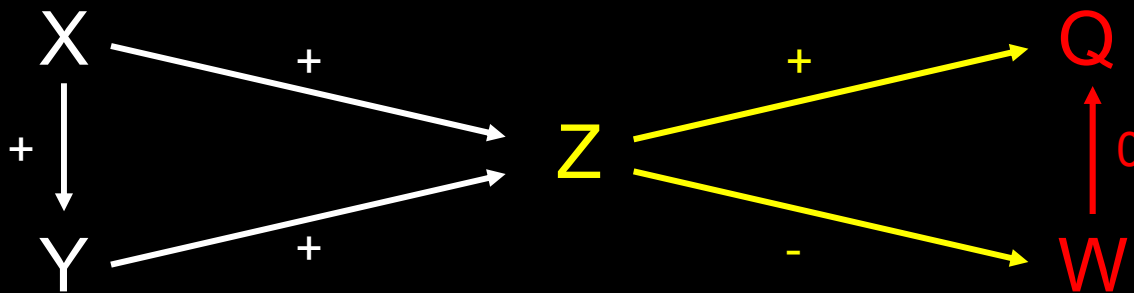
- Which set of relationships might be suppressed?



- Which set of three variables might have zero-order correlations and causal links that result in a suppressed relationship? What is the “external” or “suppressor” variable that creates the potential suppressed relationship?

Practice in Using the Elaboration Model

- Which set of relationships might be spurious?



- The relationship between **W** and **Q** might be suppressed—a false indication of no causality—because **Z** (the external variable) has a - correlation with **W** and a + correlation with **Q**.



An Application of the Elaboration Model

- **Social Problem:** Community Development
- **Issue:** Success of small businesses.
- **Fact:** Most new small businesses are owned by women.
- **Fact:** Women-owned businesses are less successful than men-owned businesses.
- **Question:** Is this a social problem? Perhaps. But only if one can rule out other reasonable explanations that do not imply discrimination against women.



An Application of the Elaboration Model

- Possible explanations for women-owned businesses being less successful:
 - Lower profit motive.
 - Fewer skills.
 - Less education.
 - Less networking.
 - More family responsibilities.
 - Industry sector.
 - Newer businesses.
 - Less access to credit.



An Application of the Elaboration Model

- Procedure:
 - Collect data on possible explanations for lower business success.
 - Use the elaboration procedure to determine the most important causes of this lower success.
 - Statistically control for other explanations besides discrimination against women.



An Application of the Elaboration Model

- Data
 - 657 small businesses.
 - 423 in rural towns (pop. < 10,000).
 - 234 in urban towns (pop. \geq 10,000).
- Businesses owned by one or two males.
 - Total = 526 (Urban = 194; Rural = 332).
- Businesses owned by one or two females.
 - Total = 131 (Urban = 40; Rural = 91).

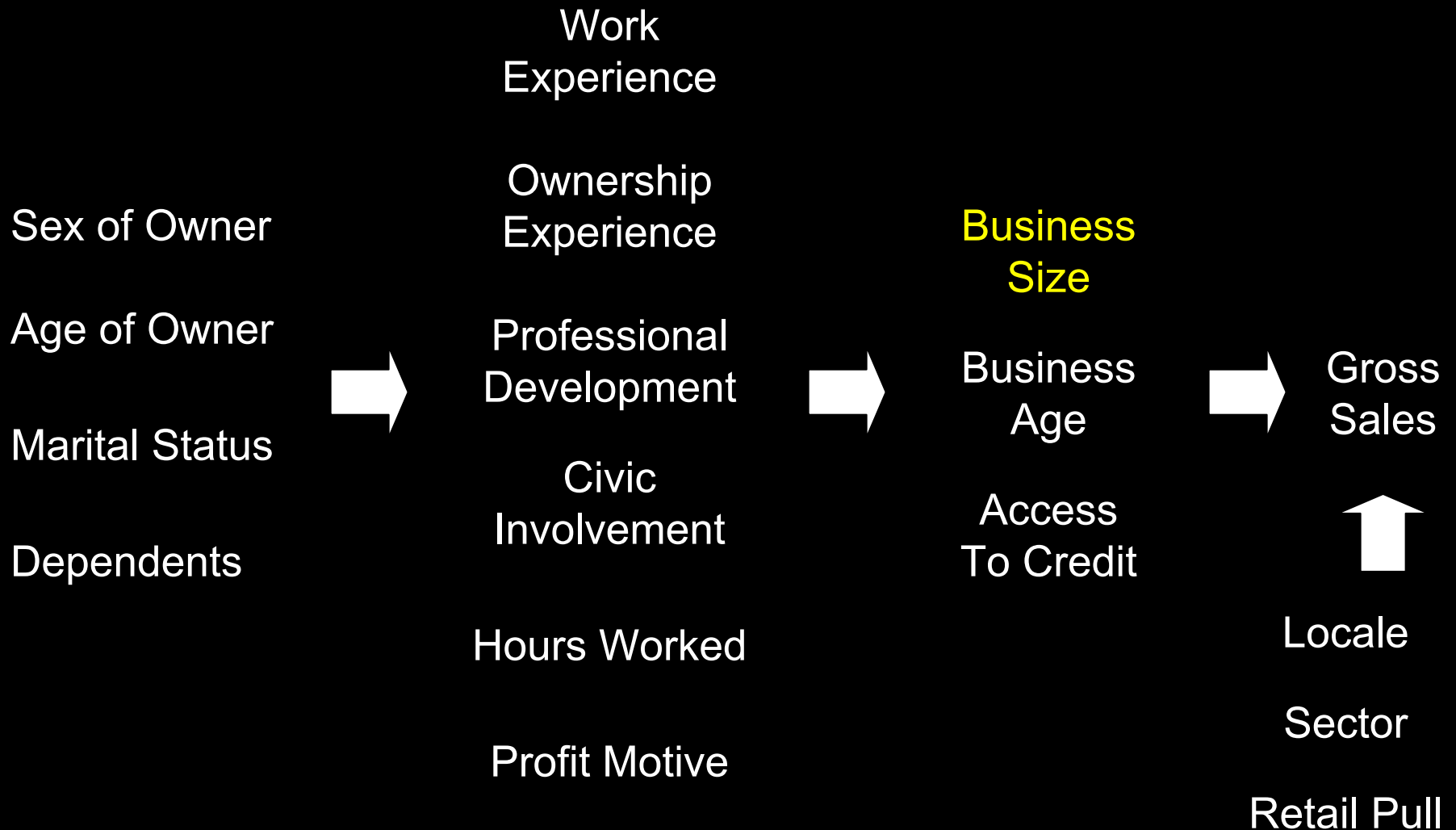


An Application of the Elaboration Model

- The two most important indicators of business success, after controlling for many other factors that might influence success, are shown in **Yellow** on the following two slides.
- The most important indicator of success, as measured by gross sales, is business size. This finding is not interesting because it is expected that the greater the number of employees in a business, the greater the gross sales.
- Can you guess which variable is the next most important in explaining success?

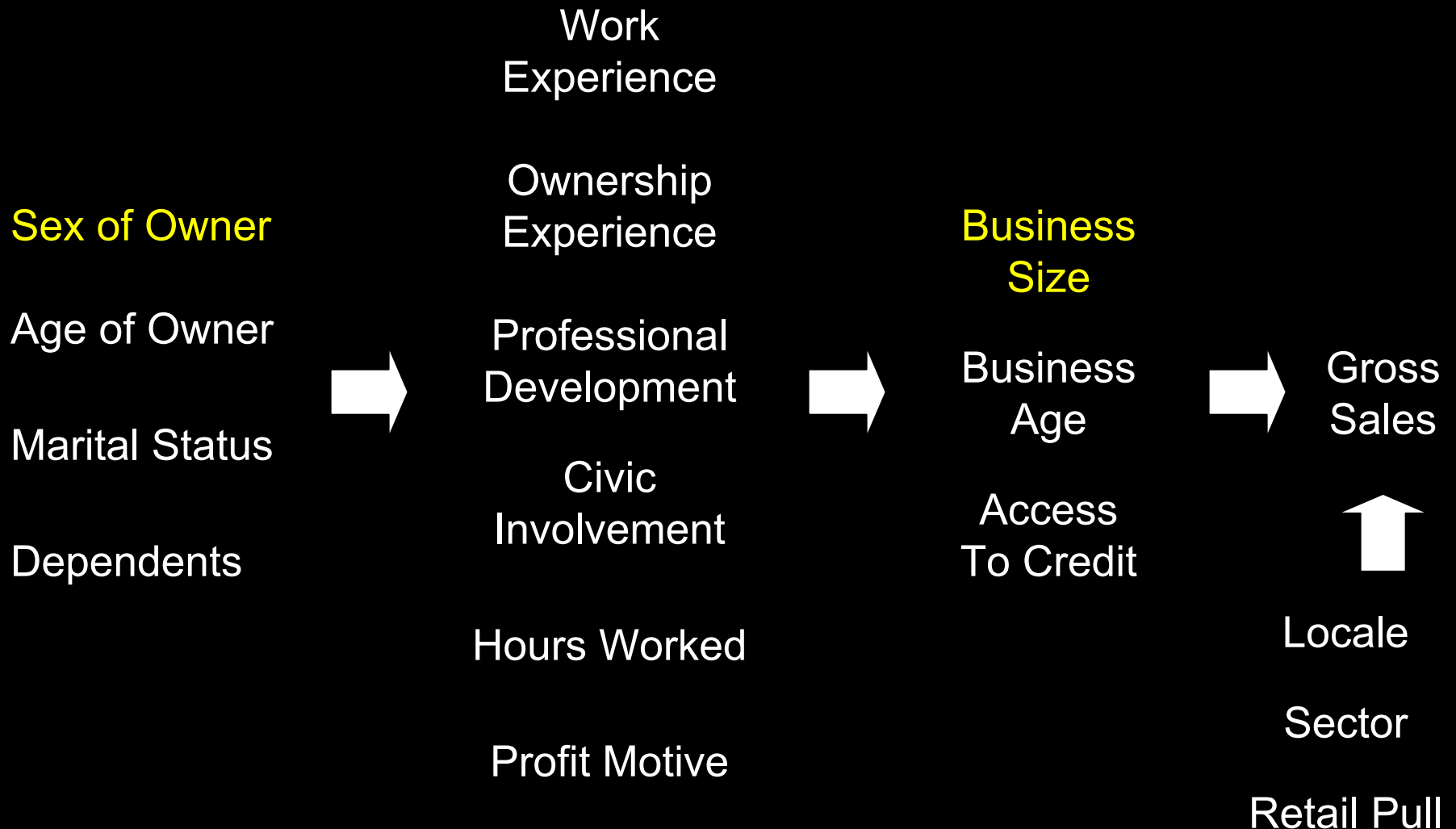
Structure-Functional Model of Business Success

Sharon Bird and Steve Sapp



Structure-Functional Model of Business Success

Sharon Bird and Steve Sapp





An Application of the Elaboration Model

Summary

- After controlling for many possible alternative explanations for less success by women-owned businesses, we found that the most important determinant of success is the sex of the owner.
- Given the limitations of social science research, this is as close as we can get in a single study to observing gendered preferences.

Questions?