Controlled Comparisons and Controlled Relationships

POSC 3410 - Quantitative Methods in Political Science

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Goal for Today

Introduce students to making controlled comparisons and understanding controlled relationships.

A Brief Review

What we have done to this point:

- We have an interest in a relationship between an independent variable and a dependent variable.
- We already know our types of relationships.

A Brief Review

Experimental design with **random assignment** can lead to proper inference about relationship between x and y.

- However, we often deal with observational or event data.
- We must deal with the problem of **selection** all the same.

It could be some third process (z) that is responsible for the relationship between x and y.

- We account for this by making **controlled comparisons**.

Types of Controlled Relationships

There are three types of controlled relationships among x, y, and z.

1. Spurious relationship
2. Additive relationship
3. Interactive relationship

Partisanship, Gender, and Gun Control

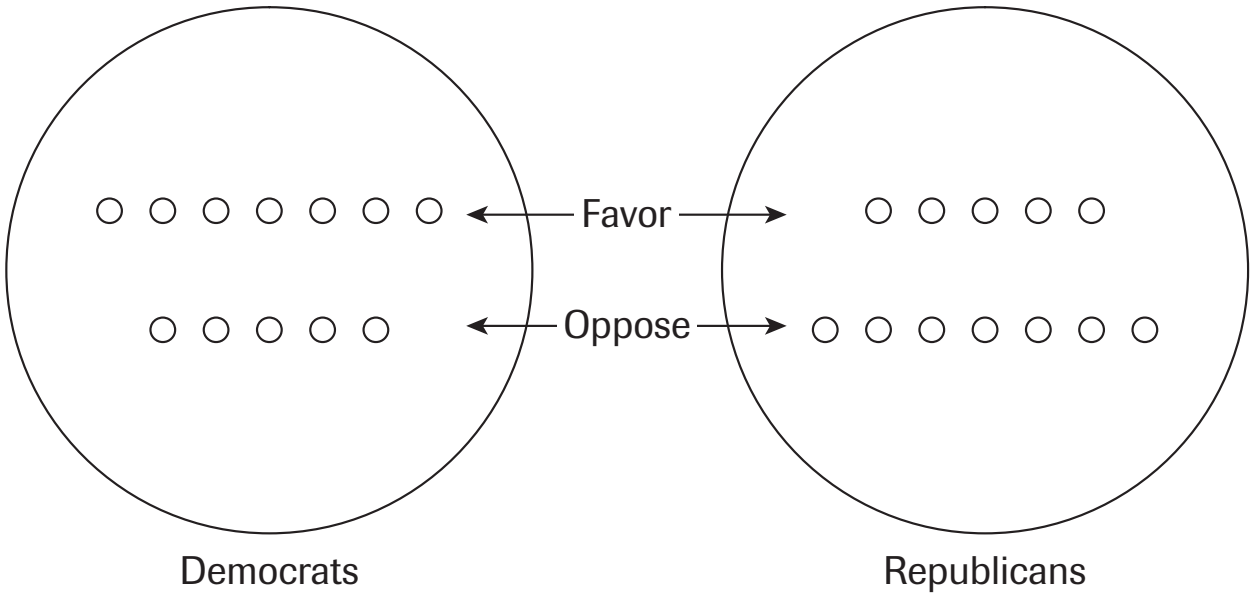
We will use the partisanship, gender, gun control example from your book.

- We already discussed the theory linking partisanship and gun control.
- However, Democrats tend to have more women than men.
    - This is an essential **compositional difference**.

There is good reason to expect gender confounds our partisanship-gun control inference.

Partisanship and Gun Control

Figure 4-1 Relationship between Partisanship and Gun Control Opinions (diagram)



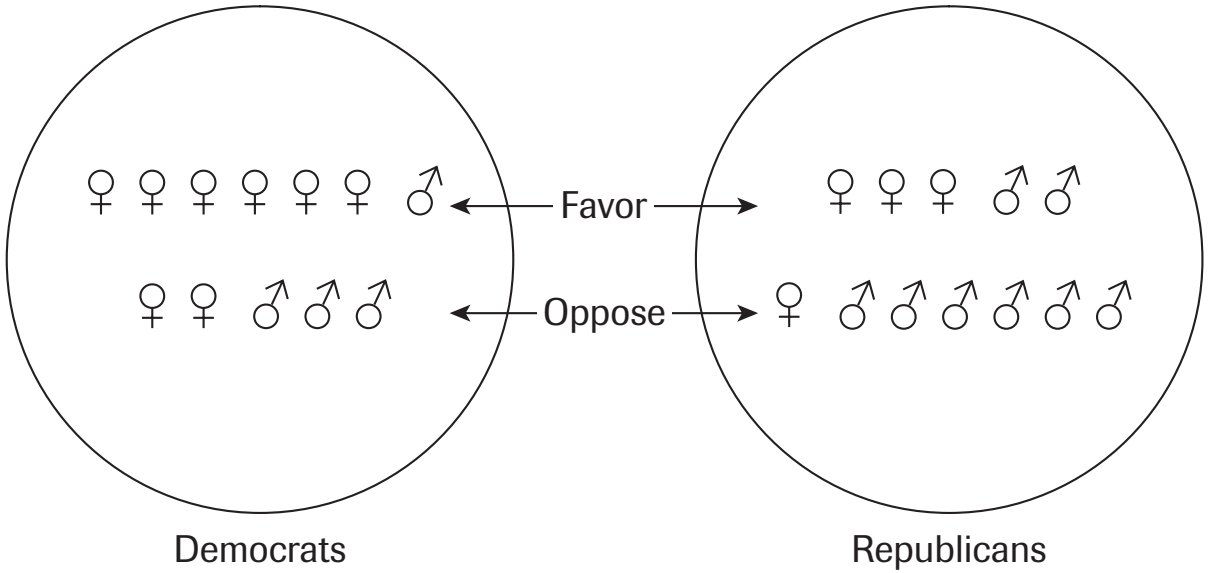
Partisanship, Gender, and Gun Control

What if we believe gender is responsible for this relationship?

- Figure 4.1 would not let us know.
- Figure 4.2 would let us know in an obvious way.

Partisanship, Gender, and Gun Control

Figure 4-2 Spurious Relationship between Partisanship and Gun Control Opinions (diagram)



Partisanship, Gender, and Gun Control

What is the effect of partisanship on gun control opinions, *controlling* for gender?

- Nine of 12 women favored gun control.
- Six of eight female Dems favored gun control (i.e. 75%)
- Three of four female Republicans favored gun control (i.e. 75%).

Of the men:

- One male Dem favored while three opposed (i.e. 25%).
- Two GOP men favored while six opposed (25%).

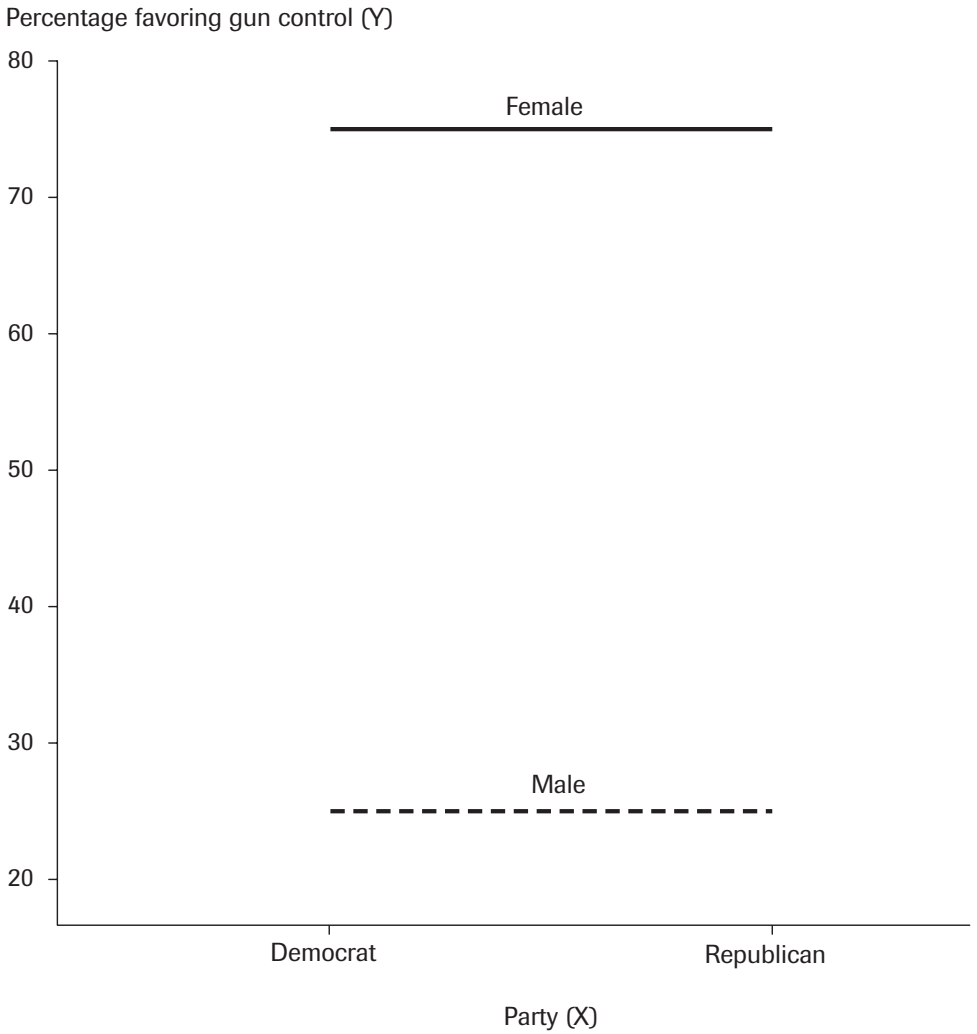
Partisanship, Gender, and Gun Control

Gender explains everything in this example.

- Formally: the effect of x on y is **spurious** to z.

Partisanship, Gender, and Gun Control

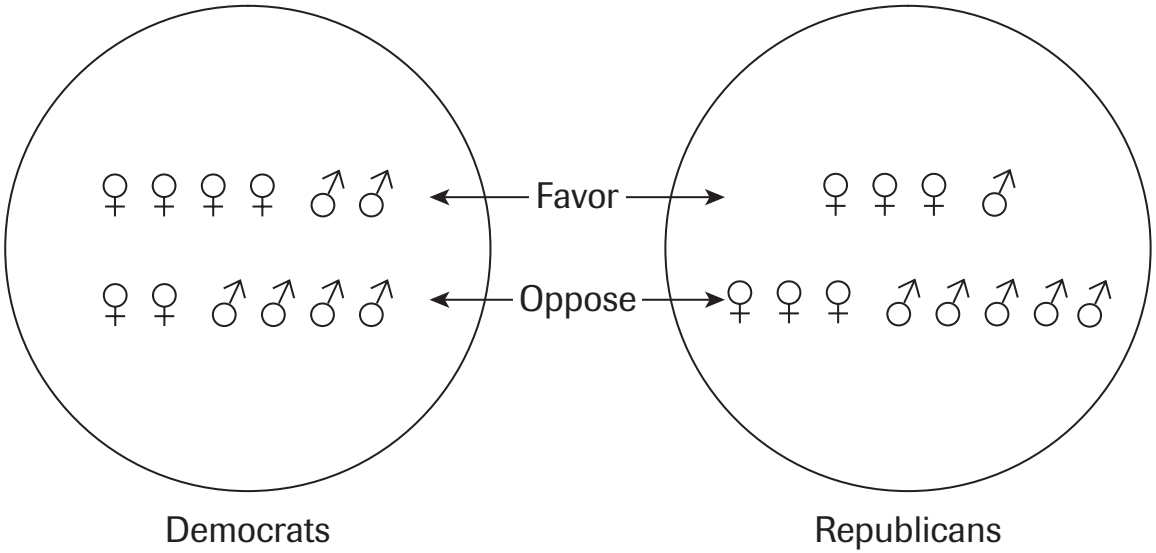
Figure 4-3 Spurious Relationship between Partisanship and Gun Control Opinions (line chart)



Partisanship, Gender, and Gun Control

Consider this arrangement.

Figure 4-4 Additive Relationships between Partisanship and Gun Control Opinions (diagram)



Partisanship, Gender, and Gun Control

Among the women:

- Four of six Democrats favor gun control (66.6%).
- Three of six Republicans favor gun control (50%).

Among the men:

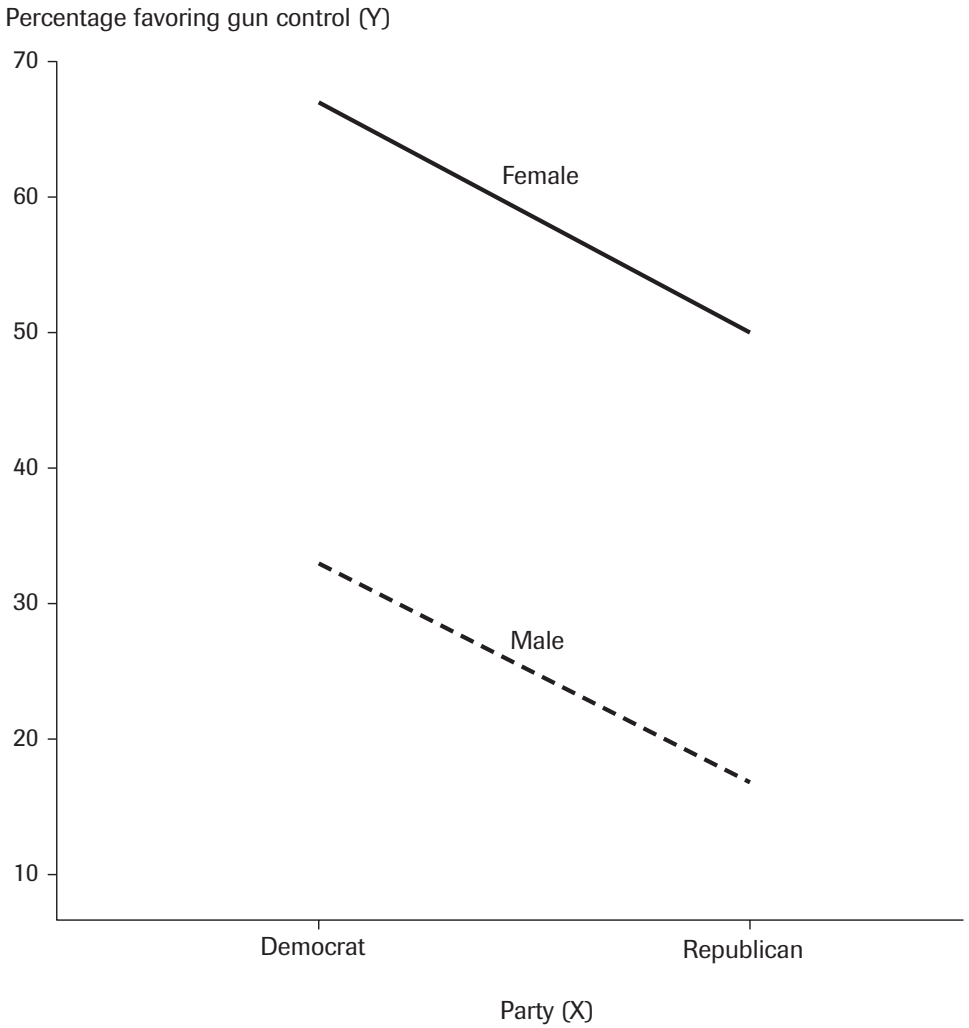
- Two of six Democrats favor gun control (33.3%)
- One in six GOP men favor gun control (16.6%).

This is an **additive relationship**.

- x and z affect y independently.

Partisanship, Gender, and Gun Control

Figure 4-5 Additive Relationships between Partisanship, Gender, and Gun Control Opinions (line chart)



Interactive Relationships

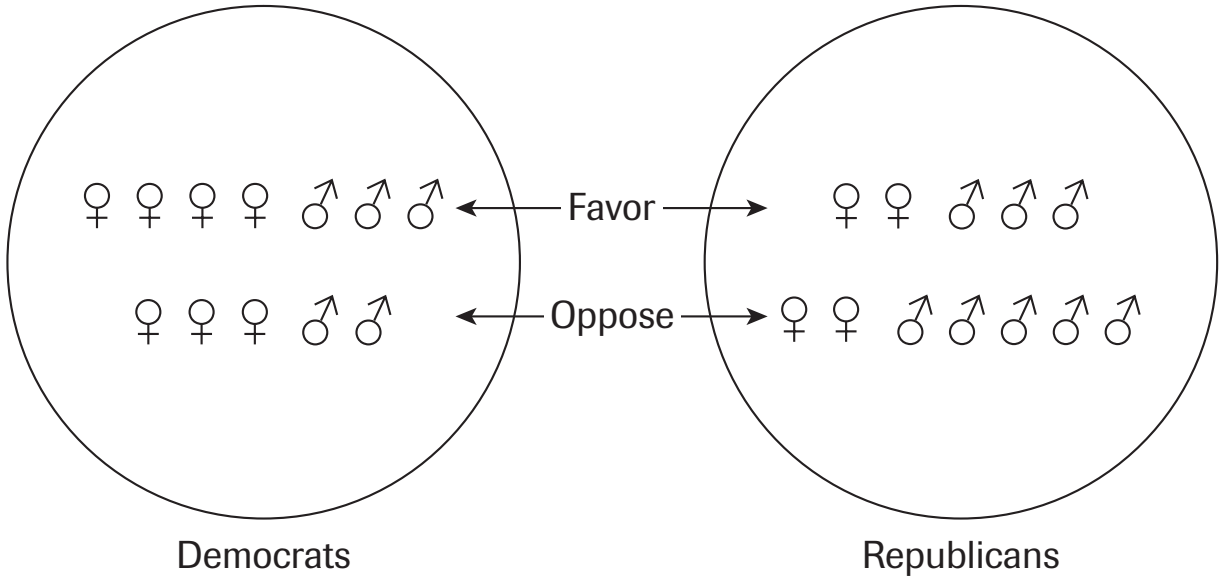
Interactive relationships are more difficult to fully describe.

- Simply: x and z act in concert to affect y
- Put another way: the effect of x on y depends on the value of z.

Partisanship, Gender, and Gun Control

Consider this arrangement.

Figure 4-7 Interaction Relationships between Partisanship, Gun Control Opinions, and Gender (diagram)



Partisanship, Gender, and Gun Control

Among the women:

- Four of seven Democrats favor gun control (57.1%)
- Two of four Republicans favor gun control (50%).

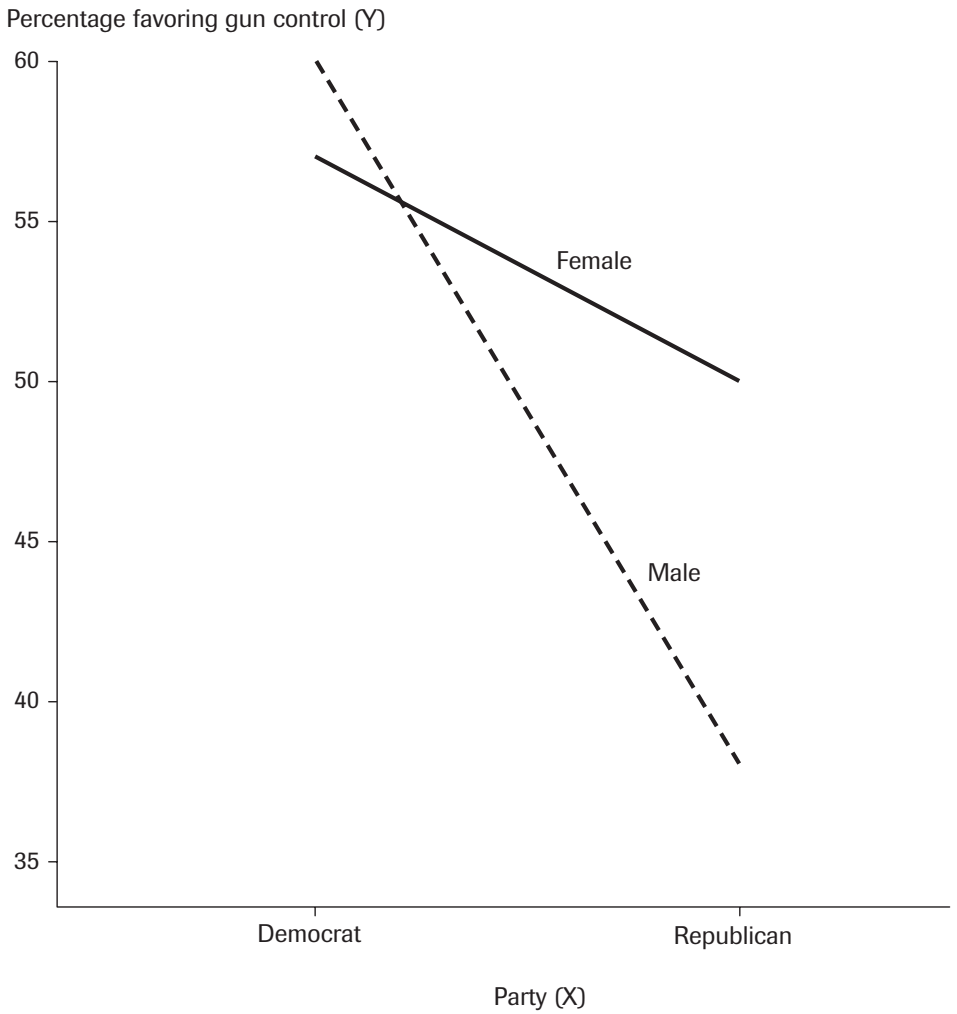
Among the men:

- Three of five Democrats favor gun control (60%).
- Three of eight Republicans favor gun control (37.8%).

Put another way: the effect of partisanship is strong for men, less for women.

Partisanship, Gender, and Gun Control

Figure 4-8 Interaction Relationships between Partisanship, Gun Control Opinions, and Gender (line chart)



Applied Controlled Comparisons

We can summarize these controlled relationships with:

1. Cross-tabulation
2. Mean comparison analysis

We will also use actual data.

Partisanship and Gun Control

Table 5-1 Relationship between Partisanship and Gun Control Opinions

	Partisanship		
Opinion on gun permits	*Democrat*	*Republican*	Total
Favor	87.0%	68.8%	79.2%
	(407)	(243)	(650)
Oppose	13.0%	31.2%	20.8%
	(61)	(110)	(171)
Total	100.0%	100.0%	100.0%
	(468)	(353)	(821)

Source: 2008 General Social Survey.

Note: Question: "Would you favor or oppose a law which would require a person to obtain a police permit before he or she could buy a gun?"

Zero-order Relationship

Table 5.1 illustrates a **zero-order relationship**.

- This is the effect of x on y **not** contorlling for z.

The zero-order effect of partisanship on attitudes toward gun control is 18.

Partisanship, Gender, and Gun Control

Consider this arrangement.

Table 5-2 Relationship between Partisanship and Gun Control Opinions, Controlling for Gender

	Gender					
	Female			*Male*		
	Partisanship			Partisanship		
Opinion on gun permits	*Democrat*	*Republican*	Total	*Democrat*	*Republican*	Total
Favor	91.5%	74.9%	84.6%	80.8%	61.1%	71.9%
	(247)	(143)	(390)	(160)	(99)	(259)
Oppose	8.5%	25.1%	15.4%	19.2%	38.9%	28.1%
	(23)	(48)	(71)	(38)	(63)	(101)
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	(270)	(191)	(461)	(198)	(162)	(360)

Source: 2008 General Social Survey.

Controlled Comparison Table

Table 5.2 is a **controlled comparison table**.

- It shows the relationship between x and y for each value of z.

These tables reveal two types of relationships.

1. Controlled effect
2. Partial effect

Controlled Effect

A **controlled effect** is a relationship between x and y within one value of z.

- It could also be between z and y within one value of x.

We obtain the controlled effect of partisanship for both women and men.

- 91.5% of female Dems favor permits to 74.9% of female Republicans.
  - The controlled effect is 16.6 percentage points.
- 80.8% of male Dems favor permits to 61.1% of male Republicans.
  - The controlled effect is 19.7 percentage points.

Partial Effect

We summarize controlled effects as **partial effect**.

- Summarizes a relationship between two variables taking into account rival variables.

It's tempting, but *don't average the two controlled effects*.

- Doing so assumes the samples are equal.

Instead: weight the controlled effect by percentage of the sample.

- In our case: 16.6 * (.562) + 19.7 * (.438) = 17.96

The partial effect of partisanship on gun control opinions is 17.96.

Partial Effect

What is the partial effect of *gender* on gun control attitudes?

- Sounds weird to ask. No one "increases" in gender.

Follow the **rule of direction for nominal relationships**.

- Treat the left-most column as the base category (here: women).

Partial Effect of Gender on Gun Control

Controlled effects:

- 91.5% of female Dems favor permits to 80.8% of male Dems (10.7%).
- 74.9% of female Republicans favor permits to 61.1% of male Republicans (13.8).

Weight the controlled effects to get a partial effect.

- $10.7(.570) + 13.8(.430) = 12.03$

The partial effect of gender on gun control opinions is 12.03.

Identifying the Pattern

Ask the following three questions for relationships among x, y, and z.

1. Does a relationship exist between x and y in at least one value of z?
2. Is the tendency (i.e. positive or negative) the same at all values of z?
3. Is the magnitude effect the same or close to it in all values of z?

Identifying the Pattern

If the answer to the first question is no, you can stop there.

- It's a spurious relationship.

If the answer to the second question is no, you can stop there.

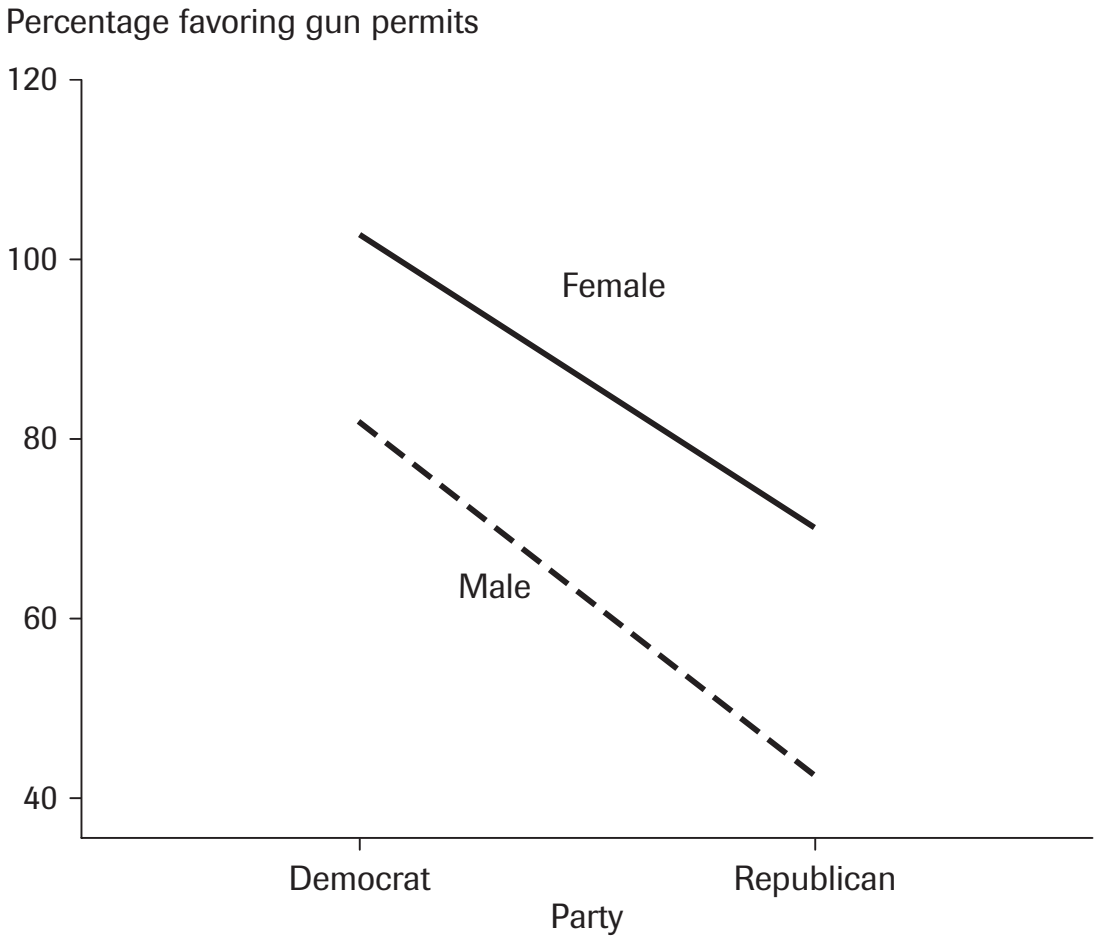
- There's an interaction effect.

If the answer to the third question is no, there's an interaction.

- If "yes", it's an additive relationship.

Partisanship, Gender, and Gun Control

Figure 5–1 Relationship between Partisanship and Gun Control Opinions, Controlling for Gender (line chart)



Abortion Opinions, Salience, and Vote Choice

Consider the following controlled comparison table.

Table 5-3 Relationship between Abortion Opinion and Vote Choice, Controlling for Issue Salience

	Issue salience					
	Low			*High*		
	Abortion opinion			Abortion opinion		
Vote choice	*Always permit*	*Not always permit*	Total	*Always permit*	*Not always permit*	Total
Democratic	63.2%	45.9%	53.2%	82.0%	34.9%	54.2%
	(103)	(102)	(205)	(132)	(81)	(213)
Republican	36.8%	54.1%	46.8%	18.0%	65.1%	45.8%
	(60)	(120)	(180)	(29)	(151)	(180)
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	(163)	(222)	(385)	(161)	(232)	(393)

Source: 2008 American National Election Study.

Abortion Opinions, Salience, and Vote Choice

The controlled effect of abortion opinion:

- 63.2 - 45.9 for "low" = 17.3
- 82 - 34.9 for "high" = 47.1
- Partial effect: 17.3 * (.495) + 47.1 * (.505) = 32.3

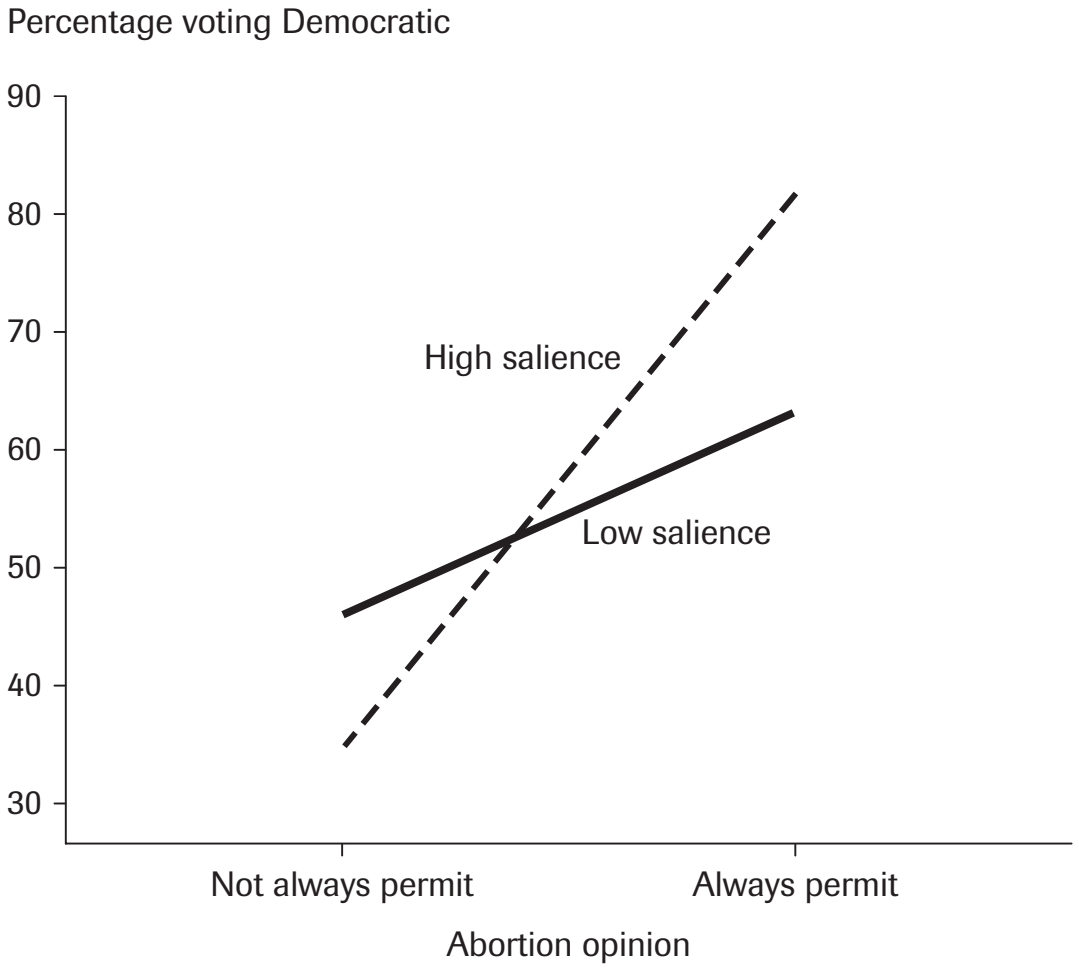
Controlled effect of salience:

- 63.2 - 82 for "always permit" = -18.8
- 45.9 - 34.9 for "not always permit" = 11
- Partial effect: -18.8 * (.416) + 11 * (.584) = -1.39

Something already looks a lot different here.

Abortion Opinions, Salience, and Vote Choice

Figure 5–2 Relationship between Abortion Opinion and Vote Choice, Controlling for Issue Salience (line chart)



Conclusion

No causal statement can be made as a zero-order relationship

- This will get more complicated in multiple regression
- Fortunately, computers do the heavy lifting for us.

Get comfortable making these types of controlled comparisons within a simple three-variable context.

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