POLS2044 WEEK 6
Descriptive inference and descriptive statistics

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In Week 6 of POLS2044 we will be focusing on descriptive inference and descriptive statistics. Descriptive inference is what we do when we try and answer "what" questions. What happened in the 2022 election campaign period? What do we mean when we talk about "democracy"? This discussion builds on the concepts and measurement discussion from Week 4. These sorts of questions are related to the "why" questions we ask when we focus on causal descriptions, but as Gerring (2012) stresses they can often involve different challenges and opportunities.

I. Reading notes and questions

Even though you are likely to have multiple assignments due in Week 6, I would encourage you to spend the time (strategically and purposively) reading through these articles. Why? Gerring (2012) should give you ideas about how description is distinct from but interrelated with causal inference. This should prove helpful when thinking how your qualitative evidence connects to your causal theory. The second two pieces are quite short, and they highlight something people have probably heard about (big data) but have probably not thought much about how it can help us learn about the parts of the political world that we care about.

I advise reading the articles in the order that they are listed on Wattle and below.

Gerring, John. 2012. "Mere Description." ***British Journal of Political Science*** **32: 1–26.**

Gerring (2012) makes clear that description has played second fiddle to causal inference. Indeed, this has been the case in this class so far. Gerring (2012) begins with a section on defining "description."

1. How is a descriptive argument different to a causal argument?
2. Why does he think it is important to ask both *why* and *what* questions?

The taxonomy section is a bit dense, and I find it hard to follow. What I think is more important to take away from this discussion is how different types of description vary by whether they are trying to (1) generalize, (2) focus on one indicator, or (3) explore multiple descriptive dimensions or categories.

Figure 4 suggests that political science mentions "causality" and causal processes more than natural sciences or other social sciences.

3. Do you think this is a problem? Why, or why not?
4. Why do you think that descriptive measurement has taken a back seat to causality in recent years?

Gerring (2012: 735) says that “all descriptive analysis involves the twin goals of conceptualization and measurement.” He then goes on to talk about the importance of falsifiability in these goals. Conceptualization, measurement, and falsifiability are all topics we have discussed in previous weeks.

5. Can you think of an important political phenomenon (that is not democracy), briefly conceptualize it and find one measurement of it?
6. Gerring (2012) writes that the challenge with description is that there are often multiple perspectives when trying to answer the question “What is that?” Why does this subjectivity make falsification so hard?

Monroe, Burt L., Jennifer Pan, Margaret E. Roberts, Maya Sen, and Betsy Sinclair. 2015. “No! Formal Theory, Causal Inference, and Big Data Are Not Contradictory Trends in Political Science.” *PS: Political Science and Politics* 48(1): 71-74.

7. In what ways can data be “big”?
8. How do the authors suggest that big data can be used inductively as the source of potential theories and hypotheses?
9. How do the authors think that big data can help uncover behaviour that was hard to view before?

Grimmer, Justin. 2015. “We Are All Social Scientists Now: How Big Data, Machine Learning, and Causal Inference Work Together.” PS: Political Science and Politics 48(1): 80-83.

Grimmer (2015) continues the big data discussion by also claiming that big data can be useful for descriptive inference.

10. What is “matching” and why might big data make it easier to do?
11. Why does the author believe that social scientists are at least as important to big data analysis as computer scientists?

II.I. LECTURE PART 1: Introduction

Recapping the last few weeks

Week 1: Scientific method
Week 2: Causal theorising
Week 3: Qualitative research approaches
Week 4: Concepts and measurement
Week 5: Surveys and sampling

Learning outcomes

Overview of the course’s learning outcomes

Where we are headed

$Y = \alpha + \beta X + \epsilon + \varepsilon$

There is often an easier map to quantitative analysis than qualitative analysis.

The basic regression equation

$$Y = \alpha + \beta X + \epsilon + \varepsilon$$

Where:

Y is the outcome you are trying to explain.
X is the main explanatory variable.
(alpha) is the intercept.
(beta) is the estimated relationship between X and Y.
is the systematic error.
is the random error.

We will be coming back to this equation in a few weeks, but first we need to start by learning about our main cause (X) and outcome (Y) variables.

Today's motivating questions

What can descriptive inference tell us that causal inference cannot?
What are the basic descriptive statistics?

Motivating puzzle

Political scientists spend much more time thinking about causal inference and data analysis than they think about conceptualising and describing their causes (X's) and outcomes (Y's).

However, the former is of limited utility without the latter.

LECTURE PART 2: Descriptive inference

Continuing from our measurement week

Most people use real-world data without thinking about how they are generated and whether they capture what they think they do.

Moving from theory to test

Adcock & Collier (2001: 531) conceptualization and measurement levels and tasks

Defining descriptive arguments

> “A descriptive argument describes some aspect of the world.
>
> In doing so it aims to answer what questions (e.g. when, whom, out of what, in what manner) about a phenomenon or a set of phenomena.”
> (Gerring 2012: 722, emphasis added)

```
Independent variable (a concept) ------------Causal theory------- > Outcome (also a concept)
|                                                                                         |
|                                                                                         |
|                                                                                         |
Operationalisation                                                       Operationalisation
|                                                                                         |
|                                                                                         |
|                                                                                         |
Measured proxy------------------------------- Hypothesis -------->Measured dependent variable
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Anyone notice Gerring’s (2012) description of description?

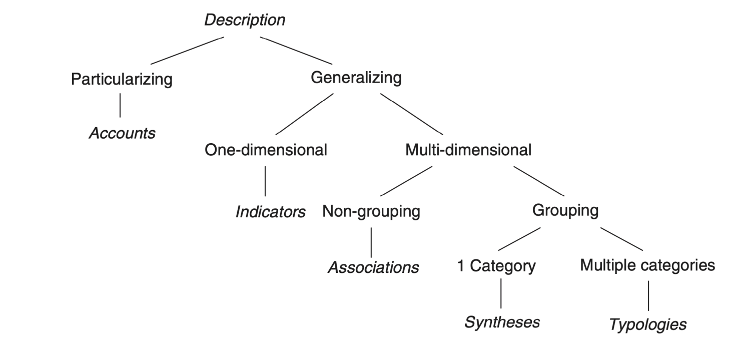


Fig. 1. Taxonomy of descriptive arguments

Gerring’s (2012) taxonomy of descriptive arguments

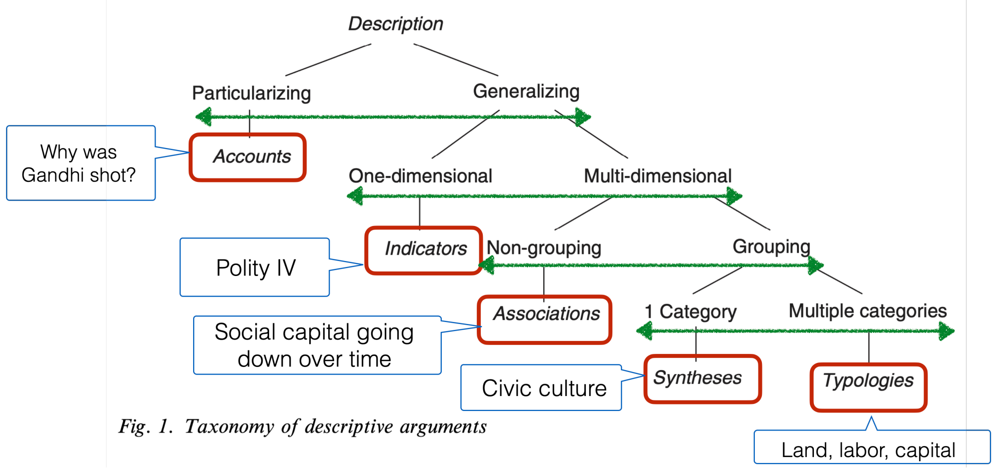


Fig. 1. Taxonomy of descriptive arguments

Description and causal inference

As Gerring (2012) makes clear, most current political science research focuses on causal inference rather than description.
However, description and causality are intimately related and can often overlap.
First, we need to understand the *what* before we can ask *why.*

That is not to say it is not important or influential.

Example of Cullen Hendrix's most cited article on measuring state capacity in JPR

Comparing causal focus across fields

Graph from Gerring (2012: 731)

Are political science topics just different?

The challenges of description

Concepts—Economic output, population, democracy
Measurement—GDP, Polity, V-Dem
Why is falsifying descriptive arguments so hard?
Describing a concept: What is democracy and how should we measure it?
Causal argument: Does democracy increase the chance of victory in war?

Why is description so hard?

"A description of even the smallest slice of reality can never be exhaustive."
(Max Weber 1905, quoted in Gerring 2012: 738)

"Any phenomenon of significance to social science is likely to call up multiple words, and multiple definitions of those words."
(Gerring 2012: 738).
"To describe something is to assert its ultimate value,"
(Gerring 2012: 740)
Therefore, descriptions include an inherent subjectivity.

Map of the highest mountain on earth with three names

A 5-minute video about perspective and memory Source: https://youtu.be/xg5y6Ao7VE4

Problematising memory

"Remembrance of things past is not necessarily the remembrance of things as they were."
Marcel Proust. 1922. *In Search of Lost Time: Swann's Way.*

One way of addressing descriptive uncertainty is through robustness checks

We will come back to these techniques in a few weeks.

Most of what we care about are latent concepts

How do we measure latent, unobservable, unmeasurable constructs?
Democracy; Corruption; Conflict; Development; Skill

Is "big data" the answer?

What is "big data"?
There is no one definition with a clear threshold for inclusion.
One way to think about big data is that its high scores in the "3Vs": Volume, Velocity, and Variety.

The 1939-44 Harvard Mark I took between three and six seconds to add two numbers using punch cards and paper tape. Stata 17 on my laptop can accept over 2 billion observations and 5,000 variables.

LECTURE PART 3: Descriptive statistics

Let us get to know our data.

Now that we have some ways of describing our topic, let us look at a few ways that we can measure it.

Remember that we should keep in mind **how the data were generated** so as to not try and take away more than we should from the data.

Google Ngram Viewer graph of "Data is" vs "data are"

Measurement metrics

Label: Employment status of survey respondent

Values: "employed" or "unemployed"

Variable type:
(1) categorical/nominal [unemployed, employed]
(2) ordinal [<5 hours, 5-15 hours, 15-35, >35 hours worked per week]
(3) continuous/interval/ratio [time worked last week]

Categorical variables

We can put cases into categories based on their values, but we cannot **rank** or order them.

A categorical (and count/continuous) variable example

Magpie swooping attack percentages across Australia by state in 2022

Ordinal variables

Variables for which cases have values where we can make universal ranking distinctions.

If we treat an ordinal variable like a categorical variable, we are acting as if we have less information than we really do.

Two examples include rating Domino's ordering experience and age groups

Continuous variables

Sometimes called interval variables or ratio variables (if they have a meaningful 0). They have equal unit differences.

Example of elevation and sea level

Describing categorical variables

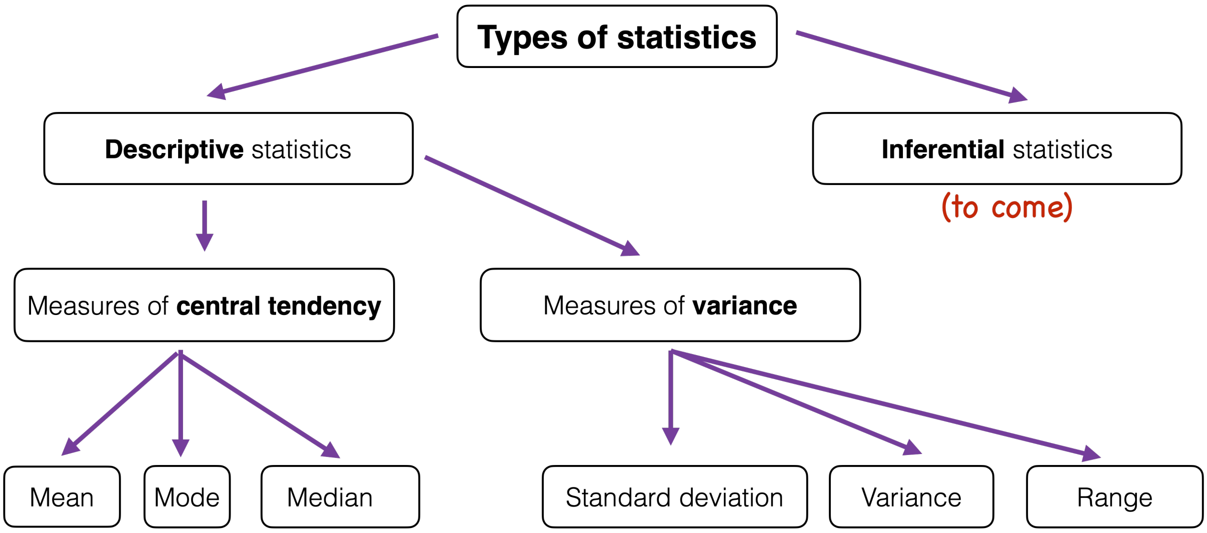
Usually, we focus on the frequency distribution of categorical variables with a table, pie charts, or bar graphs.
The only central tendency statistic is the mode (the most frequent value).
Quantiles (including percentiles) are also used. They are a measure of position within a distribution.

Example of quantiles/percentiles is the (originally named) Standard Aptitude Test (SAT), created in 1926.

Describing continuous variables

We are primarily interested in the central tendency and the distribution of values around this central tendency.
We are also interested in outliers.
The midpoint value is the median.
The average value is the mean.
The dispersion around the mean is described by the standard deviation.

My way of thinking about types of statistics



Finding the mean

Mean= sum of observations / number of observations

Standard deviation

This is basically a way of telling the reader how the data are scattered around the average value.

A sample's standard deviation (*sd*) is given by the square root of the variance (the average distance away from the average value over the number of observations minus one (the degree of freedom, more on that later).

Or more concretely:

$$sd = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n - 1}}$$

Where:
 is your variable's mean.
 is an individual value.
n is the sample size.

The normal distribution

With only the mean and standard deviation we can tell a lot about our observations if they approximate the normal distribution, which is at the heart of probability theory.

A descriptive distribution example (magpie swooping)

The normal (Gaussian) distribution example

Height values together form something close to a normal distribution

Outliers definitely happen.

Example of a person struck by lightening seven times.

An example of descriptive statistics and graphing in Excel

Using a graduate outcomes survey from 2021

https://www.qilt.edu.au/surveys/graduate-outcomes-survey-(gos)

III. WEEK 6 TUTORIALS

In this week's tutorial, we will be discussing the strengths and weaknesses of descriptive inference when applied to a particular concept, giving our Microsoft Excel analytical superpowers, and taking our first steps in generating descriptive statistics.

PART 1: Descriptive inference (as a tutorial)

1. Choose one of the following phenomena: "corruption", "democracy", or "urban population".

2. Describe the most important characteristics of an outcome either. When doing so, think about the following questions:

   a. What is the level of analysis of your descriptive argument?
   b. What actors or institutions are included in your description?
   c. What is the spatial (across space) and temporal (across time) domain considerations?

3. Can the class agree or disagree on the most important elements of your description?

4. Do you think that other tutorials would reach the exact description you have reached? Why or why not?

PART 2: Install Excel's Data Analysis ToolPak (individually)

We will be using Microsoft Excel repeatedly over the remainder of the semester. As I mentioned in the first week, almost all modern workplaces have computers with access to Microsoft Excel including through Microsoft 365. Therefore, instead of having you use a more advanced (and often quite cool) but unnecessary software like R Studio or Stata, we will be doing our data analysis in Excel. All ANU students can download Microsoft 365 including Excel if you have not downloaded it yet.[1] You can then use Excel online or on your desktop.

[1] Download information here: https://services.anu.edu.au/information-technology/software-systems/microsoft-office-365.

If you are all in on Google Sheets, there is a comparable analytics add-on for Google Sheets called XLMiner Analysis ToolPak.

Below are instructions for installing add-ons to your Excel or Google Sheets that we will be using extensively. If you have not done so yet, please install your analysis tool pack now as a group so we can all be on the same page moving forward.

Excel

Load and activate the Analysis ToolPak.[2]

1. Click the **File** tab, click **Options**, and then click the **Add-Ins** category.
2. In the **Manage** box, select **Excel Add-ins** and then click **Go**.

If you're using Excel for Mac, in the file menu go to **Tools** > **Excel Add-ins.**

3. In the **Add-Ins** box, check the **Analysis ToolPak** check box, and then click **OK**.
    a. If **Analysis ToolPak** is not listed in the **Add-Ins available** box, click **Browse** to locate it.
    b. If you are prompted that the Analysis ToolPak is not currently installed on your computer, click **Yes** to install it.

If needed, here is a video introduction to installing Analysis ToolPak on a PC. https://youtu.be/V60-IFnih3Q .

Google Sheets

1. Open a blank spreadsheet.
2. Click the **Extensions** tab, click **Add-ons**, click **Get Add-ons**.
3. In the Search apps box, type **XLMiner Analysis ToolPak**.
4. Click on the relevant result (downloaded almost 3 million times).
5. Click **Install**.

PART 3: Descriptive statistics (divide into working groups of ~3 students)

Using the methods I demonstrated in lecture this week, find and report descriptive statistics (mean, median, mode, standard deviation, minimum, and maximum) for one of the following variables listed below using the Analysis TookPak in Excel or Google Sheets. It is up to your group which dataset you chose to analyse. All datasets are in a folder in Wattle/Week

[2] Steps taken from at https://support.microsoft.com/en-us/office/load-the-analysis-toolpak-in-excel-6a63e598-cd6d-42e3-9317-6b40ba1a66b4

6/Tutorial. These are data excerpted from much larger and more complex datasets so as to make them a bit more manageable to work with. The focus here is on practicing basic descriptive analysis using real data.

If you need help with the process, Echo360 will have a recorded version of my Week 6 lecture hands on with the Analysis ToolPak.

Table 1. Dataset choices

Dataset	Source	Description	Variable to analyse
cpi_2021	Transparency International	Annual corruption score	CPI score 2021
Polity_2018	Polity IV Project	Annual democracy score	polity2
nyc_squirrels	https://www.thesquirrelcensus.com/	A 2020 census	squirrel_number

Paste your completed version of the following table in the Wattle tutorial.

Table 2. Summary statistics and interpretation

Variable name	Mean	Median	Mode	Standard deviation	Minimum	Maximum
Below describe any descriptive findings you find particularly interesting about the distribution of your variable. *Any substantive descriptive conclusions you can reach given these descriptive statistics?*						