

Chapter 1: Thinking Like a Scientist

Demonstration and/or Discussion Topic: The Gambler's Fallacy

Relevant Learning Objectives: 1

Estimated In-Class Time: 5–10 minutes, depending on length of discussion

Class Size: any

Class Format: any

Another way to illustrate the limitations of intuition is to discuss the gamblers fallacy. Ask students to imagine if they were in Vegas and played a slot machine 25 times with no payout. Compared to that first play, is there a greater probability that the next play will pay out? Or if one flips a coin 20 times and gets heads each time, is one more likely to get tails on the next trial? Even though students may understand probability intellectually, intuition can drive people to state “Yes, it is more likely!” That ignores that each trial is independent and not dependent on the results of prior trials.

Turn these questions into a demonstration. If you use a personal response system (e.g., Polling on Connect), you can record students' responses to these questions to show the prevalence of people's reliance on intuition. If you collect anonymous responses, you can also add a discussion of the effects of anonymity on participant responses. You can also talk about potential differences between how participants respond while imagining a scenario versus what people would actually do in the moment.

Demonstration: Using the False Consensus Effect to Demonstrate Importance of Systematic Observation

Relevant Learning Objectives: 1, 3

Estimated In-Class Time: 30 minutes or more with a large class and when students calculate data; 10 minutes data is collected in class, but you calculate results at home and present the results next class

Class Size: any

Class Format: any

The following demonstration, based on the false consensus effect, emphasizes the need for systematic rather than casual observation. To begin, consider the false consensus effect, a classic phenomenon from social psychology. We often believe that others are more like ourselves than they really are. Thus, our predictions about others' beliefs or behaviours, based on casual observation, are likely to err in the direction of our own beliefs or behaviour. For example, college students who preferred brown bread estimated that over 50% of all other college students

preferred brown bread, whereas white-bread eaters estimated more accurately that 37% showed brown bread preference (Ross, Greene, & House, 1977). This is known as the false consensus effect (Ross et al., 1977; Mullen, Atkins, Champion, Edwards, Hardy, Story, & Vanderlok, 1985).

Before describing the false consensus effect, have students answer the questions listed below. Program these questions into Google Sheets, Qualtrics, Survey Monkey, or your choice of survey software. You may also choose to include questions of greater psychological interest (e.g., Rate your political affiliation on a 7-point scale from Left to Right; To what extent do you agree with the idea that all people are redeemable, even the worst criminals; etc.). Next, have students predict the class mean for each question. According to the false consensus effect, students' predictions about the class mean should be influenced by their own positions. Consequently, a student whose position is below the class mean is likely to make a prediction that will be below the class mean as well.

To demonstrate the effect statistically, compute the actual class mean for each question using the students' personal data. Next, score each response in the following way: For each question, score a +1 if the participant's personal answer and predicted class mean are either both below or both above the actual class mean; score a -1 if the participant's personal score and predicted class mean are on opposite sides of the actual class mean. Sum all six questions so that each participant now has a single score that ranges between -6 and +6. If people err randomly, the average score for all students should be zero. In contrast, if people err in the direction of their own beliefs, the average should be greater than zero. A simple, one-group *t*-test can be calculated using $M = 0$ for the null hypothesis. (This can easily be done in your statistical software of choice, though if you'd prefer, you can present the class means and have students score themselves. This will limit some of the usability of these data, however.)

Personal Answer	Behaviour Questions	Prediction for Class
	1. How many loads of laundry do you wash per week?	
	2. How many times per year do you attend worship services at a church or temple?	
	3. How many times per week do you eat a meal from a fast-food restaurant?	
	4. How many items per week do you recycle?	
	5. How many times per year do you see a movie at a theatre?	
	6. How many times per week do you consume alcohol?	

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Demonstration: Comparing Single Observations to Multiple Observations, to Demonstrate the Unrepresentativeness of Small Samples

Relevant Learning Objectives: 1, 2

Estimated In-Class Time: 20 minutes

Class Size: 30 students. If class is larger than 30, this demonstration may need substantial modifications (e.g., use 5 small groups of students to demonstrate at the front of the class)

Class Format: In-person

The systematic observation employed by scientists generally relies on many independent instances whereas casual observation is often based on only a few instances. The following demonstration is designed to show how misleading a small sample of observations may be. Divide the class into groups of three or four students each. Fill a bowl or basket with a "population" of poker chips or simple slips of paper. On each chip or piece of paper there should be written a single score. (An approximate normal distribution of 200 numbers is provided below.) Let each score represent a value of a psychological variable (e.g., extraversion, reaction time, attention span, memory capacity, intelligence test score).

Have each group draw 5 samples from the population and compute the mean for each sample. Each group, however, should draw samples of a different size from the other groups. For instance, group one draws 5 samples of size 1, group two draws 5 samples of size 3, group three draws 5 samples of size 5, and so on. The rate of progression from small to large samples depends on the number of groups. It is a good idea to have the last group draw fairly large size samples (e.g., $N=20$ or 25). Once the means for each sample are computed, have each group plot the means on a graph on the board. It should be obvious that with small samples we can easily get a distorted picture of the population mean. Note how the variability from sample mean to sample mean decreases dramatically as we increase the sample size. Discuss how many of our casual observations are based on relatively few observations.

The following population of 200 scores yields a population mean of 17 and a standard deviation of 4.66.

X	frequenc y	X	frequenc y	X	frequenc y	X	frequenc y	X	frequenc y
5	1	11	7	17	20	23	7	29	1
6	2	12	9	18	18	24	5		
7	2	13	10	19	16	25	4		
8	3	14	13	20	13	26	3		
9	4	15	16	21	10	27	2		
10	5	16	18	22	9	28	2		

Discussion Topic: Failing to Use Scientific Skepticism

Relevant Learning Objectives: 1, 2

Estimated In-Class Time: 5-20 minutes, depending on length of discussion

Class Size: any

Offer students the opportunity to reflect on times that they might have allowed themselves to accept beliefs or engage in practices that they would not have if they had engaged in scientific skepticism. For example, it can be easy to fall for claims circulated by social media that could be hoaxes or rumours, or to believe the claims of salespeople. Conclude the discussion by brainstorming ways to investigate whether claims are valid (e.g., www.snopes.com), and how to detect pseudoscience (e.g., www.randi.org). (Examples: fake news headlines; social media posts that link to articles but misrepresent them; TikTok trends or “hacks” that do not actually work; pseudoscience and “pseudo-profound bullshit” like astrology, crystal healing, homeopathy, etc.)

Admitting we've erred is difficult for many people. To make this discussion less threatening, consider sharing a time when you failed to use your scientific skepticism, or invite people to discuss the judgments of people they know.

Chapter 1: Sample Answers for Selected Questions in the Text

Deepen Your Understanding Questions

1. Read several blog posts or editorials in a local newspaper and identify the sources used to support the assertions and conclusions. Did the writer use intuition, appeals to authority, scientific evidence, or a combination of these? Give specific examples.

A good response to this should specifically identify what distinguishes the scientific evidence from lay or heuristic evidence.

4. A newspaper headline says that "Obesity is More Common Outside Major Cities." You read the article to discover that a researcher found that the rates of obesity are lower in cities like Vancouver, Toronto, and Montreal than in less urban centres across the country. Based on this information, is it appropriate to infer cause and effect and explanations of behaviour? Why or why not? Come back to this question after you have read the next few chapters. For more information, see Vanasse, A., Demers, M., Hemiari, A., & Courteau, J. (2006). Obesity in Canada: Where and how many? *International Journal of Obesity*, 30, 677-683.

There are three elements to consider when looking at cause and effect. First, is a need to ask about temporal precedence: did living in a major city precede obesity? Second, is a need to look at covariation of cause and effect: do people in major cities experience obesity more than do people in small cities and towns? Third, one would want to eliminate alternative explanations: could something besides city life be responsible for the higher incidence of obesity in major cities?