THINKING CRITICALLY – WORKSHEET 1
"RELIABLE" SOURCES, EVIDENCE, PROOF, AND KNOWLEDGE

READ: We want our sources of information to be "reliable". This applies to all our sources, for any information, in general. But we can use an example to motivate how to do it.

Part I: Who Dunnit? – Work in groups to answer the following questions on a whiteboard. Be prepared to support your answers with the rest of the class.

You're a rookie detective and arrive on a crime scene with two people involved: person D is dead, person A is alive and claims self defense. Your only evidence in this made-up scenario is witness testimony.

1. Answer the following questions to help brainstorm a list of qualities you'd <u>want</u> your witness testimony (sources of information) to have, which would make the testimony "reliable".
   a. Do you want your witness to be biased – to have a view or motivation that could make them either lie, or misinterpret what they remember happening? Can you <u>always</u> tell if they're biased?

   b. Do you want your witness's testimony to make internal sense? For example, if you interview them on two separate days, do you want both accounts to stay consistent or to change with time?

   c. Do you hope your witness really did witness it or just hear about it from someone else? Do you want your witness to see what happened or just hear it happen when they weren't looking?

   d. Do you want to have just one witness or multiple witnesses?

   e. If you have multiple witnesses, would you want them to generally agree or generally disagree on what happened? Note: eyewitnesses are never completely accurate/consistent in the real world.

   f. Would you prefer all your witnesses spoke with each other before talking to you or that their testimonies were independent of each other?

WRITE THESE DOWN ON A WHITEBOARD AND PREPARE TO DISCUSS THEM AS A CLASS

2. Together in groups, answer the related questions for each of those above but to figure out what qualities you'd want in sources of information you find on the Internet about some claim that might be true or false (e.g. soft margarine is "healthier" for the typical person than soft butter). Don't pick a specific claim; just imagine a generic statement you want to know is true or false.
   a. Do you want your sources to be biased? What could you look for to tell if a source is likely biased or not?

   b. Do you want your sources to make internal sense, to be internally consistent? To be sure they are internally consistent, do you want them to explain their conclusion, backing their argument up with references, or just state their conclusion, without supporting info?

   c. Do you hope, ideally, that your sources are primary sources or secondary sources, or do you want both? Look up these terms if you are not sure what they mean.

   d. Do you want, ideally, to have just one source or multiple sources reporting on the same claim?

   e. If you have multiple sources, would you want them to generally agree or generally disagree about whether the claim is true or false?

   f. Would you prefer all your sources copied each other, or that they presented independent analyses of the evidence for and against the claim?

3. In groups: By default, we all tend to stop looking when we think we have the answer, which is sometimes just the first source we find, other times it's when we confirm what we thought was true beforehand (this is called confirmation bias). What is a strategy you could use to help overcome this tendency?

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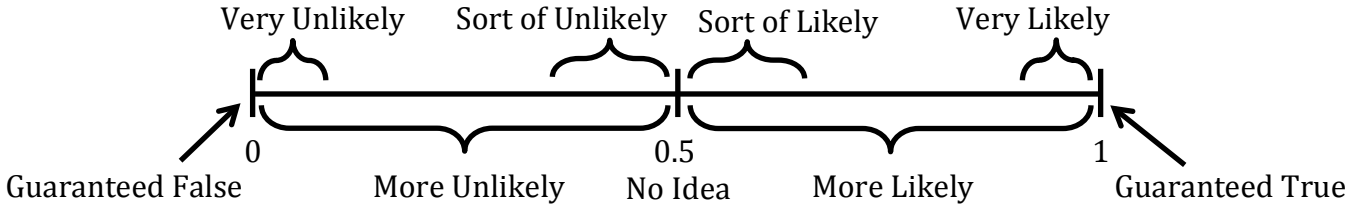
4. In groups:
    a. If you think you have a reliable source, is there any possibility the information from that source is wrong? (A rephrasing of "a") In other words, if you actually had all of these the qualities from question (2) in your sources of info and you used your strategy you came up with from question (3) to find them, does that guarantee your info is correct or is there some possibility it is still wrong?

    b. If it doesn't guarantee correctness, why even try to find reliable sources?

    c. With all this in mind, is it better to say some source is "reliable" or to qualify it by saying it is "pretty reliable", "highly reliable", etc.? Is it misleading to just say a source is "reliable"?

5. Think of a spectrum: a number line ranging from 0 to 1 like the one shown below. Let this number line represent how likely you think some claim is to be true or false.



If you rate some claim at a 0, you think it is guaranteed false. If you rate it at a 1, you think it is guaranteed true. If you rate it at a 0.5, you have absolutely no idea if it's true or false (and so on: see above).

a. If I flip a coin, look at the result and cover it up so you can't see, roughly how certain should you be about which side is facing up, based on the spectrum above?

b. In the coin flip scenario, where I flipped the coin and looked, roughly how certain should I be about which side is facing up, based on the spectrum above?

c. How likely should you rate the claim that the Earth is roughly a sphere (not flat)?

d. How likely should you rate the claim that it is impossible to have a square circle?

e. Based on what's been covered, what should we keep in mind when someone says a source is "reliable" or "highly reliable" when that source says some claim is true or false.

WRITE ANSWERS TO 4 AND 5 ON A WHITEBOARD AND PREPARE TO DISCUSS WITH THE CLASS

6. Suppose you have two conflicting pieces of evidence, from the original scenario in question 1 (person D is dead, person A is alive):
    a. An eyewitness "swears" person A defended themselves, and
    b. A recording from a nearby security camera showing person A was the attacker.

   Which is more reliable? Is either absolutely foolproof? How can you tell which conclusion is more likely?

7. When someone demands that you provide "proof" that some claim is true, what should you really be striving for? (Leading questions: Is proof ever absolute? How can we think of the word "proof" so that a bunch of good evidence for some claim can be considered proof?)

WRITE ANSWERS TO 6 AND 7 ON A WHITEBOARD AND PREPARE TO DISCUSS WITH THE CLASS

Part II: Finding Those Sources

Now you have a general tactic, but sometimes finding the information is the hard part. Let's assume you're using the Internet. If you want printed sources, you can find which one(s) you want on the Internet, first.

8. Compile a list of Google search tips and techniques you could use to find whatever you're looking for more quickly and efficiently. (If you don't use Google for your search engine, look for equivalent information for the one you prefer.) Use your general tactic from the last Part of this activity to help find the most effective, most reliable, and as many as you can of the possible Google search tips/techniques. (Do the work to make sure these are good and useful tricks.)

9. Let's put your Google skills along with your newfound method of finding reliable source to the test.
    a. Suppose your favorite website's search engine is really terrible. How could you use Google to search this site instead?

b. What is the current definition of a “second”, the unit measuring duration of time?

c. An object that swings back and forth is called a pendulum. What does the period of a pendulum mean?

d. What did Galileo use to measure that the period of a pendulum doesn’t depend on how widely it swings back and forth? I’m not asking what was the pendulum he used, or what he used the pendulum to measure, but what did he compare the swing period to, thinking that it gave a regular interval of time?

e. How long did it take for the current Guinness world record holder for most claps in a minute to complete just one of those claps, on average, during his championship clap session? (This involves a little math.)

f. What is the running time of the movie Batman v. Superman: Dawn of Justice (2016)? (Use hours and minutes, not seconds.)

g. Is dihydrogen monoxide relatively safe to ingest?

h. Is the Pacific Northwest Tree Octopus really endangered?

Part III: What Science Cares About – The Scope of Science

We are concerned with knowing what is true or not about the natural universe – not matters of pure opinion. Understanding the difference is important. Most people are pretty good with this. Whether the Earth is flat is a matter of objective fact. What the "best" color is, is a matter of opinion. Value judgments, assigning value to something, is inherently subjective (it can vary from person to person).

10. To "know" what's true or not assumes a good working definition of "knowledge" and nobody honestly says they "know" something if they don't believe it. So we also need a good working definition of "belief". Use the skills you learned throughout all the previous parts to find a good, foundational definition of "belief" and "knowledge". Look at multiple independent sources and be sure they make sense. We want these to be as simple as possible (but not simpler), general, and free from emotional baggage. Start by listing multiple (maybe 5 or more) different definitions of knowledge from different sources, then compare and contrast them to argue which one is best.

11. Once we've agreed upon a definition of knowledge, use this concept to come up with a good definition of a "fact". (Help: does a fact have to have absolutely everyone agreeing with it to be a legitimate fact? Is there such thing as a fact nobody ever supported with really, really good evidence, or argument, or conclusive demonstration?)