Transcript: Philosophy VIDEO 1.7 – Disconfirmation: Ravens, Ravens, Ravens!

Let's shift gears. Why are we here? If you have learned anything from the past several videos, I'll bet it's this. Questioning is confusing. A bit of a mess, really. Interesting, if you like a good mess, but what's it good for?

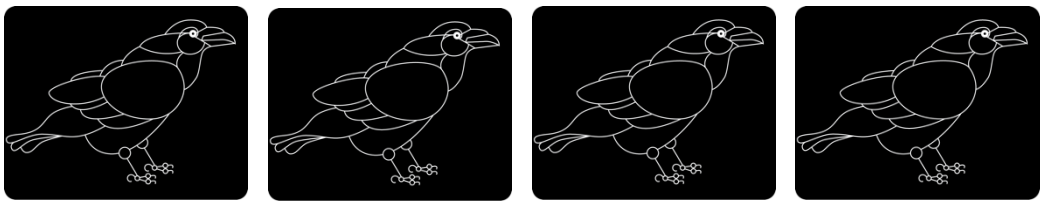
How can giving ourselves a headache about Q serve as a foundation for our educations, in any practical, or even theoretical sense?

Let me give you some baby philosophy of science. That is, over-simplified, and not the very latest high-end stuff. But you've gotta crawl before you can walk. And I think if we crawl for a bit we might see why sorting out the nature of questioning, even if it's a bit of a mess, can be interesting and even practical.

In the last two videos I talk a bit about Francis Bacon, famous philosopher of science. I mentioned, although maybe you've forgotten—and that's ok—that he worked out a very innovative logic of induction.

What's induction?

Well, suppose you see one black raven, then another black raven, then another black raven, then another black raven. Are you starting to see a pattern here?



That's right: all ravens are black!

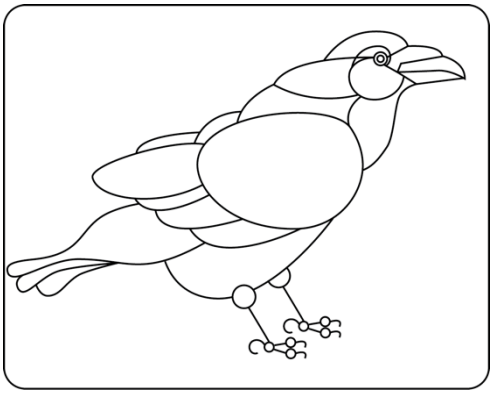
As a pattern for how induction works in science goes, that's way too simple. But the general idea is that natural science is based on starting with particular observations and somehow, rationally, proceeding to warranted generalizations. Induction is obviously different from deduction.

Deduction. What's that. I'll bet you know. But I'll tell you anyway:

P1 All ravens are black.
P2 Edgar is a raven.
C Edgar is black.

Stuff like that—and it does get way more complicated—is deduction. Logic.

Obviously one of the tricky parts of induction is that you never really know that tomorrow the sun won't rise on an albino raven.



In fact—fun fact—in the real world, 1 in a million ravens is albino. White. So, strictly, all ravens are black isn't true. Again, it's complicated. But it's pretty intuitive that science involves both induction and deduction, and it's tricky to say how induction works—what with all that uncertainty about white ravens—and it's tricky as well to say how it interlocks with the deductive stuff.

Bacon hardly gave us the last word on all this, but he is remembered for having thought about it real hard. He thought the key was: knowing what questions you have to ask. Putting Nature to the question, remember.

Now, let's skip forward to the 20th Century. A famous 20th Century philosopher of science was Carl Hempel, who co-wrote a famous paper with another philosopher named Paul Oppenheim. Their paper, published in 1948, was called "Studies in the Logic of Explanation".

Let me read you the opening paragraph.

> To explain the phenomena in the world of our experience, to answer the question "why?" rather than only the question "what?", is one of the foremost objectives of all rational inquiry; and especially, scientific research in its various branches strives to go beyond a mere description of its subject matter by providing an explanation of the phenomena it investigates.

The essay then promises to shed light on this "by means of an elementary survey of the basic pattern of scientific explanation" and to offer "a more rigorous analysis of the concept of law and of the logical structure of explanatory arguments."

Let me give you a real simple summary of their idea, even though it's actually very complicated, as you might guess from the name: the Deductive-Nomological Model. I'll start by simplifying that. Let's call it DN. D for deduction. I already sort of told you what deduction is. Logic. N for Nomological. Nomos is Greek for law. So DN, judging from the name, says either that scientific explanation is a method for deducing laws, or a method of deducing things from laws. That second the right one.

The Deductive-Nomological model claims that scientific explanations are deductions from laws.

For example:

All ravens are black. (Law)
Edgar is a raven. (Fact)
Edgar is black. (Fact)

Why is Edgar black? (Inquiring scientific minds want to know.)

Edgar is black because he's a raven. (Explanation)

This is a toy example. Not scientifically impressive. If, instead, I plugged in some Newtonian laws of motion, and a selection of facts about planets and a star they orbit at time T (mass, position and velocity)—and if I were more competent at physics than I actually am—I could cook up something a bit more impressively explanatory-looking.

I'm just trying to get across gist. As one philosopher put it: on this deductive-nomological view, "the essence of scientific explanation can be described as *nomic expectability*." That is, laws tell you what to *expect*. That's what explanation is in science.

There are problems with DN. No one just buys it these days—certainly not in the toy form I sketched. But let me highlight just one problem, and a possible solution to the problem. And that will carry us on to a slightly more interesting view.

Suppose your objection is this: DN turns out to be method of deducing things from laws, not so much a matter of deducing laws from things. Fair enough.

But then where do laws come from, smart guy? How do we arrive at them? What about induction?

The answer is that Hempel and Oppenheim are kind of skittish about induction, because of that whole white raven risk that I just warned you about.

Here's a way they might try to deflect the objection that they need to say where laws come from. Here's the deflection: who cares where Newton's Law comes from! That's just some biographical accident about Newton, the man. Maybe that story about the apple bonking him, and him having a *eureka*! realization about gravity is true. Probably not. Sounds like a myth.

Either way, what matters is Newtonian mechanics works. If Newton's laws hold—notice I said *if!—then* you can explain stuff using them.

To put it another way, philosophers of science distinguish the so-called logic of discovery from the logic of justification and the logic of explanation. The logic of discovery, often, isn't very logical. People mess about, find stuff, maybe have a *eureka*! moment. What's truly logical is on the other end. Once you've got it worked

out, tidied up, laid out Like Newton's Laws of Motion, *that's* when the explaining starts.

Yeah, OK, but we still want to know: where do laws come from? Why do we trust some law-like statements, not others?

Now we get to the interesting next position I promised. What if we give a real simple answer? Laws are just … hypotheses. And hypotheses are basically … guesses. Good guesses, we hope. But guesses—hence fallible. Like Newton's laws, which turned out to be strictly wrong, although it took centuries for scientists to disconfirm them, empirically.

So: we hypothesize that Newton's laws are true. That is, we guess. And, while we wait for the first experimental refutation of Newton, we use those laws to explain. If it turns out the laws are no good, then the explanations are bad, too. (If it weren't for bad explanations, some people would have no explanations at all.)

Let me say it again: laws are hypotheses and the game of science is to disconfirm them. To try to show they are false.

I make a guess: all ravens are black.

You—because you are a scientist—run out and start looking for white ravens. That's what science is all about. People laying bets in the form of general claims, and other people trying to turn those bets into losers.

Now, there is a lot to be said for this view, which is especially associated with a philosopher of science named Karl Popper, who was a contemporary of Hempel. Mid-20th century. I'm going to say more later about what is good about Popper's view of science as disconfirmation. But for now, I'll restrict myself to saying something negative.

It's kind of weird to model science as a guessing game.

It's kind of like the problem I pointed out in the second video, where I said it's funny to think of Questioning as a Pillar. Questioning seems mostly like a demolition technique. Demolition is an important part of the construction industry. But we don't think of dynamite as good foundation material. Similarly, Popper is surely right that science is self-critical, that's its core. All the same, there is a certain risk that we will describe science only as a kind of auto-immune system for attacking itself. That doesn't really seem to explain the positive side of science.

To put it another way: maybe it's easier to make the negative side of science—the knocking-down side—rigorous. But science is also the other side. What's that?

Here's a funny fact. I quoted the opening paragraph of that Hempel/Oppenheim paper. It's all about questions. Why and What? But the paper itself doesn't really talk about that. This sort of makes sense: asking why and what? May be more on the

discovery side of the story. We ask why before we know. Then, when we know, we can explain. Hempel and Oppenheim seem to focus only on the explanation side—the thing you can do after you answer why? But that still leaves the why itself—the role of questions—underexplored. And maybe the same goes for Popper.

Let me skip to the chase. Here's a quote from yet another philosopher of science, Sylvain Bromberger. I wouldn't call him famous, but he's highly respectable. Professor at MIT. It's from the introduction to a book of his *On What We Know We Don't Know* (1992). Very Socratic title.

> We find ourselves, as individuals and as communities willy-nilly cast in a world not of our making, in which we want to survive, if possible to thrive, and whose features we want to understand. We start out with little prior information about that world, but we are endowed with the ability to come to know that there are things about it that we don't know, that is, with the ability to formulate and to entertain questions whose answers we know we do not know. It is an enormously complex ability derived from many auxiliary abilities. And it induces the wish to know the answer to some of these questions. Scientific research represents our most reasonable and responsible way of trying to satisfy that wish. That is its most tenable defining goal, and not, as others have held …

OK, at this point allow me to break in. Bromberger lists a bunch of philosophies of science, including Bacon's, and Hempel's, and Popper's, which he doesn't agree with. I'll skip that list and proceed to the solution, according to Bromberger.

> However, in seeking its goal science repeatedly runs into difficulties. Many of these difficulties are physical in nature and call for the design of new and more powerful instruments. Others are psychological and call for the invention of devices that supplement our memory and our computational powers. Still others, and those are the ones that are relevant here, are intellectual and pertain to our ability to conceive, formulate, consider, connect, and assess questions, and to our ability to conceive, formulate, consider, connect and assess answers. These sorts of difficulties often call for inspiration and creative intelligence. Careful observation and description are not enough.

In short, unless we understand how questions work, we can't understand what science is.

So that's kind of a big deal. I'm not saying Bromberger is definitely right. But I think he's right that the mess that is questioning is worth cleaning up if we want to figure out how things work around this place—the university. How does all the negative rigor of science interlock with the positive need for inspiration and creative intelligence. Good question, that. And a good place to end this video.