Philosophy 203: History of Modern Western Philosophy Hamilton College
Spring 2012 Russell Marcus

Class #21 - Causation and Induction
David Hume, *An Enquiry Concerning Human Understanding*, §V - §VII (AW 548-564)

I. Laws of Nature

Let's return to claims P1-P7.

P1. It is raining outside right now.
P2. It snowed in February.
P3. Shakespeare wrote *The Tragedy of Macbeth*.
P4. 2 + 2 = 4.
P5. I exist.
P6. Objects near the surface of the Earth accelerate toward the center of the Earth at 9.8 m/s^2.
P7. The sun will rise tomorrow.

P1-P3 state what Hume calls matters of fact.
He claims that such assertions can be traced back to original impressions, and for these three propositions, Hume's claim seems plausible.
The tracing turns out to be trickier than Hume thought, though.
The project was pursued in the 20th century by logical empiricists like Rudolph Carnap, whose *Logical Structure of the World* attempted to use contemporary logical tools to carry out Hume's project.
Nevertheless, we will not pursue worries about these claims, and accept personal experience, testimony, and at least some instances of memory as reliable evidence.
P4 states a mathematical fact, and is thus a relation of ideas.
We will grant that mathematical theorems follow from self-evident axioms using unassailable logical tools, including the principle of contradiction.
P5, our knowledge of ourselves, leads to a complication to which we shall return, in our next class.

For now, let's look at P6 and P7, and indeed L1-L3, Newton's three laws of motion.

L1: Inertia: an object in motion will remain in motion, an object at rest will remain at rest, unless acted on by an unbalanced force.
L2: The force produced by an object is equal to the product of its mass and its acceleration.
L3: For every action there is an equal and opposite reaction.

L1 - L3 refer to physical laws.
While the sun does not actually rise, we use the sentence as shorthand for lawlike claims about the rotation of the Earth on its axis.
None of these claims are relations of ideas, since their denials do not lead to a contradiction.
If the Earth had a different diameter, the acceleration due to gravity at its surface would be different.
Similarly, if the physical laws were slightly changed, gravitational force could be different.
The denial of P6 is not contradictory in any obvious way.
Similarly, 'The sun will not rise tomorrow' is possibly true.
So P7 is not a relation of ideas either.
We can not discover that denials of laws of nature are false by mere process of thought, as we can with relations of ideas.

> The course of nature may change, and...an object seemingly like those which we have experienced, may be attended with different or contrary effects. May I not clearly and distinctly conceive that a body, falling from the clouds, and which in all other respects resembles snow, has yet the taste of salt or feeling of fire? Is there any more intelligible proposition than to affirm that all the trees will flourish in December and January and decay in May and June? Now, whatever is intelligible and can be distinctly conceived implies no contradiction and can never be proved false by any demonstrative argument or abstract reasoning *a priori* (*Enquiry*, §IV.2, AW 546a-b).

Thus it seems difficult to defend any claims about the laws of nature.
We do not have any experience of the future, so they can not be confirmed by experience.
If they are matters of fact, they have to be traceable back to original sense impressions.
But, when they pronounce on future events, we go beyond our experiences of the past, inductively, and project into the future.
Those claims about the future are unfounded.
We thus can have no knowledge of claims like P6 and P7.

II. Cause and Effect

Scientific laws are generally taken to describe the causal structure of the universe.
But we have no sense impressions of many terms used, including 'gravity', 'force', 'mass', and 'energy'.
We have experience only of events, not their causes.

> The effect is totally different from the cause, and consequently can never be discovered in it. Motion in the second billiard ball is a quite distinct event from motion in the first, nor is there anything in the one to suggest the smallest hint of the other. A stone or piece of metal raised into the air and left without any support immediately falls. But to consider the matter *a priori*, is there anything we discover in this situation which can beget the idea of a downward rather than an upward or any other motion in the stone or metal?...When I see, for instance, a billiard ball moving in a straight line towards another, even suppose motion in the second ball should by accident be suggested to me as the result of their contact or impulse, may I not conceive that a hundred different events might as well follow from that cause? May not the first ball return in a straight line or leap off from the second in any line or direction? All these suppositions are consistent and conceivable (*Enquiry*, §IV.1, AW 543b-544a).

Hume asks us to consider our inability to know the properties of novel objects, like the cohesion of marble.
The secret powers, the connections between events, are hidden from us.

> Let an object be presented to a man of ever so strong natural reason and abilities; if that object is entirely new to him, he will not be able, by the most accurate examination of its sensible qualities, to discover any of its causes or effects. Adam, though his rational faculties are supposed entirely perfect at the very first, could not have inferred from the fluidity and transparency of water that it would suffocate him, or from the light and warmth of fire that it would consume him (*Enquiry*, §IV.1, AW 543a).

When we perform inductions and pronounce on the laws connecting events, we go beyond the evidence of our experience.
We pretend that we see connections among events,

But, in fact, all we ever see are conjunctions.

> We only learn by experience the frequent conjunction of objects, without being ever able to comprehend anything like connection between them (*Enquiry*, §VII.1, AW 560b).

All our beliefs about the world are based on experience.
Experience only tells us what was or is, not what has to be.
This follows from the fact that we have no access to the causes.
Laws of nature reduce disparate phenomena to simple statements.
But such reductions require insight into the causal structure of the world, which we can not get from sense experience.
Thus we can not establish the truth of laws of nature, despite our best efforts.

> The utmost effort of human reason is to reduce the principles productive of natural phenomena to a greater simplicity and to resolve the many particular effects into a few general causes by means of reasonings from analogy, experience, and observation. But as to the causes of these general causes, we should in vain attempt their discovery, nor shall we ever be able to satisfy ourselves by any particular explication of them. These ultimate springs and principles are totally shut up from human curiosity and inquiry...Thus the observation of human blindness and weakness is the result of all philosophy and meets us at every turn in spite of our endeavors to elude or avoid it (*Enquiry*, §IV.1, AW 544a-b).

We have no knowledge of both particular and general claims about laws of nature.
We do not know Newton's laws.
We do not know that the sun will rise tomorrow.
The problem is not that there might be a big explosion.
Such an event would be consistent with physical laws.
The problem is that the laws could suddenly shift from what we think they are.

III. The Problem of Induction

Our inability to know physical laws is generally known as the problem of induction.
Induction is how you know about unobserved phenomena, including predictions about the future.
One challenge lies in how to determine when causes are similar.
How do we get knowledge of the unobserved?

Hume argues that induction relies on analogy.
We have to consider when cases are similar in order to know when we can assimilate particular experiences and when a law applies.

> All our reasonings concerning matters of fact are founded on a species of analogy which leads us to expect from any cause the same events which we have observed to result from similar causes. Where the causes are entirely similar, the analogy is perfect, and the inference drawn from it is regarded as certain and conclusive. Nor does any man ever entertain a doubt where he sees a piece of iron that it will have weight and cohesion of parts as in all other instances which have ever fallen under his observation. But where the objects have not so exact a similarity, the analogy is less perfect and the inference is less conclusive, though still it has some force in proportion to the degree of similarity and resemblance. The anatomical observations formed upon

> one animal are, by this species of reasoning, extended to all animals; and it is certain that, when the circulation of the blood, for instance, is clearly proved to have place in one creature, as a frog, or fish, it forms a strong presumption that the same principle has place in all (*Enquiry*, §IX, AW 575a).

The question we have to ask, in all cases, is when to expect uniformities to extend beyond our observation, as Bertrand Russell points out.

> Domestic animals expect food when they see the person who usually feeds them. We know that all these rather crude expectations of uniformity are liable to be misleading. The man who has fed the chicken every day throughout its life at last wrings its neck instead, showing that more refined views as to the uniformity of nature would have been useful to the chicken (*Problems of Philosophy*, p 63).

Here is a version of Hume's skeptical argument about induction.

PI
- PI1. Our beliefs about future events and unobserved objects are matters of fact.
- PI2. Beliefs about matters of fact are based on experience.
- PI3. Experience tells us how things were, not how they will be; it tells us only about actually observed phenomena.
- PIC. So, our beliefs about the future and the unobserved are unknown.

PI1 is a definition.
PI2 is the basic principle of empiricism.
Scientific generalizations which do not limit themselves to past observations go beyond sense evidence.
Descartes, for example, argued that innate principles can allow us to make the inductive leap.
An appeal to innate principles will not work for Hume, obviously.
We can not go beyond the evidence of our senses.
PI3 is the result of Hume's observations about causation.

> When we infer any particular cause from an effect, we must proportion the one to the other and can never be allowed to ascribe to the cause any qualities but what are exactly sufficient to produce the effect...If the cause assigned for any effect is not sufficient to produce it, we must either reject that cause or add to it such qualities as will give it a just proportion to the effect. But if we ascribe to it further qualities or affirm it capable of producing other effects, we can only indulge the license of conjecture and arbitrarily suppose the existence of qualities and energies without reason or authority (*Enquiry*, §XI, AW 588a).

Here is a specific version of the problem of induction.

B
- B1. I have seen one billiard ball strike another many times.
- B2. Each time the ball which was struck has moved, motion was transferred.
- BC. So, the struck ball will move this time.

Notice that BC does not follow deductively from B1 and B2.
B is an invalid argument.
An argument is valid if it is impossible for the premises to be true and the conclusion to be false.
You can see that B is invalid if you consider what would happen if the laws of physics shift.
The conclusion could be false, while the premises remain true.

An additional premise could make B a valid inference
Consider the principle of the uniformity of nature (PUN).

PUN The future will resemble the past.

If we add PUN as a third premise, then the conclusion will follow.

B* B1. I have seen one billiard ball strike another many times.
B2. Each time the ball which was struck has moved, motion was transferred.
B3. The future will resemble the past.
BC. So, the struck ball will move this time.

The problem with B* is that we have no basis for believing PUN.
All inductive inference presupposes it, but it can not justify itself.

> All inferences from experience suppose as their foundation that the future will resemble the past and that similar powers will be conjoined with similar sensible qualities. If there is any suspicion that the course of nature may change, and that the past may be no rule for the future, all experience becomes useless and can give rise to no inference or conclusion. It is impossible, there-fore, that any arguments from experience can prove this resemblance of the past to the future, since all these arguments are founded on the supposition of that resemblance (*Enquiry*, §IV.2, AW 547b).

If we had knowledge of cause and effect relations, of the connections among events, we could tie them together to yield PUN.
We would know the hidden springs by experience.
But, we only have knowledge of constant conjunction.
So, all scientific generalizations which do not limit themselves to observed evidence are unjustified.
Physical laws like Newtonian gravitation or the gas laws go beyond experimental evidence.
Even the existence of a material world is a scientific hypothesis generated by experience.

> It is a question of fact whether the perceptions of the senses are produced by external objects resembling them; how shall this question be determined? By experience, surely as all other questions of a like nature. But here experience is and must be entirely silent. The mind never has anything present to it but the perceptions and cannot possibly reach any experience of their connection with objects. The supposition of such a connection is, therefore, without any foundation in reasoning (*Enquiry*, §XII.1, AW 595a).

Hume thus rejects any possibility of using the standard account of truth, neatly encapsulated by Aristotle, and often called the correspondence theory.

> To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, and of what is not that it is not, is true (Aristotle, *Metaphysics* 1011b25).

For a statement to be correspondence-true, the world has to agree with what is said of the world.
But, we can only know one side of the equation, only our ideas of the world and the world as it is in itself.
Hume agrees with Berkeley that the primary/secondary distinction provides no assistance in assuring ourselves of the existence of an external world.
But, Hume rejects recourse to God's goodness to secure the veracity of our sense perception.

The God hypothesis, like claims about our knowledge of the laws of nature, goes beyond legitimate inference, goes beyond the data.

Even the existence of the external world is beyond our ability to know.
Philosophers, as we have seen, speculate broadly about the world and its laws.
Hume insists that such speculation is unfounded.
He proposes that philosophy be rid of such speculation.

> When we run over libraries, persuaded of these principles, what havoc must we make? If we take in hand any volume - of divinity or school metaphysics, for instance - let us ask, *Does it contain any abstract reasoning concerning quantity or number?* No. *Does it contain any experimental reasoning concerning matter of fact and existence?* No. Commit it then to the flames, for it can contain nothing but sophistry and illusion (*Enquiry*, §XII.3, AW 600b).

IV. More Problems of Induction

Hume's skepticism is centered on the problem of induction, which persists, in extended fashion, in contemporary philosophy.
We can identify three problems that might be called problems of induction.

The first might be called the weak problem of induction.

WI We have limited intelligence and experience.

There is not enough evidence to draw the conclusions that we draw.
Scientific theories are generally under-determined by the evidence.
Often there are two or more competing yet equally well-supported theories about the world.
Such theories agree on all the empirical evidence we have gathered.
Even if we presume that physical laws will be uniform and stable, we don't know which theory to use.
Scientists can solve some of the problems of WI by hard work.
For example, physicists have spent some time wondering whether the fine-structure constant is really a constant, throughout space-time.
There was not enough evidence about it, so they worked to gather more evidence.
Currently, most physicists seem to agree that it is constant.
If we were smarter or had more time, we might solve the problems of WI by gathering sufficient evidence.

WI is not Hume's problem of induction.
It is just a problem of limitations on evidence.
It is not really a philosophical problem.

The second problem might be called the strong problem of induction.

SI Even given all possible evidence from the past, we can not know that the laws of nature will not shift radically and unexpectedly.

SI is Hume's problem.
Despite Hume's complaints about inductive processes, we do make successful predictions.

We presume that the laws of nature will remain uniform and stable, even if that assumption is unjustified.
Hume's problem of induction is thus a puzzle.

A third problem of induction, often called the new riddle of induction, extends the puzzle.
The new riddle gets its name from Nelson Goodman's *Fact, Fiction, and Forecast*.
You know what it means for an object to be green.
Consider the property called 'grue'.
An object is grue if it has been examined prior to 1/1/2020, and found to be green or not so examined and it is blue.
Consider the competing claims G1 and G2.

G1 All emeralds are green.
G2 All emeralds are grue.

All evidence for an emerald being green is also evidence for its being grue.
G1 and G2 each describe a lawlike generalization.
They are equally well confirmed by the evidence.
Goodman's new riddle is to determine why we think that G1 is a law and G2 is not.

NRI Even given that the laws of nature remain stable, we do not know which predicates are confirmed.

One could construct other artificial properties, like the property of being a papod.
A papod is something which has been examined before 1/1/2020 and is a piece of paper or has not been examined and is an Ipod.
All evidence that something is a piece of paper is also evidence that it is a papod.
NRI shows that Hume's problem is not just about physical laws, but about common terms we use to describe the world, too.

SI and NRI are among the most serious problems in philosophy, especially in the philosophy of science.
Berkeley shows that Lockean empiricist principles lead to difficulties with our beliefs in an external, material world.
Hume shows that these problems infect all of science, not merely belief in matter.
Goodman shows that the problem infects even our most common uses of language.
Berkeley believes that we can continue to speak with the vulgar and think with the learned.
Hume shows that even the most learned beliefs are unjustified.

V. The Psychological Definition of Causation

We have looked at Hume's problem of induction and his skeptical conclusions.
Hume's skepticism is not just Locke's humility.
It is a thorough rejection of ordinary beliefs.
It is founded on his observation, perhaps inherited from Berkeley, that we are isolated from causal connections.
All we can experience are conjunctions of events, certain regularities in the past.
From those regularities we formulate laws of nature,
But we can not know that the regularity will persist.
Still, we talk about causation all the time.

We do believe that there are connections between events.
We exit through the door, not the window.
We do not really doubt that the sun will rise.

> When one particular species of event has always, in all instances, been conjoined with another, we make no longer any scruple of foretelling one upon the appearance of the other, and of employing that reasoning which can alone assure us of any matter of fact or existence. We then call the one object *cause*, the other *effect*. We suppose that there is some connection between them, some power in the one by which it infallibly produces the other and operates with the greatest certainty and strongest necessity (*Enquiry*, §VII.2, AW 563a).

If a philosopher denies a common belief, it is intellectually responsible to account for that belief.
Hume thus reinterprets ordinary talk of causal connections.
He argues that our confidence in the regularity of nature is mere unjustified habit.

> After a repetition of similar instances the mind is carried by habit upon the appearance of one event to expect its usual attendant and to believe that it will exist. This connection, therefore, which we *feel* in the mind, this customary transition of the imagination from one object to its usual attendant, is the sentiment or impression from which we form the idea of power or necessary connection...The first time a man saw the communication of motion by impulse, as by the shock of two billiard balls, he could not pronounce that the one event was *connected*, but only that it was *conjoined* with the other. After he has observed several instances of this nature, he then pronounces them to be *connected*. What alteration has happened to give rise to this new idea of *connection*? Nothing but that he now *feels* these events to be *connected* in his imagination, and can readily foretell the existence of one from the appearance of the other. When we say, therefore, that one object is connected with another, we mean only that they have acquired a connection in our thought (*Enquiry*, §VII.2, AW 563a).

When we devise, by induction, physical laws, we make a mental leap unsupported by evidence.
Consider if a person were suddenly brought into the world.
She would have no habits, and so no beliefs about regularities or causal powers.
By experience, she would develop certain habits, certain expectations, all while never having any experiences of causal connections.

> Suppose...that he has acquired more experience and has lived so long in the world as to have observed familiar objects or events to be constantly conjoined together - what is the consequence of this experience? He immediately infers the existence of one object from the appearance of the other. Yet he has not, by all his experience, acquired any idea or knowledge of the secret power by which the one object produces the other, nor is it by any process of reasoning he is engaged to draw this inference. But still he finds himself determined to draw it. And though he should be convinced that his understanding has no part in the operation, he would nevertheless continue in the same course of thinking. There is some other principle which determines him to form such a conclusion. This principle is *custom* or *habit* (*Enquiry*, §V.1, AW 549a-b).

What we develop by experience are mental capacities, not insights.
But habit, again, gives you only conjunction, and not connection.
Similarly, we habitually suppose the existence of an external, material world, without any direct experience of it.
Remember, Hume agrees with Berkeley that we experience our sensations, and not their causes.

We have no experience of the things in themselves.
Thus, the term 'cause' refers to a mental phenomenon.

> The appearance of a cause always conveys the mind, by a customary transition, to the idea of the effect. Of this also we have experience. We may, therefore, suitably to this experience, form [a] definition of cause, and call it *an object followed by another, and whose appearance always conveys the thought to that other* (*Enquiry*, §VII.2, AW 563b).

Properly distinguished, Hume claims, causes are internal, rather than external.
They are not in nature, but in our minds.
Causes are psychological, rather than objective.

Berkeley, when faced with the limits of what we can know, interpreted the terms we use that seem to refer to objects as referring to our mental states.
Hume, rejecting Berkeley's idealism, assumes that there is a material world.
Still, we can not know about the laws which govern the interactions of objects in the world.
Instead of internalizing the world, Hume internalizes cause and effect.

To see how radical Hume's psychologistic claim is, it might be useful to compare his views with those of Frege, writing in 1884.
In the following quote, Frege is responding to Mill's psychologistic view of numbers, which is essentially the same as Locke's, and Hume's.

> Number is no whit more an object of psychology or a product of mental processes than, let us say, the North Sea is. The objectivity of the North Sea is not affected by the fact that it is a matter of our arbitrary choice which part of all the water on the earth's surface we mark off and elect to call the North Sea. This is no reason for deciding to investigate the North Sea by psychological methods. In the same way number, too, is something objective. If we say 'The North Sea is 10,000 square miles in extent' then neither by 'North Sea' nor by '10,000' do we refer to any state of or process in our minds: on the contrary, we assert something quite objective, which is independent of our ideas and everything of the sort (Frege, *Grundlagen*, §26).

Hume recognizes that we speak as if the world and the causal laws are objective, existing independently of us.
But, he argues that we are unjustified in believing that.
Thus, we are left as skeptics with unjustified but perhaps explicable habits.