The Problem of Induction

Now we’re going to, in Hume’s words, raise some doubts about things that only a fool or a madman would question. But, we as philosophers will raise these doubts in the interest of intellectual curiosity...

1. Two categories of knowledge: The sorts of things that we claim to KNOW via some reasoning process may be divided into two categories:

(1) Relations of Ideas (deductive knowledge): Some things can be known merely by considering ideas in the mind and discovering the relations between them. For instance, merely by considering the definition of the term ‘triangle’, we can know that <triangles have 3 sides> is true. This knowledge does not require any experience of the world, and <triangles have 3 sides> would still be true regardless of whether or not any actual triangles existed in reality. Other examples include <2 + 2 = 4> and <All bachelors are unmarried>, which merely express relations between the concepts or ideas involved in those statements. These sorts of truths can be known with CERTAINTY; i.e., there is NO WAY that these statements could be false. To deny them would result in a contradiction. For instance, if you claimed that <Some bachelors are married> what you would really be claiming is that <Some unmarried males are married>, which contradicts itself.

(2) Matters of Fact (inductive knowledge): Most of what we claim to know is not true by definition, but is rather based on our experiences. For instance, imagine that you knew the DEFINITIONS of ‘water’ and ‘fire’, but had never seen either before. Without experiencing first-hand or witnessing water suffocating a person, you would not be able to know that <Water will suffocate a person> is true. Similarly, with <Fire will consume a person>, or <The Sun will rise tomorrow>. These sorts of truths can only be known by EXPERIENCE. Denying them does NOT result in a contradiction. For instance, if you claimed, <The sun will NOT rise tomorrow>, this would not be false by definition, since the claim does not contradict itself. Since matters of fact are not true by definition, we cannot know them with absolute, 100% CERTAINTY.

2. How do we know matters of fact?: Relations of ideas can be known with certainty merely by understanding the concepts involved, and how those concepts can consistently be related to one another. But, how are matters of fact known?
As stated, matters of fact are known by experience. We have an experience of one thing, and then another, and then we infer that there is a connection between them. For instance, if you claim to know that <My friend is in Hawaii>, your reason for believing this might be the post card from Hawaii that you received. You cite the fact of the post card, and the claim that <My friend is in Hawaii> and you infer that there is some kind of connection between the two things. But, what is this connection? Hume claims that it is one of cause and effect. For instance, if you hear a voice speaking in the dark, you reason to the fact that <There is a person in this room> because you assume that the person and the voice are connected as a cause to an effect.

3. On cause and effect: So, matters of fact are known because of an assumed relation of cause and effect between two things, based on experience. But, then, how is this relation known? In other words, How can we know that something is the cause of something else?

Causation is known only by experience: Since effects are entirely different things than their supposed causes, effects cannot be discovered merely by examining their causes (as if effects were somehow contained within them). Cause and effect cannot be known by reason. We only learn what the effects of certain things are by EXPERIENCE. Imagine:

- You just popped into existence a moment ago. I roll one billiard ball toward another. What do you think will happen? YOU HAVE NO IDEA! Will it come to a halt? Will it travel straight THROUGH the second ball? You’ll probably be quite surprised when the first ball hits the second and comes to a stop while at that same moment the second ball starts moving!

  Now imagine that I pick up a billiard ball and hold it in the air and then let go. What do you think will happen? YOU HAVE NO IDEA! Your best guess is probably that it will continue to hang right there. Imagine your surprise when it immediately begins moving downward! Why not upward? Or sideways?

In other words, prior to experience, we have no reason to expect that an object will behave a certain way or produce a certain effect.

Causation is known by REPEATED experience: Seeing one billiard ball strike another once, or seeing me drop one of the balls once, does not seem to be enough to justify any knowledge of cause and effect though. For instance, imagine that you had never seen bread before. Maybe you eat a bit of it, and find that it nourishes you. You don’t die, and your hunger is satiated. Now, the next time you see a brown, loaf-shaped
object with a certain smell, consistency, etc.—what reason can you possibly have for thinking that THIS object will ALSO nourish you?

If the ball went downward the first time, what reason do you have for believing that it will go downward the second time that I drop it? And so on...

There must be something more than a SINGLE experience, then.

Hume observes that we infer cause and effect when we observe a constant conjunction of things. When I am hungry and I have some bread, I do not hesitate to eat it. I do not stop to think, “Well maybe this time, this sort of object will kill me.” Why? Because every time that I have seen something that looked and smelled like bread in the past, it nourished me when I ate it. Therefore, bread + nourishment have always been ‘constantly conjoined’ together in my past experiences. So, when I see bread, I expect that it will AGAIN be conjoined with nourishment.

But, note the assumption that this inference relies on. We start from the fact <Bread has always nourished me in the past> and conclude that <This bread will nourish me now>. But, in order to go from the former to the latter, we must assume the following:

**The Assumption:** Things that have been joined together in the past will CONTINUE to be joined together in the future.

Or, put simply: **The future will conform to the past.**

Hume writes, “From causes which appear similar, we expect similar effects. This is the sum of all our experimental conclusions.”

But, Hume says, this assumption is not intuitive. How, then, is it justified? It is not known prior to experience, with certainty—for, its denial, <Things that have been joined together in the past will NOT continue to be joined together in the future>, does not result in a contradiction. Bread that makes one hungry rather than full, or a ball that moves upward when released rather than downward, or the Sun’s failure to rise tomorrow—these are all perfectly conceivable things. Therefore, The Assumption must be known by experience. Every time, in the past, that we tried to predict what the future would be like, we discovered that when those events arrived in the present, things DID conform to the past. So, this assumption is known via constant conjunction.

But, notice now that our chain of justification is circular. For example:
1. The Sun has risen every morning in recorded history.
2. The future will continue to be like the past.
3. Therefore, the Sun will continue to rise every morning.

But premise (2) is justified as follows:

1. Every time I made a prediction about the future based on past observations, the future has always met my expectations (in other words, in the past, the future has always been like the past).
2. The future will continue to be like the past.
3. Therefore, the future will continue to be like the past.

Clearly, the second argument is problematic. It reasons in a circle. The second premise and the conclusion are the same! You can’t support a conclusion by repeating the conclusion. That’s like saying:

“I conclude that Perry is the thief! How do I know? Because Perry IS the thief!”

That’s no evidence at all. In short, Hume points out that all induction is based on the following circular reasoning.

(a) Knowledge about matters of fact rests on knowledge about cause and effect.
(b) Knowledge about cause and effect rests on (i) our experience of constant conjunction, and (ii) The assumption that the future will conform to the past.
(c) The assumption (b.ii) that the future will conform to the past is justified by (iii) our experience of constant conjunction, and (iv) the assumption that the future will conform to the past.
(d) The assumption (c.iv) that the future will conform to the past is justified by (v) our experience of constant conjunction, and (vi) the assumption that the future will conform to the past.
(e) The assumption (d.vi) ... And so on, to infinity.

So, how is The Assumption justified at all? We seem to assume that, if a thing that looks a certain way (e.g., bread) has always produced a certain effect (e.g., nourishment), then it will ALWAYS do so. But, why? There is no reason for us to think that such a connection is a necessary one. All we ever observe are single instances. With bread, for instance, I never observe the necessary connection between bread and nourishment, per se. All I ever observe is the eating of bread, and then my own nourishment. But, no matter how many times I eat bread, I never see MORE than this. The 1000th time, I still merely observe the eating and then the nourishment. The necessary connection—the causation—between the two is never observed.
Hume concludes that there is ultimately no explanation for The Assumption except custom, or habit. Due to the experience of constant conjunction of two things, our minds are naturally led to the conclusion that there must be some connection between those two things, with no reason that justifies this.

But, this is a PSYCHOLOGICAL explanation of The Assumption, not a philosophical justification of it.

The Problem of Induction as Undermining All of Science: This worry is a problem for scientists, who conduct all of their investigations based on induction. Induction is the inference that, through repeated observation, future observations will conform to past ones. For instance, if I observe that the sun rises in the East 1000 times in a row, I can hypothesize that it will ALWAYS rise in the East. Likewise, if I have observed all 1000 of my test subjects have been cured of some disease by my vaccine, I conclude that this gives me a good reason to believe that the one-thousand and FIRST patient (#1,001) will probably ALSO be cured by the vaccine.

This is how all scientific inquiry is conducted. But, if the assumption that the future will conform to the past is unjustified, then all of science is ultimately unjustified—because all hypotheses in science rely on it. [In fact, nearly ALL knowledge turns out to be unjustified (e.g., my belief that this bread will nourish me, or that this chair will support my weight, or that my voice will be heard by others nearby, etc.).] According to Hume, whether I’ve observed the Sun rising in the East one time, one thousand times, or one MILLION times, there is no more reason to believe that it will rise in the East NEXT time. This is total skepticism about all scientific inquiry.

How do we answer Hume?
Causation and the Laws of Nature

1. Causation: Now, let’s back up a bit. We seem to think that induction is inferred because there is CAUSATION in the world. That is, we think that drinking water CAUSES our thirst to be satiated, one billiard ball striking another CAUSES the second ball to begin moving, stepping on the brake pedal CAUSES the car to stop, and so on.

Hume has said that we only infer that causation has occurred whenever we observe a “constant conjunction” of one type of event followed by another. But, then, Hume would have to count the following as an instance of causation:

- **Causing Coffee:** My alarm clock goes off at 5:59am every day. A minute later (at 6am every day), the local coffee shopkeeper makes some coffee and unlocks her front door.

There is surely a ‘constant conjunction’ between these two events. But, intuitively, there is no causation here. My alarm clock does not CAUSE the coffee shop to open. But, notice, constant conjunction is the only thing that is ever observed with ANY two things. So, why do we infer causation for some things but not others? The Humean view has difficulties distinguishing causal connections from so-called ‘accidental regularities’.

Here are a few other cases of “constant conjunctions”:

- Every time the barometer drops, it begins to rain.
- Every time I forget to bring my umbrella, it rains.
- Every time I wear my special jersey, my team wins.

We DO think that barometers and rain are causally connected, but the falling barometer does not CAUSE the rain (rather, they just both have a common cause; namely, falling pressure). In the latter two cases, we sometimes mistakenly attribute causation, when what is really happening is just coincidence.

Intuitively, causation involves some kind of necessary connection between types of events. This has led many philosophers to propose that causation occurs only whenever there are regularities in accordance with the laws of nature.

Accidental regularities are just that—ACCIDENTS. Causation, on the other hand, is a regularity that is somehow GOVERNED or REQUIRED to occur due to some sort of constraint on the ways that the things in the universe can behave. We call these constraints ‘laws’.
Unsurprisingly, David Hume rejected the existence of laws of nature. He thought that what we think of as "laws of nature" are nothing more than mere regularities. Whenever we discover some pattern or regular feature of the world, we call it a "law".

But, again, many regularities appear to be merely accidental. Consider these regularities:

- All of the pens in this room are at least 3 feet from the ground.
- All Thursday dinner parties are attended by 15 or fewer people.

This is a regularity, but surely it is not a law. The universe does not REQUIRE this of pens, or Thursday dinner parties.

We might reply that, in order to be a law, the regularity must apply UNIVERSALLY. However, contrast the first set of claims with the second set:

- All human beings die before their 125th birthday.
- All tin foil balls are less than 100 ft. in diameter.
- No mammal travels faster than 75 miles per hour.
- All objects that are dropped fall to the ground.
- All uranium spheres are less than 100 ft. in diameter.
- Nothing travels faster than $3 \times 10^8$ meters per second (the speed of light).

ALL of these are universal generalizations, but notice something: It is not physically impossible for something to violate the universal generalizations on the left. But, scientists tell us that it IS physically impossible for something to violate the universal generalizations on the right (a uranium sphere 100’ in diameter would exceed critical mass and explode). In other words, only the items on the right seem to be governed by laws of nature.

But, what is a 'law of nature'?

Here is a summary of 4 counter-intuitive results of Humeanism:

(1) **No Necessities.** Intuitively, when I drop a stone, in some sense it MUST fall. But, Humeans deny this. There is no necessitation in the universe. Sure, the stone falls. But, it just HAPPENS to fall. End of story. It might have flown upward instead. The fact that stones ALWAYS ‘just happen’ to fall is a huge cosmic accident. We’re lucky that the world (up to now at least) has been so regular. Really, what we call a ‘law’ of nature is just a DESCRIPTION of what happens. Laws are DESCRIPTIVE, not PRESCRIPTIVE (i.e., they do not ‘govern’ what happens).

(2) **No Explanation.** When stones fall, it seems that there should be some REASON why they do. Humeans deny this. There simply is no reason why stones fall when they do. Again, it’s all just a giant cosmic accident. On Humeanism, there is a law BECAUSE stones fall. Intuitively, however, stones fall BECAUSE there is a law!
(3) Accidental vs. Lawful Regularities. As we have seen, Humeanism lacks the tools to distinguish what seem to be NECESSARY regularities (e.g., All stones fall to the ground) from merely ACCIDENTAL regularities (e.g., All of the pens are 3 feet off of the ground). On Humeanism, it’s ALL an accident.

(4) Global, Not Local. Intuitively, when a stone falls, it seems that the law of gravity applies to THIS stone. On Humeanism, laws are merely descriptions of GLOBAL regularities. All regularities are accidental, but we call the global regularities “laws”. There is nothing in particular that applies to THIS stone. However, we typically think of laws as applying in each instance (i.e., locally).

2. Two Anti-Humean Views of Laws: Anti-Humeans are divided into two camps.

(a) Laws are Relations Between Universals: In the late 1970's, Fred Dretske, Michael Tooley, and David Armstrong proposed that laws are relations between universals (for this reason, it is called the ‘Dretske-Tooley-Armstrong view’, DTA.)

For instance, physicists tell us that ‘force equals mass times acceleration’ (F=ma) is a law. The DTA view proposes, in this case, that the properties (universals) of ‘having mass’, ‘having a force applied’, and ‘having acceleration’ are sort of “glued” together by some necessary connections. That is, whenever an object has two of these universals, it is guaranteed to have the third.

(b) Laws are Reducible to Dispositional Properties: Dispositionalists claim that objects have irreducible “dispositions”. That is, objects are fundamentally DISPOSED to act in certain ways in certain conditions.

Many words in our language capture the idea of something’s “being disposed” to act in a certain way. Consider the property of ‘fragility’ for instance. If something has the (dispositional) property of ‘fragility’, then it is such that it will break when struck. So, dispositions are such that they MUST manifest themselves in a certain way when the object that instantiates it is placed in a certain sort of condition. So, when you place an object with the disposition fragility in the condition of being struck, it necessarily manifests as the object’s breaking.

But, the dispositionalist will say that MASS is like that too. ‘Having mass’ is just the property of being disposed to act in a certain way (for instance, objects with mass are disposed to attract other objects with mass).

Solving the Problems: Regarding the four counter-intuitive results of Humeanism, the Anti-Humean gets it right on all accounts:
(1) **No Necessities.** If there are laws (e.g., a law of gravity), then it IS true that, when I drop a stone, in it MUST fall. So, what we call laws DO govern (they are prescriptive rather than merely descriptive).

(2) **No Explanation.** When stones fall, there IS some REASON why they do. Namely, they fall because the natural necessities (i.e., laws) required it!

(3) **Accidental vs. Lawful Regularities.** Anti-Humeanism has the tools to distinguish between the two. <All of the pens in this room are 3 feet off of the ground> is merely an accidental regularity, for instance, because the universals *being a pen* and *being 3 feet off of the ground* are not linked by a natural necessity. Having one of those properties does not necessitate the other. On the other hand, having mass DOES necessitate attraction to other massive bodies.

(4) **Global, Not Local.** When this stone falls, the law of gravity DOES apply to THIS stone. The laws do apply in each instance (i.e., locally).

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3. **The Problem of Induction Re-Visited:** If there are such things as laws of nature, then inductive inferences WOULD be justified. For instance, we would be justified in claiming that the sun will rise tomorrow because the laws of nature guarantee it!

Why should we care about laws? Well, we like to think that we can make predictions (by induction). Imagine that I am a Humean and I am trying to predict what will happen when I drop my pen, and this is a regularity:

- All of the pens in this room are at least 3 feet from the ground.

Predictions involve what is called ‘**counterfactual reasoning**’. I think about what WOULD happen (or WOULD HAVE happened) if such and such occurs. But, when we engage in counterfactual reasoning, we hold certain things fixed; namely, the LAWS.

The regularity above is not a law. If we hold IT fixed, then we would get the following absurd prediction:

- What will happen if I drop this pen?
- It will hover at 3 feet from the ground.
- Why is that?
- Because all of the pens in this room are at least 3’ from the ground.

We know that the pen will NOT hover 3 feet from the ground, because the particular regularity cited by B is NOT A LAW. Discovering laws enables us to make predictions based on the generalization that “like things produce like results”. But, the Humean owes us an account of why we hold certain laws (like gravity) fixed in our counterfactual reasoning, but not the regularity about pens being 3 feet above the ground.
4. Conclusion: In short, we are faced with two explanations of why there seem to be regularities in the world. Here is a summary of them, and their main problems:

(1) Humeanism: Regularities are nothing more than a cosmic accident. There is no feature of the universe which constrains the way that things behave.

Main points:
- There are NOT necessary connections between distinct things.
- Laws are descriptive. They merely DESCRIBE what has happened.
- There is a law of gravity because every object has fallen when dropped.

Problem: The Humean has no way to distinguish between lawful regularities and accidental regularities. For the Humean, ALL regularities are accidents.

Second, cause and effect are not EXPLAINED. We want to know: WHY do stones fall when dropped? For the Humean, there is no answer.

Finally, sort of skepticism creeps in here. If there are no constraints on the behaviors of objects, then at any moment the observed regularities might be broken. For all we know, tomorrow water might be poisonous, people might fall away from Earth’s surface into the sky, and roller skates may begin doing philosophy. There is nothing about the nature of the universe to prevent these things from occurring.

(2) Anti-Humeanism: Regularities are a result of governing laws. There are necessary connections between objects, which constrains the ways in which things are able to behave.

Main points:
- There ARE necessary connections between distinct things.
- Laws are prescriptive. They GOVERN what has happened/will happen.
- Every object has fallen when dropped because there is a law of gravity.

Problem: The Anti-Humean has yet to offer any satisfying account of WHY or HOW there can be such necessary connections. The Anti-Humean has no answer. They ultimately just tell us that such connections are “primitive” features of the universe. But, what does that mean? That seems to be no explanation at all, so it is unsatisfying.