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# The problem of induction

**Dr. Uttam Singh**
Department of Philosophy, Allahabad University, Allahabad, Uttar Pradesh, India

**Abstract**
The problem of induction, also known as "Hume's Problem of Induction", is a demonstration that there can be no justification for any rule of inductive inference. This topic will set up two sections of the traditional problem for a formal theory and so how the corresponding set up fails for a material theory of induction. It will then review attempts to resurrect the problem of induction for material theories. These attempts will be sharpened into two objections. First, a historical-anthropological objection plays out in our real history, its fails because it relies on highly speculative historical fables, an empirical objection plays out in the logical space of justification. It fails because it depends on the dubious presumption that experience can be captured propositionally in a way that does not already require inductive knowledge, and because it relies on a narrowly hierarchical version of empiricism, incompatible with modern inductive practice.

**Keywords:** paradigm, assumption, contingent, domain, inference

## Introduction

The problem of induction, also known as "Hume's problem of induction," is a demonstration that there can be no justification for any rule of inductive inference. Take the rule that lets us infer from all past A's being B that the next A will be B. The rule is not deductive. Past performance, as the saying goes, is no guarantee of future performance. Do we justify it by noting that the rule always has worked, so we should expect on inductive grounds that its next application to work? That would be circular. The difficulty is seen instantly, yet it is so hard to escape that it has become the paradigm of an intractable philosophical problem.

The purpose of this paper is to suggest that the problem can be escaped. While the problem requires very few assumptions, there is one that is not usually challenged. It is that inductive inference is governed by universal rules. If this assumption is discarded, then, I will argue here, the problem can no longer be set up.

This assumption is discarded if we move from a formal theory of induction to a material theory of induction. In a formal theory of induction, valid inductive inferences are distinguished by their conformity to universal templates. They may be simple, such as the inference from all past A's being B that the next A will be B. Or they may be more complicated, such as the requirement that degrees of inductive support conform to the probability calculus.

In a material theory[1], inductive inferences are warranted by facts. We can infer inductively from some samples of the element Bismuth melting at 271°C to all melting so, because of a fact about chemical elements: generally, all samples of one element agree in such physical properties. Or we are warranted to assign a degree of support of one half to the colorblindness of a newborn son by facts about the genetic make-up of the parents: these particular parents have a physical chance of a half of passing on the colorblindness trait. Since the facts that warrant inductive inferences are contingent, there are no universal warrants. No system of inductive logic holds universally; each holds only in the limited domain in which the warranting facts are true.

If one adopts a material theory of induction, one no longer separates factual content from the rules of inductive inference. The problem of finding a justification for these rules collapses into the problem of justifying ordinary facts. That collapse, I shall argue, so alters things that the traditional problem of induction can no longer be set up. The goal of the present paper is not to develop and defend a material theory of induction. That has been done elsewhere. The present goal is to show how adopting a material theory of induction dissolves the problem of induction.

The first two sections of this paper will set up the traditional problem for a formal theory and show how the corresponding set up fails for a material theory of induction. It will then review attempts to resurrect the problem of induction for material theories. These attempts will be sharpened into two objections. First, an historical-anthropological objection plays out in our real history; it fails because it relies on highly speculative historical fables. An empirical objection plays out in the logical space of justification. It fails because it depends on the dubious presumption that experience can be captured propositionally in a way that does not already require inductive knowledge; and because it relies on a narrowly hierarchical version of empiricism, incompatible with modern inductive practice.

## Setting Up the Problem of Induction

If we are ever to hope to make progress with the problem of induction, it is essential that we give it a precise formulation.[2] Too often, discussions of the problem bleed off into other problems attached to inductive inference, such as Hempel's raven or Goodman's grue problem, and then further into a

general sense that inductive inference is philosophically problematic in all its aspects. That sort of problem is irresolvable. One cannot hope ever to demonstrate that inductive inference is free of all woes, including those as yet unimagined.

For present purposes, I shall take inductive inference to mean ampliative inference, a notion that is broader than the enumerative inference against which the problem of induction is leveled in the older literature. I shall take the problem to be a particular, brief demonstration of the impossibility of justifying any rule of inductive inference. It is summarized by Salmon[3] as a dilemma with deductive and inductive horns.

Consider, then, any ampliative inference whatever… We cannot show deductively that this inference will have a true conclusion given true premises. If we could, we would have proved that the conclusion must be true if the premises are. That would make it necessarily truth preserving, hence, demonstrative. This, in turn, would mean it was nonampliative, contrary to our hypothesis….

At the same time, we cannot justify any sort of ampliative inference inductively. To do so would require the use of some sort of non-demonstrative inference. But the question at issue is the justification of non-demonstrative inference, so the procedure would be question begging…

Salmon's second, inductive horn leads to a circularity ("question begging"). This second horn could equally be developed as a fatal infinite regress, as does Popper[4] when he formulates the problem in terms of justifying the principle of induction:

…the principle of induction must be a universal statement in its turn. Thus if we try to regard its truth as known from experience, then the very same problems which occasioned its introduction will arise all over again. To justify it, we should have to employ inductive inferences; and to justify these we should have to assume an inductive principle of a higher order; and so on. Thus the attempt to base the principle of induction on experience breaks down, since it must lead to an infinite regress.

**Attempts to Resurrect the Problem**

Can it really be that easy? I believe it can. The task is not to show that a material theory of induction is immune to all challenges; that is an impossible demand. The task is merely to show that this particular challenge fails. And it does. What was a short, sharp and decisive demonstration of a fatal difficulty for a formal theory of induction becomes inconsequential when replicated for induction, materially conceived.

Nonetheless, many are likely to share my initial sense of foreboding when we deal with a regress. We should, of course, be very concerned with the regress of justifications associated with a formal theory of induction. For it is troublesome in its earliest steps. It is already fanciful for inductions to have higher order inductions performed on them; and then yet higher order inductions performed on these. The problem is already evident locally, in these first few steps. The corresponding regress in a material theory is not troubling, locally. Each local part merely reports how we justify this proposition on the basis of that one and that one. Yet we are dealing with a regress and they can be dangerous. While no problem may be evident locally, might there be some problem in the global structure of the regress? John Worrall[5] clearly harbors such apprehensions. He has sought to state more precisely how the regress of inductive justifications can eventually lead to trouble (Section 1):

However, if we follow this backward direction, we soon meet what seems to be an insuperable problem: the accreditational buck, it seems, has to stop somewhere - it can't be an infinite chain (or, rather, tree since more than one non-phenomenal premise will standardly be involved in any 'demonstrative induction' and perhaps there will be more than one way of accrediting a given theory by this method). Even if we were to think, following Hume's thought experiment, of the starting point being Adam making some initial observation, we know that nodes in the tree must contain, at some stage, universal claims – and so we would still have to account for some initial act (or acts) of generalisation. And given that we want each node to be justified we would seem to be back at the same old problem.

Thomas Kelly[6] has objected on similar grounds. To give it a sharper formulation, he separates out the commitment of the material theory that grounds the problem. A material theory, he urges, must be committed to (Section 3)

**Prior knowledge**

In order to learn a fact by induction, one must have prior knowledge of the material fact that licenses the induction.

He then turns to "E," which he defines to be the totality of our knowledge immediately before we acquired our first piece of inductive knowledge. He continues:

Suppose that we try to take a first, minimal step beyond E. Again, intuitively, this proposition will be Our First Piece of Inductive Knowledge…My worry is that, given that the only empirical knowledge that one has at the point is observational knowledge and its deductive consequences, there won't be anything suitable around to play the role of material postulate.

After examining Worrall's and Kelly's remarks and their fuller texts, it becomes clear that there are actually two distinct concerns being raised in connection with the termination of the justificatory regress. One is an "historical-anthropological" objection and the other "empirical." They are elaborated and rebutted in the following sections.

**The Historical-Anthropological Objection**

The regress in this objection plays out in time. When we trace back the history of how humanity actually acquired inductive knowledge, we come to the moment of the first induction. It is a specific event that must arise for some particular human. No material fact is then available to warrant this first induction. For all such warranting facts must make more general assertions in some fashion if they are to license inductive inferences from the specifics of particular observations to the more general. The problem of induction returns for the material theory in the inability of our inductive enterprise ever to start historically, that is, if induction is as the material theory asserts.

To illustrate the worry, we need only imagine an Adam, still bereft of any inductive knowledge, emerging from his cave. Presumably, he can come to know that, as general matters, which are the substances around him that are good to eat, that

ascending heights is dangerous, as are certain insects, that thunder follows lightning and that day follows night. Yet he cannot come to know these as generalities by induction from the particulars of his experience if he does not already have inductive knowledge of general scope to serve as the warrating material postulates.

**The Empirical Objection**

The regress of this empirical objection is atemporal; it plays out in the logical space of our present justifications. As empiricists, we expect all our empirical knowledge to be grounded in experience. But pure experience, absent any general knowledge, provides no material postulate to allow induction to proceed. So, the objection asserts, the material theory entails that induction is possible only if we deny empiricism and, by means other than induction from experience, introduce knowledge of contingent facts that transcend the deductive consequences of our experience.

To illustrate this worry, consult a modern ephemeris for a complete record of all the observed positions of the morning and evening star. We should like to infer that one star becomes the other and that the one object—Venus—persists in intermediate positions, even when those positions are obscured from our gaze by the earth or the sun. The relevant induction requires supposition of a material fact about the continuity of motion of celestial objects. Such a supposition cannot be located in any purely observational fact in astronomy or elsewhere. The material theory of induction does not permit the induction to proceed from purely observational premises.

Might we escape by recalling that celestial objects are Newtonian masses governed near enough by Newton's laws of motion and gravitation? They entail that these masses trace out continuous trajectories, which is just the material fact needed. Calling up Newton's mechanics breaks the no-prior-inductive knowledge presumption, for Newton's mechanics was itself learned inductively from particular facts about bodies and their motions. If we replace Newton's mechanics by these particular facts, the problem returns. We have no material facts of a sufficiently general character that can license inductive inferences to the intermediate, unobserved positions of the morning and evening star.

This empirical objection fails, I maintain, since its cogency requires a commitment to two quite narrow presumptions in epistemology both of which are dubious. The first is that it is possible to separate out the purely experiential propositions that can be known without prior inductive knowledge. The second is a strict, hierarchical construal of empiricism, a kind of naive inductivism.

**Why It Fails: The Presumption**

That we can separate out purely observationally or experientially based knowledge independently of our larger conceptual system is a fiction Wilfrid Sellars denounced famously as the "myth of the given." Our present purposes do not require a full development of Sellar's critique. Rather, all that is needed is to cast doubt on the narrower idea that there are propositions that capture experience without the prior requirement of inductive knowledge. For experience must be first be expressed propositionally if it is to figure in inductive or deductive reasoning; and the empirical objection requires such propositions as the supposed starting point of inductive and deductive inferences.

My narrower version of Sellars' point begins with the idea that language is unable to provide a mode of expression for our experiences that does not already presume general knowledge of the type provided by induction. Take for example, the proposition "The ball is red." For this proposition to be understood, one must have a prior conception of both "ball" and "red." Neither is simple. A ball is, most crudely, a roughly spherical object of any size, so that an understanding of the term "ball" requires some understanding of the general principles of spatial geometry and the physical possibilities it affords. A common connotation of "ball" is of a rigid or elastic body, which presumes some knowledge of the elastic properties of materials. A functional property of "ball" is that it can roll if pushed, thereby presuming an understanding of both kinematical and dynamical notions. Finally, a connotation is that balls are involved in games, presuming some knowledge of game play in human society. Similar demands are made for understanding the predicate "red." Minimally it requires the ability to classify, even if only hesitantly, which of the infinite range of colors in the color manifold are appropriately labeled "red." We would not say someone with normal vision understands "red" if they are unable to pick a red ball from a pink one or a violet one, when asked.

Perhaps the example is poorly chosen and we should seek to express pure experience with terms less context-dependent than "ball" and "red". Might we replace the proposition with "This thing [pointing] is the same color as that thing [pointing]." This translation is, in the end, no simpler. How we to know just which portions of the world are are picked out by the pointing unless we have a general understanding of the default designations of terms like "this thing" in similar contexts? And understanding just which aspects of the two things are same when they agree in color is every bit as complicated as understanding "red."

Might we escape by seeking an artificial language? Might we take pure experience to be expressed, for example, in the glowing diode or inked line traced by a chart recorder attached to some sensor? The same problem returns. For the glowing diode or inked line has no meaning until it is interpreted. That process requires a general sort of inductive knowledge. We need to know, for example, that the inked line is connected by some physical process to the physical magnitude of interest and that the connection is such that increases and decreases in that magnitude correspond to deflections in the inked line.

The parable of Adam in his cave was intended to conjure up a notion of induction-free, propositional knowledge. The parable failed not just because it relied on a fantasy history, but because of the impossibility of induction-free propositional knowledge in the first place.

**Conclusion**

Formal approaches to induction face the venerable problem of induction: attempts to justify their formal rules prove to be circular or to trigger an infinite regress of fanciful inductions upon inductions. In a material theory of induction, the warrant for an inductive inference is no longer a universal template,

but contingent facts. That transition precludes the setting up of a direct analog of the problem of induction. The corresponding regress is simply the prosaic tracing back of the inductive supports of facts we believe.

We have reviewed efforts to develop this regress into a problem comparable to the original problem of induction. These efforts turn out to depend upon dubious presumptions. One version, the "historical-anthropological objection," requires fanciful fables concerning the cognitive behaviors of early humans. Another, the "empirical objection," presumes that we can express our observations and experiences propositionally in a way that is not already dependent on inductive knowledge. Further, it presumes a strictly hierarchical version of empiricism that does not conform with the inductive practices of science.

The essence of the problem of induction is the positive demonstration of a tenacious and intractable problem for formal approaches to induction. We presently have no demonstration of a corresponding problem for induction, materially conceived. Of course no one can now say what an ingenious paradox monger of the future may concoct for the material theory of induction or, for that matter, for any philosophical theory. We cannot now prove that a material theory is immune to all such future threats. We can conclude, however, that present efforts to set up the problem have failed and so, for the time being, the problem of induction is solved by adopting a material approach to induction.

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