ONTOLOGICAL SOLUTIONS TO THE PROBLEM OF INDUCTION

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ABSTRACT: The idea of the uniformity of nature, as a solution to the problem of induction, has at least two contemporary versions: natural kinds and natural necessity. Then there are at least three alternative ontological ideas addressing the problem of induction. In this paper, I articulate how these ideas are used to justify the practice of inductive inference, and compare them, in terms of their applicability, to see whether each of them is preferred in addressing the problem of induction. Given the variety of contexts in which inductive inferences are made, from natural science to social science and to everyday thinking, I suggest that no singular idea is absolutely preferred, and a proper strategy is probably to welcome the plurality of ideas helpful to induction, and to take pragmatic considerations into account, in order to judge in every single case.

KEYWORDS: induction, uniformity of nature, natural kinds, natural necessity

In his famous critique, Hume challenged the legitimacy of the inductive inference, namely the inference from the premise "observed Fs have been Gs" to the conclusion "all Fs are Gs."[1] He was also the first one who responded to the challenge, by introducing an ontological principle, i.e., the *uniformity of nature*, joining which to the inductive premise was supposed to legitimate the inference. He was again the first one who challenged the response, as the principle cannot be established without circularity (Hume 1739). Since then, and despite the initial failure, not only was this idea not forgotten, but also further similar attempts were subsequently made by others, to solve the problem, in more or less the same way as the uniformity of nature does. Among those suggestions, two ideas were distinguished: *natural kinds* and *natural necessity*. While both were employed in the literature to address the problem of induction, there is a subtle difference between them which might be historically interesting. While the term natural kinds was initially invoked to support the inductive inference, the term natural necessity was introduced initially in metaphysics and only then be employed to legitimate the induction. Therefore, three ontological alternatives are now available, joining each to the inductive premise have been argued to legitimate the inference. In this paper, I will compare

[1] There is also an alternative schema for the inductive inference, with the premise "Observed F1… Fn have been Gs" to the conclusion "Fn+1 is G." To the extent of this paper, there is no significant difference between them, and because of its prevalence, we work with the first one.

them, in terms of their applicability and usefulness, to see whether each of them is preferred in addressing the problem of induction. I begin with the more favored idea, i.e. natural kinds, then go to the natural necessity, and finally come back to the idea of uniformity.

Natural Kinds and the Inductive Inference

The tradition of natural kinds, as Hacking (1991) noted, has been mostly concerned with the problem of induction. Mill (1843) invoked *Kinds* when he spoke of "subsidiary operations to induction." John Venn, by whom the term *natural kinds* was coined, also proposed this idea while searching for a basis to apply probability rules in the domain of natural objects and events (Venn 1876). According to him, these rules owe their applicability on artificial objects to the overall resemblance embedded, in advance, in the objects involved in trials, a resemblance which is not evident in natural objects. The idea of natural kinds, then, is supposed to provide this resemblance in nature, required for probability rules to be applied therein.[2] In Chakravartti's words, "The primary motivation for thinking that there are such things as natural kinds is the idea that carving nature according to its own divisions yields groups of objects that are capable of supporting successful inductive generalizations and predictions" (Chakravartti 2007, 152).

Nonetheless, what has been rarely articulated is details of this support, and the way in terms of which the idea of natural kinds fulfills its legitimating role in the inductive inference. Here is where my work begins. In order to articulate the details, I refer to Sankey' s account of natural kinds, as it is developed properly and addresses the problem of induction clearly. As Sankey (1997) stated:

> We are rational to employ induction when we form our beliefs about the future because nature is, in fact, uniform. It is uniform in the sense that the fundamental kinds of things which exist are natural kinds of things, which possess essential sets of properties. Because all members of a kind possess the same essential properties, unobserved members of a kind will possess the same properties as members of the kind which have already been observed. This is why, when we infer that an unobserved object will have a property which observed objects of the same kind have, we turn out to be right. For having such a property is just part of what it is to be an object of the same kind as the other objects.[3]

[2] Attempts of the same kind can be seen in Russell (1948), Quine (1969), Boyd (1999), Kornblith (1993), Sankey (1997), Ellis (2001), Chakravartti (2007), Bird (2018), etc., noting that Russell's case is somehow different, as he ultimately preferred to refer to Keynes's principle of limited variety rather than natural kinds.

[3] As clear, Sankey's account is one among many accounts of natural kinds. But its essentialist

According to Sankey, were all instances so far observed of a substance with say atomic number 26 have the melting point of 1536° C, we can conclude that all substances with atomic number 26 have the melting point of 1536° C. The reason is that having atomic number 26 is sufficient for a substance to be recognized as iron. Moreover, having the melting point of 1536° C is among the essential properties of the iron. Supposing invariability of kind essences over time and individuals, unobserved instances of iron can be claimed to possess both properties of having "atomic number 26" and "melting point 1536° C." Then, if a substance with the first property is observed, the second property can be legitimately ascribed. Here is my articulation of this inductive inference, based on a classical essentialist conception of natural kinds presupposed in Sankey's account:

Inference (A)

(1) All observed Fs have been Gs.

(2) All Fs belong to kind K.

(3) G is among the essential properties of kind K.

(4) If something is F, it necessarily is G.

Therefore,

(5) All Fs are Gs.

In the schema above, the conjunction of lines (2) to (4) and the premise (1) seems to legitimate the inference. But let us see how these lines are themselves justified. Line (4) is presumably entailed by the conjunction of (2) and (3), as necessity is generally presumed to be involved in essentialism. Line (5) is directly entailed by (4), and (1) is an observed matter of fact. What we must worry about are premises (2) and (3), which are not well-grounded. The idea which philosophers of natural kinds had in mind when they invoked these categories seems to be that (2) and (3) are justified because they provide the best explanation for an unexpected fact stated in (1). On this account, natural kinds solve the problem of induction through an IBE for the inductive premise.[4]

character, inherited from Ellis' account, makes it a typical instance of the classical conception of natural kinds.

[4] There is also another view among philosophers of natural kinds (Kornblith 1993; Boyd 1999) in which these categories are appreciated because they provide the best explanation for the *reliability of induction* (or *inductive success*), not the inductive premise. In this view, natural kinds are not supposed to solve the justificatory problem of induction. For an inference externalist, there seems to be no significant difference between the justification of an inductive inference and the explanation of its reliability. For an inference internalist, however, there is a significant difference

Natural Necessity as an Alternative

Considering that (4) is entailed by premises (2) and (3), and they are inferred thanks to their explanatory power as regards (1), one may ask why not initially postulate (4), rather than begin with (2) and (3), in order to legitimate the inference? In other words, instead of appealing to natural kinds and essential properties to explain (1), why not invoke necessary relations directly? Since (4) entails (1), necessary relations seem to be capable of affording a rival explanation for (1), with also an advantage, if the simplicity of explanation is taken into account and simpler is taken as metaphysically weaker. Regarding the premises, two metaphysical postulates are involved in (2) and (3): the ideas of natural kinds and essentialism, while only one metaphysical postulate is involved in (4): the idea of necessity. Since the idea of natural kinds, as it is postulated above, involves itself necessary relations between properties,[5] premise (4) turns out to be weaker. It urges us to recast the inference in a simpler form:

Inference (B)

(1) All observed Fs have been Gs.

(4) If something is F, it necessarily is G.

Therefore,

(5) All Fs are Gs.

This parsimonious version, surprisingly, is followed by an undesired consequence: the idea of natural kinds is removed from the inference, as the inference is vindicated without appealing to natural kinds. It recalls, surprisingly, an alternative solution to the problem of induction, offered by philosophers of natural necessity (Shoemaker 1980; Foster 1983; Armstrong 1983; BonJour 1998; Tooley 2011). Before articulating this suggestion, let us pause here to see whether no other advantage is supplied by natural kinds, compared to the natural necessity, which invites us to keep kinds. Among others, a virtue traditionally associated with natural kinds has been their capability to systematize the generalizations, namely to include a multitude of interconnected properties in a kind, and allow us to implicitly make these generalizations, while working with kinds. Kinds' epistemic virtue is therefore

between them. For him, then, the above-mentioned second view would not be a solution to the problem of induction, since this problem challenges the justification of inductive inference, and needs something more to be answered, something like what the tortoise asked from Achilles discussing the deduction, in Carroll (1895).

[5] Not to deny other accounts of natural kinds, Boyd (1999) for example, treats essentialism and necessitation differently.

a pragmatic one. It is, in other words, a matter of economy of thought, which contributes significantly to the abbreviation of the laws of nature postulated in the scientific theories. However, not in every case of scientific laws, natural kinds are legitimate to be presupposed. In the law of momentum conversation, i.e., $m_1v_1 = m_2v_2$, for example, only properties are illustrated, and no kind, implicitly or explicitly, is involved. Then, one may claim that there are at least some generalizations in science to which natural kinds do not contribute.

The fact that natural kinds are only pragmatically useful, and even in some cases not pragmatically useful, corroborates the idea that, ontologically speaking, kinds are not as substantial as properties. It could support views of natural kinds in which these categories were taken to be interim tools of practicing science. Recall, for example, Russel's claim that the doctrine of natural kinds "is only an approximate and transitional assumption on the road towards fundamental laws of a different kind" (Russell 1948, 391), or Quine's claim that "we can take it as a very special mark of the maturity of a branch of science that it no longer needs an irreducible notion of similarity and kind" (Quine 1969). It also works as an argument against the ontologies which regard kinds as substantial as properties,[6] as far as the epistemic utility of natural kinds was regarded to contribute to their substantiality.

Hence, as argued above, there are at least some inductive inferences which can be legitimated by appealing to the idea of necessity. Now, one may wonder which kind of necessity should be involved in this reconstruction. Considering that the *explanandum*, "all observed Fs have been Gs," is confined to the actual world, the metaphysical necessity, which ranges over all possible worlds, would make *the explanatory hypothesis* redundantly strong. Then, as far as natural necessity is considered to be weaker than metaphysical necessity, as it is restricted to the worlds governed by natural or physical laws rather than metaphysical laws, the necessity in line (4) is preferred to be regarded as natural necessity.[7]

This line of argument is taken further by Beebee (2011) who noticed that natural necessity is yet too strong. In her words, "the fact that what calls for explanation is only that the observed *F*s have been *G*s is important, since alternative explanations come into play, aside from the one that postulates timeless necessary connections" (Beebee 2011, 509). Natural necessity, according to her, was the best explanation, if the explanandum had been "all Fs have been Gs." But when only "*so far* observed Fs have been Gs," the best explanation seems not to be a natural

[6] Lowe's *The Four-Category Ontology: A Metaphysical Foundation for Natural Science* (2006) is an instance.

[7] Philosophers who take natural necessity as a sort of metaphysical necessity (Shoemaker 1980; Swoyer 1982; Ellis 1999; and Fine 2002) naturally skip this moderation.

necessity, unless it conjoins with another statement, i.e., "unobserved Fs have been Gs, too." The rationale in Beebee's argument is that a hypothesis may be the best explanation for A&B, without being the best explanation for A or B. Hence, she introduced a moderate version of necessity, namely a "time-limited necessity" (N_t), as a preferred explanation for the inductive premise (1). This notion of necessity, however, would not be a solution to the problem of induction anymore, simply because (5) is not entailed by N_t.

Time-limited necessity is a relation with a time index, according to which the conjunction between F-ness and G-ness necessarily holds until *t*, without holding necessarily thereafter. But how can a relation be genuinely necessary and expires at a particular time? Beebee (2011) and Psillos (2017) attempted to answer this question. But I want to address the question in a different way, since what is involved in N_t (F,G) can also be recast in a more familiar way, by employing a Goodmanian indexed-predicate. Then t (F,G) can be replaced by N (F,G_t), where Gt means "G until t."[8] While the inductive premise is explained by both relations, none of them supports inductive inference, in a way that rules out inductive skepticism. Now, the question is that among the predicates G and G_t, which one is preferred? And as clear, it is the very question raised by the new riddle of induction. Then, the debate on the timeless necessity and time-limited necessity is connected to the debate on ordinary predicates and indexed-predicates. As time-limited necessity leaves Hume's problem unsolved, answering the old problem of induction turns to depend on an answer given to the new problem of induction. Then so far as we have any convincing solution to set grue-like predicates aside, we have likely a solution to prefer N(F,G) over N(F, G_t).

Cases in Favor of the Uniformity

Now, let us go back to the inference (B), to see whether the rationale ascribed to set natural kinds aside is applicable to the necessity itself. In other words, isn't there any weaker metaphysical alternative to support the inference, compared to necessity? As far as the explanation for (1) is concerned, and the explanation is treated as an entailment, one may ask why not remove the line (4), and employ (5) directly as an explanation for (1)? Is not it possible to use (5) as the best explanation for (1) and take it to be true, based on an IBE? A third inference comes with the positive answer to this question:

Inference (c)

[8] Such predicates were introduced by Armstrong (1983) as quasi-universals, but just to be rejected as opposed to genuine universals.

(1) Observed Fs have been Gs.

Therefore

(5) All Fs are Gs.

Obviously, this inference may look premise-circular, as the conclusion is indeed the conjunction of premise (1) and a hypothetical statement: "non-observed Fs are Gs," and as the latter sentence has nothing to do with the explanation of (1), it seems that the burden of explanation is ultimately on the first conjunct, which is at the same time the *explanandum*. Without denying the circularity, it seems to me that it goes indeed back to the IBE structure, not to this particular case, or to the inference itself. Note that an explanation referred to here is not a causal explanation, which offers, for example, a mechanism responsible for Fs' being G. What is meant by the explanation in this inference is a formal explanation, which involves an entailment to the *explanandum,* that obtains in the above inference. Then, this apparent circularity can be ruled out, as far as IBE is recognized as a legitimate rule of inference in cognitive activities.

Adequacy of uniformity as a solution to the problem of induction, however, has been challenged extensively by the necessitists. As Foster (1983) argued, necessity is required when it comes to distinguishing between uniformities by accident and uniformities by necessity. Necessity, in Armstrong's terms (1983), is also an ontological basis which warrants that uniformities observed between the instantiations of Fs and the instantiations of Gs hold in every point in time and space. Furthermore, necessity is fruitful to explain the uniformity observed, as Tooley (1977) illustrated. Nonetheless, there are two cases which show that the justification of induction cannot exclusively depend on the necessity:

First, successful inductions are not confined to natural science. In social science, and also in everyday thinking, we commonly make successful inductive inferences, while necessity is very hard to be supposed in the social realm. As in natural science, there are some law-like statements in social science, which support inductive inferences, while these statements are often claimed to be not necessary. Take, for example, the relation between money supply and inflation, which goes as follows: 'Inflation will happen, if the money supply grows faster than the economic output.' To suppose any kind of necessity in this relation seems not conceivable. Some philosophers who understand laws as something necessary even preferred to call regularities in social science as 'trends', underlining their difference from laws, and saving the latter for the regularities in nature (Little 1986). Theories of social reality, Searle's (1995) for example, also leave no room for any kind of necessity, metaphysical, natural or conceptual, in the social realm.[9] According to Searle, the institutional reality is constructed through the acts of collective intentionality and is grounded on social conventions, which keeps arbitrariness an essential part of the social phenomena.

Second, the solutions for the problem of induction are not confined to ontological solutions. As it is known, Bayesian theories have been very successful in addressing this problem. Thanks to the conditional probabilities, it can be shown that likeliness of a belief regarding unobserved cases can be updated through the next observations, following such an equation: $P(E'/E) = (E'/H)\ P\ (H/E)$, where E' stands for an unobserved instance, and E for all observed instances. As clear, a Bayesian approach is indifferent to the nature of theories, pieces of evidence, properties, the relation between them, and even the agent who grasps the evidence. No matter whether he is Russell or its turkey, Pavlov or its dog, and whether the context is natural or social. The logic of belief update is in all cases uniform. While connecting necessity to the justification of induction leads to discrimination between inductions in the natural and social sciences, Bayesian approaches treat them uniformly. In other words, any kind of discrimination between inferences based on their ontological basis seems to be untenable in a Bayesian approach. Putting it in terms of natural kinds, one can say that no matter whether a kind is natural or social, or even artificial, what supports an inductive inference is its reliance on the kind-hood, not the naturalness of a kind. Then, social and artificial kinds can be as justificatory to the induction as natural kinds are. In other words, making inductive inferences over screws and iPhones, or over money and police, are as justified as making inductions over horses and woods. The fact that dogs are ancestrally wolves which were evolutionarily manipulated by human beings makes no difference in tenability of inductions over each species. Therefore, to make the justification of induction depends on the necessity will be accompanied by two unpleasant consequences: it is against our observations regarding practicing social science, and it underlines discrimination which is not found in other successful solutions to the problem of induction.

Conclusion

Inductive inferences are made in different contexts, based on different evidence, and by different subjects. In some cases, in natural science for instance, natural kinds are fruitful means to support these inferences. In other cases, some natural laws for

[9] While necessity is ruled out from the social realm by most philosophers, there were also some exceptions, Hegel for example, who found necessary interconnections in the social realm.

example, the natural necessity is a proper ontological idea to support an inductive inference. In some cases, in social science or everyday thinking, nonetheless, necessity is neither an economic nor a tenable idea, to be supposed to support the inductions. There, uniformity of nature is perhaps all we need to support an inductive inference. Then, when it comes to an ontological solution to the problem of induction, a proper strategy is probably to welcome the plurality of ideas helpful to induction, and to take pragmatic considerations into account in order to judge in every single case.[10]

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