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Inductive Inference, Rationality and Pragmatism: Peirce and Ajdukiewicz

ABSTRACT. This paper interprets the problem of inductive inferences through the lens of a pragmatistic approach. Such an approach privileges the norms of scientific inquiry over a hard scheme of rationality that does not tolerate fallible doctrines and thus tends to reject inductive inference as reliable. The paper shows that both Charles Sanders Peirce and Kazimierz Ajdukiewicz shared a pragmatistic model of rationality that helps to value the role of induction in scientific inquiry by emphasizing (1) the possibility of the self-correcting experimental character of statistical induction in the case of Peirce and (2) a model of rationality that favours the norms of inquiry over a strict scheme of rationality that completely rejects the possibility of using fallible methods, in the case of Ajdukiewicz .

KEY WORDS: induction, pragmatism, Ajdukiewicz, Peirce, models of rationality

There is little serious doubt about the role of inductive inference in scientific inquiry, as it has proven to allow knowledge to grow. The concerning lack of agreement, however, is about the justification of induction itself: Induction has been associated with fallible reasoning and therefore its reliability has been brought into question. Philosophers, famously Hume and Popper, have been very harshly critical of inductions, for reasons that will be spelt out below. This paper presents the philosophical stance of the pragmatistic approach of induction, championed by many philosophers and scientists, but most notably and interestingly in the cases of Charles Peirce (1839–1914, the famous polymath founder of Pragmatism) and Kazimierz Ajdukiewicz (1890–1963, a prominent member of the Polish logical

movement and Lvov–Warsaw School). These two philosophers belong to different historical periods of philosophical development, but share a common interest of ascribing priority to the practical consequences of adopting beliefs, attitudes, methods and practices. Both Peirce and Ajdukiewicz were brilliant logicians and, last but not least, both were deeply involved in the science of their time, for which direct experience in scientific endeavours helped them to contrast the value of their theoretical constructs. These facts make the establishment of a connection between the two philosophers philosophically interesting and illuminating, as their considerations on the value of induction seem to converge in the priority of a self-controlled scientific practice. In the following lines I will introduce the accounts of the inductive inference of both philosophers and later on recollect their contributions for a pragmatistic model of rationality that is friendly to inductive inference.

It has to be said that there is no evidence, to my knowledge of the works of Ajdukiewicz published in English, of the Polish philosopher quoting Peirce directly, which makes the connection and convergence ever more interesting.

Induction as problematic

The traditional complication of accepting inductive inference is in the hardness of justifying what Hume put in these words “instances of which we have had no experience resemble those of which we have had experience” [Hume, THN, p. 89]. The problematic aspect of this kind of definition of induction lays on the following dilemma:

a. Either we justify induction by a deductive inference or by an inductive inference
b. Induction does not hold by deduction, because it is contingent
c. Induction cannot be justified by induction, as this will be circular
d. Therefore; induction cannot be justified

Hume’s traditional challenge to induction, however, presupposes a very fundamental definition of induction, for which the argument as it is

presented starts to shake. More importantly, though, it seems that in the face of the dilemma a. there is an assumption that the only ways of justifying a method of inference are deductive (if they cannot be inductive). If we manage to show that this is a false dilemma, then we will have ways of defending induction.

Peirce's and Ajdukiewicz's accounts will present us with views that I will call "pragmatist". Pragmatist considerations are approaches to justification by means of which we can express that an inferential practice has to be contextualized and located in establishing methods of inquiry that are evermore self-controlled and yet fallible.

Karl Popper thought that in the face of this problematic character one should altogether reject understanding induction as part of the accepted elements of scientific reasoning. Popper presented a picture of scientific inquiry that roughly appears as deductive and completely free of inductive inferences:

> [A] theory of induction is superfluous. It has no function in a logic of science… The best we can say of a hypothesis is that up to now it has been able to show its worth, and that it has been more successful than other hypotheses although, in principle, it can never be justified, verified, or even shown to be probable. This appraisal of the hypothesis relies solely upon deductive consequences (predictions) which may be drawn from the hypothesis: There is no need even to mention "induction". [Popper, LSD, p. 315]

The predictive character of a given hypothesis is provided by deductive means, and is potentially awaiting for a decisive event that can prove it wrong (deductively again). In this paper I will challenge this view as a crass characterization of the behaviour of a hypothesis for the following reasons that seem to be at the basis of the Ajdukiewicz defence of induction:

1. It is not clear that all hypothesis can be decisively falsifiable in the alleged deductive manner.
2. Such a picture neglects the value of statistics and probability in scientific practice, and thus throws away inductions that seem reliable due to the potential danger of bad inductions.

3. Popper's picture oversimplifies the nature of scientific-error: in order to understand what can be a falsation event we need to be able to understand what kind of conditions are needed for giving significance to statistical data a probabilistic data.

Peirce on induction

In Peirce's famous expression, induction is an ampliative form of inference. Other relevant forms of inference as deduction, which is explicative and abduction, which is hypothetical, present us a complete picture of the usual forms of inference that constitute rational behaviour.

Induction as self-correcting

Peirce championed the idea that induction can be considered a self-correcting inferential activity. Peirce defined induction in these terms:

> Induction is the experimental testing of a theory. The justification of it is that, although the conclusion at any stage of the investigation may be more or less erroneous, yet the further application of the same method must correct the error. [Peirce, CP, 5.145]

Deborah G. Mayo comments on the above definition explaining that inductive methods (as long as they are understood as methods of experimental testing) can be understood as error-correcting methods and formulates the following thesis:

> Self-Correcting Thesis SCT: methods of inductive inference in science are error correcting; the justification for inductive methods of experimental testing in science is that they are self-correcting. [Mayo, 2005, p. 299]

Of course, traditional views of probability would hardly accept that such inferential practice is about self-correction: For example, it is hard to establish a conceivable self-correcting practice of rudimentary induction: qualitative induction can formulate a severity test, but only when it ap-

proaches a statistical pattern. A statistical conception of probability can, nonetheless, provide a much more reliable severity test, as it can be defined as asymptotically correct and can generate arguments that have the general structure of a Modus Tollens.

Ajdukiewicz on induction

Ajdukiewicz introduced a consideration of the logic of inductive reasoning from the viewpoint of a fallible theory: if our inferences provide us with a right balance of degrees of certitude and degrees of reliability, we can cautiously accept that the methods of induction have a value that counts in the context of inquiry.

Ajdukiewicz, however, does not deny the fallible character of induction: He introduces a working definition of inference that provides a first frame of what rationality strives for:

> We call *inference* the activity of the mind consisting in that on the basis of accepting with some degree of certitude sentences called *premises*, the acceptance of another sentence, called *conclusion*, is reached with some, but always greater than before, degree of certitude. [Ajdukiewicz, 1974, p. 13]

Ajdukiewicz also introduces two important notions that we should care to define too: inferences reach *degrees of certitude* and *degrees of reliability*. The acceptance of a sentence accompanies a subjective state called the "degree of certitude". The degree of certitude is subjective but can be measured objectively by a calculus of profits and losses: thus far these notions are expressed in the traditional calculus of probabilities. However, Ajdukiewicz expresses that there is yet another degree that has to be considered important for our calculus to be complete: the degree of reliability. Ajdukiewicz defines this with these words:

> …By *degree of reliability* of a given scheme of inference I shall mean the ration between the number of values of the variables (or of the systems of values of the variables) occurring in this scheme which satisfy both the premises and the conclusion, and the number of those which satisfy the premises. [Ajdukiewicz, 1974, p. 18]

This degree is an innovation that presupposes an acquaintance with the experimental conditions and contextual aspects of a given induction. The ratio of the degrees of certitude over the degrees of reliability offers us a reason to justify a given induction not only in virtue of the induction, but in virtue of the clear fitness to fit a purposive behaviour. Therefore: an induction is a form of inference whose ratio will show us in a systematic manner how a given set of information is relevant to a goal. Induction, thus, is methodologically and pragmatically acceptable as a method that will provide us the means to achieve a goal in the context of an unsettled decision.

Models of rationality

It has been established that the virtues of accepting pragmatistic accounts of inductions on the grounds of their balance of reliability is given in the capacity of induction to push scientific inquiry forward. The claim has a number of philosophical bearings to a conception of rationality. Thus, models such as the nomological-deductive, for example, tend to dismiss the value of induction due to the lack of validity in the traditional sense. I do not want to contend against deductive models of rationality here, but to explain that such kinds of models need to be adapted to our goals. This means that if our goal is to test the validity and consistency of a theoretical framework, then the model is highly suited to adapt favourably to our needs. Nonetheless, this paper has framed induction not in the context of an established set of information, but focuses in the very activity that provides us with the information that is deemed to interact with our beliefs: this interaction is inevitable. The goal, however, is to make that interaction self-controlled, and thus a model of rationality will be purpose-sensitive. This means that the traditional conceptions of models of rationality fall short for this task. Although proven effective, the traditional models of rationality focus on the norms of the correct reasoning of a given set of propositions. In these models, we can prima facie revise deductive relations and consistency, which does not necessarily mean that conceptual change is impossible, but we use logic in a certain convenient isolation: the established truth of the propositions plays a fundamental role, and the

model spins off a theory that exhibits facts of validity. There are two main approaches used to understand these facts of Rationality:

(a) Model Theoretic approaches (MTA)
Sentence A follows logically from a set of sentences M, iff every model of M is a model of A. It is based on truth transmission.

(b) Proof Theoretic approaches (PTA)
Proof theoretic consequence is normally understood as derivability in a formal system. A sentence A is derivable from a set of sentences M using the axioms and inference rules of K. (e.g. BHK)

Regardless of our adoption of one of the two models above, these have already taken for granted the facts of validity in a set of hypotheses that, if not deemed true, at least they are taken as proven as accepted or working assumptions. Such models will not engage in the idea of spelling out how can we experimentally settle the truth of them.

The error-correcting approach to induction, as well as the primacy of fulfilling practical goals, expands our models of rationality to the point that they can use fallible methods that reveal statistical tendencies. The statistical information is a necessary step in the establishment of a severity test: information has to be contrasted against experimental conditions that will help us to grow in degrees of reliability. Does this mean that we can risk ourselves to errors? Indeed, and rightly so. Error has informational value, it provides us, at least in science, with what is called "scrap value". We can learn from our errors and mistakes as long as we have a systematic way of accounting for them: this is the value of induction against the backdrop of a pragmatistic approach to rationality. In the pragmatistic approach of rationality the primacy is given to practice: this means that we can induce with ever more technical precision and still be considered rational, even though we blunder every now and again in our striving to achieve scientific knowledge.

What model of rationality fits inductive inference?

Ajdukiewicz establishes that the rationality of inference can be reconsidered as balancing away the degrees of certitude over the degrees of reliability that can be disclosed in the practice of inductive inference:

> A sufficient condition for some method of inference to be rational from the practical point of view is that the degree of certitude of conclusions derived according to this method from true premises does not exceed the degree of reliability of this method of inference. [Ajdukiewicz, 1974, p. 22]

The latter quotation stands for what Ajdukiewicz saw as the practical point of view. He cares to tell us that what he aims to provide is not a logical account of induction, but a way of value induction in the context of inferential practices that have a methodological profit in achieving cognitive goals. Ajdukiewicz expresses:

> When do we call human activity rational? We call it rational when it leads to the goal. Thus, the concept of rationality of action requires relativization to some goal. Some way of acting may be rational with respect to one goal, but irrational with respect to another. [Ajdukiewicz, 1974, p. 20]

And he presents the pragmatist point of view as a fair criterium to accept a practice of inference as rational:

> We shall accept as rational from the practical point of view a certain method of inference, if the balance of profits and losses resulting from the activities based on the conclusions obtained by this method from true premises is not negative – after this method of inference has been applied for a long time. [Ajdukiewicz, 1974, p. 21].

Peirce's pragmatism can be conceived as a proposal to understand rationality from a particular stance related to his other contributions. Ajdukiewicz's pragmatic approach relativizes the traditional dilemma of induction, subjecting it to the primacy of fulfilling practical goals present in science and its methodology. In this paper I have identified an aspect of rationality which is specific to understanding the concepts involved in fallible approaches to the logic of scientific inquiry and the scientific practice of a statistical and probabilistic nature: rationality can be identified with logic as long as any principle acknowledged as rational is due to the ways we have to explain and abstractly represent the processes by which a conclusion, C, is offered to a problem, X. These things being so, the fol-

lowing questions crop up for logic as well as for rationality: Is there a way to accept fallibility in order to avoid "blocking the road of scientific inquiry"? The views of our philosophers introduce a way of help to see that a pragmatist attitude can reconsider the neutralisation of error given in proposals that reject falsity and still respect a sensible and consistent practice of logic (what could be recognised as a *Logica Utens*).

Now, the concept of *Logica Utens* is strikingly close to what appears to be the requirements of self-controlled inquiry, whose norms are norms for successful inferences (inductions, deductions and abductions). Pragmatism is a method to achieve a process of successful unblocked inquiry, and renders it possible to think that even what we consider as a fallible method within a system might as well have an informative aspect.

Regardless of whether we have chosen either of the two interpretations, we need to deal with abstract objects and their relations, and they obviously can be revised in the system, but the logical facts of the abstract objects themselves do not change: they are tantamount to relations between abstract objects. The objects of scientific inquiry exceed traditional models of rationality because they need sophisticated theorising to be observed and experimented upon: induction provides a way of approaching these objects in a systematic manner and, therefore, induction is justified as a systematic means to achieve our goal, i.e., pragmatically.

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