

One approach to Escaping the Pragmatic Problem of Induction: Sailing Between Scylla and Charybdis

Nathan Oseroff

December 18, 2017

Introduction

Popper's programme of hypothetico-deductivism is often thought to produce what Wesley Salmon refers to as a *pragmatic problem of induction*. There is a dilemma: either (1) rational decision-making rests on decisions that are not known to be more likely to be successful based on their past success (thus rational decision-making is impossible) or (2) decision-making is known to be more likely to be successful based on their past success (and thus inductive approaches are inevitable). If this dilemma is not sidestepped, inductive approaches to rational theory preference are (so Salmon concludes) unavoidable.

I first show that some formulations of the pragmatic problem of induction are analogous to the problem of underdetermination: while the pragmatic problem of induction is directed at *reasons for action*, the underdetermination thesis is directed at *reasons for belief*.

Consequently, hypothetico-deductivist approaches can avoid the dilemma if there is the possibility of developing a theory of rational decision-making that does not rely on the previous success of the decision-making process, presenting an analogous hypothetico-deductive solution to the problem of underdetermination. This requires not making the implicit assumption that a rational subject ought to give greater credence to decision-making processes that have had previous success. This approach is successful if there are *non-evidential* grounds (i.e., reasons both for belief and action that are not inductively supported) for rational decision making. I argue such grounds exist.

1 Introduction

Reasons for belief and reasons for action are often differentiated in philosophy, but there should be a clear *prima facie* explanation for making this differentiation. One brief plausible explanation is as follows: it is possible, in the absence of reasons for belief for a subject to suspend belief, for there are no reasons to think the belief is true, reliable, warranted, and so on. Yet, the suspension of belief is itself an action. Therefore, there is a reason for action without a corresponding reason for belief.

We can sort between reasons for action and reasons for belief by noting that reasons for belief are often of primary interest in attempting to solve *theoretical problems*. These theoretical problems often have no immediate or obvious practical concern or may not have any future application (e.g. results in theoretical physics, philosophy or maths). This is *rational theory preference* directed at theoretical problems.

On the other hand, reasons for action concern *practical problems*. Unlike theoretical problems, practical problems involve relatively immediate issues that require action: which path in a forest to take, whether to buy insurance or invest in stocks or bonds. Rather than rational theory preference, reasons for action are concerned with *rational decision-making*, caring only about satisfying immediate (and close to immediate) goals of a subject when faced with uncertainty.

It is this latter category of reasoning that a particular version of hypothetico-deductivism called *critical rationalism*, as developed by Popper and his students William W. Bartley and David Miller, are subject to an apparently debilitating criticism. Hypothetico-deductivist accounts give an account of rational theory-preference and not an account of rational decision-making. There is no presently accepted account of practical action under hypothetico-deductivism accounts (although Miller 2009 attempts to construct one approach). Other students of Popper like Imre Lakatos and John Worrall, when faced with falling short of giving an account of rational decision-making, ultimately accepted some sort of inductivism as the only viable approach. What was booted out the front door as unacceptable for rational theory-preference has returned quietly through the window under the guise of rational decision-making.

1.1 Summarisation

I will now give a brief summarisation of the critical rationalist conception of science. All exegesis will be left to the footnotes, which can be avoided if desired. This summary is necessary to understand how and why the pragmatic problem of induction was considered so worrisome to Lakatos and Worrall.

1. During the *context of discovery*, there may be cases of scientists that make abductive or inductive inferences; however, this is a psychological thesis, rather than an epistemic thesis. As Richard Rorty in *Philosophy and the Mirror of Nature* objected to Locke's causal explanation of the origin of a belief as justification for perceptual belief, this same objection is directed at causal explanations for the formation of scientific theories.¹
2. During the context of justification, a scientific theory is retained until there is some criticism indicating that, given the available empirical evidence, it is false or likely to be false.²

¹Inductive inferences in the *formation* of scientific theories no more make the resultant scientific theories likely to be true than conjectures made under different circumstances and due to different psychological causes, for example, August Kekulé's dream of the shape of the benzene molecule linked to the shape of the ouroboros.

Other examples include Sir John Eccles' and Otto Loewi's dreams of crucial experiments. While Loewi says, 'the night before Easter Sunday of that year [1920] I woke, turned on the light and jotted down a few notes on a tiny slip of thin paper. Then I fell asleep again. It occurred to me at six o'clock in the morning that during the night I had written down something most important, but I was unable to decipher the scrawl.' (Loewi O. An autobiographical sketch. *Perspectives in Biology and Medicine*, 4, 1, 17, 1960.)

The loss of Loewi's crucial experiment is a shame, and while the specifics of their crucial experiments are not of interest here, what is of importance is that if these imaginative and unconscious insights are explained equally well by inductivists and non-inductivist gestalt psychologists like Otto Selz and Karl Bühler working with the Würzburg school of psychology, Piaget's theory of learning or Adriann de Groot's work on the psychology of problem solving in chess (*Thought and Choice in Chess*, Mouton Publishers, The Hague, the Netherlands, 1978), then inductive inference as a *psychological* phenomenon then applies to almost any and all belief-formation processes, even those that appear antithetical to paradigmatic examples of inductive inferences. If all belief-formation processes are inductive it is therefore useless as a psychological explanation or the formation of belief. 'Induction' as theory-formation is therefore an empty word deserving of elaboration on what distinguishes an inductive inference from a guess or dream.

Eccles, for example, recalls the development of the Golgi-cell theory of inhibition as follows: 'Then in 1947 I developed an electrical theory of synaptic inhibitory action which conformed with all the available experimental evidence. Incidentally this theory came to me in a dream. On awakening I remembered the near tragic loss of Loewi's dream so I kept myself awake for an hour or so going over every aspect of the dream, and found it fitted all experimental evidence'. (Eccles JC. From electrical to chemical transmission in the central nervous system. *Notes and Records R Soc Med*, 30, 2, 219-230, 1976.)

Thus, as a psychological theory of belief-formation, any scientific theory that is formed historically as a product of an inductive inference is not granted any special privileges over other scientific theories that have non-inductive histories. In short, the genesis or heritage of a belief is irrelevant when considering whether the belief is more or less likely to be true.

²This, it should be noted, is quite different than how falsificationism is usually presented in undergraduate classes, but it differs greatly from the literature that sprung up after the publication of the first edition of Popper's *Logik der Forschung* in 1934, especially in the publication of the greatly expanded English translation, *The Logic of Scientific Discovery* in 1959, as well as in the work

3. There is no suitable account during the context of justification in which scientific theories are made more probable or given corroborating evidence the credence in any scientific theory ought to increase.

With this brief summary in place, I will now present three reconstructions of the pragmatic problem of induction, each with different conclusions...

2 The pragmatic problem of induction

In this section I first begin with a dilemma. No matter which option is chosen, the hypothetico-deductivist loses. In later sections of this paper I attempt to show some way out of this dilemma, but any route taken is liable to collapse into either horn of the dilemma if there is not proper care taken to avoid certain problems, namely accepting that past success is likely to lead to future success or that in order to have a reason for belief the reason for belief must itself be justified.³

The dilemma that faces the hypothetico-deductivist is explained by Worrall as follows: either a hypothetico-deductive approach will *fail* or else *beg the question*. (John Worrall, 'Why Both Popper and Watkins Fail to Solve the Problem of Induction', D'agostina and Jarvie (eds) *Freedom and Rationality: Essays in Honor of John Watkins* (Dordrecht: Kluwer: 1989), 277).

Consider Scylla, one horn of the dilemma: take it that there exists a principle *P* that, if it were justified, would solve the pragmatic problem of induction. If this

of Popper's students like Lakatos and Feyerabend and 'fellow travellers' like Mario Bunge, Hans Albert, Peter Medawar and John Eccles.

While it is not my intent to go into detail how critical rationalism and other hypothetico-deductive theories of rational theory preference are or are not preferable to other theories of rational theory preference, it is my intent to give it a fair hearing before it confronts the pragmatic problem of induction. The claim is *not* that if there exists a falsifying instance of a scientific theory the scientific theory must immediately be discarded or that falsification is ever definitive. That would be absurd. Many outcomes of experiments, as Duhem and Quine (and Popper himself) note, are incredibly controversial, and require a great number of auxiliary hypotheses and assumptions about the experimental setup. Any one of these auxiliary assumptions may be in error.

However, if it is the case that there is an unanswered criticism of the *scientific theory*, the scientific theory must leave; if there is an unanswered criticism of an *auxiliary hypothesis* or *experimental setup*, these assumptions must leave also. They can only be permitted back into the fold so long as these criticisms are in fact answered in a way that the 'blame' of the existence of incoherence between the system of statements is placed elsewhere by giving a suitable explanation for distributing blame that replaces the previous explanation that targeted the scientific theory.

³This horn naturally leads to Agrippa's trilemma: if in order to have a reason for belief *p* one must have a justification *q* for that belief *p*, and that justification must be expressed in propositional form, *q* must itself be justified by another justification *r* or a conjunction of justifications, thus leading to an infinite regress or a vicious circle; if *q* is not justified, then to accept *q* would be to beg the question.

principle P is to be accepted, there must be a theory of reasons for belief that permits accepting this principle P . This theory serves as a justification for this principle P . Assume that the theory of reasons for belief is hypothetico-deductive: hypothetico-deductive reasons for belief ought to be rationally preferred over all other theories of reasons for belief. This approach looks *prima facie* plausible as well, given the problems that face inductivist theories of reasons for belief.

The hypothetico-deductive theory of reasons for belief, as explained above, forbids inductive inferences. If this justification entails the principle P , this justification will also be in need of being justified, or else the justification for P would *beg the question*. Why, after all, should a hypothetico-deductive theory of reasons for belief be accepted and not other theories of reasons for belief? There must be another justification for accepting the hypothetico-deductive theory of reasons for belief, and this justification cannot *solely* be that inductive theories of reasons for belief fail, as if hypothetico-deductivism is the only game in town, for the hypothetico-deductive theory of reasons for belief could fail *as well*. Thus, any deductive reason given for accepting hypothetico-deductivism is question-begging.

Now consider Charybdis, the other horn: if hypothetico-deductivism does not entail the principle P , it is either a tautology or does not entail the principle P . If it is a tautology, it is uninformative, and thus fails to justify the principle P in any way since it does not provide any support. There are therefore no reasons for accepting hypothetico-deductivism. If hypothetico-deductivism is replaced with another theory of reasons for belief that provides a non-zero degree of support for P but falls short of entailing P , then this replacement theory of reasons for belief smuggles in an inductive (that is, a non-deductive) inference, and therefore any modification to a hypothetico-deductivist approach to rational theory preference will let slip in inductive inferences.

In summation, so long as accepting hypothetico-deductivism requires giving good reasons for belief that hypothetico-deductivism is true, and on the basis of the truth of hypothetico-deductivism justifies a principle p , which solves the pragmatic problem of induction, there is no way out of this dilemma: one horn descends into question-begging; the other into inductivism.⁴

⁴However, should good reasons for belief extend to the elimination of all other plausible candidates, the dilemma is easily resolved *at least in principle*: if there is a finite number of candidates for theories of reasons for belief and all other candidates are dismissed as unsuitable due to defects but there are no presently discovered defects within a single candidate, then while it may not give reasons for belief that the presently defect-free candidate is true, it certainly gives good reasons for *preferring* this candidate over its rivals. These defects in other candidates give reason to believe that all other candidates are *false*.

For example, if there are n number of theories of reasons for belief, one of them being a hypothetico-deductive model of rational theory preference and all others being breeds of hypothetico-deductive/inductive, abductive or inductive models of rational theory preference,

2.1 How should this problem be interpreted?

The first reconstruction is to argue that two things must necessarily be true: rational decision making must rely on rational theory preference and rational decision making must be inductive. Since there is no hypothetico-deductivist account of rational decision making, this account must be inductive in order to bridge the 'gap' between rational theory preference and rational decision making.

The second reconstruction of the pragmatic problem of induction is, instead of an argument against hypothetico-deductivism, a compelling intuition pump that rational decision making made under total ignorance must be inductive, otherwise no decision can be made.

The third reconstruction is that rational decision making under partial ignorance is necessarily inductive, since it relies on the assumption that the reliability of any choice can be known (or the best available option is likely to be chosen) only if there is an inductive inference made.

and each of these models were effectively criticised leaving only one candidate *C* left, surviving all available criticism, this would be a good reason to think that the surviving candidate *C* is (at minimum) *preferable* to all the others.

Of course, it could be that a criticism was misplaced and another candidate model of rational theory preference is in fact better, but this is true in general: humans act under conditions of ignorance, not omniscience. Faced with ignorance, it is conceivable that in many cases there have been mistakes in reasoning or memory or omission, but conceivability is *itself* not a criticism of the possibility of candidate elimination of models of rational theory preference; what is needed is to show that the conceivability is an actuality: that there is a misplaced criticism of a rival model or an omitted criticism of the candidate model *C*.

To argue otherwise would be to assert that rational theory preference by the process of elimination is impossible in general or impossible only in this instance. If the former, then this is disastrous for the practice of philosophy, for this is how many philosophical programmes are frequently argued for in philosophical practice: the faults of other programmes are emphasised or uncovered through criticism while the positive attributes of desired programmes are emphasised or defended from criticism. Through this process of criticism and defence of programmes those that cannot be saved from criticism are eventually weeded out as unsuitable candidates.

If the process of elimination is impossible only in this instance, then there must be an argument presented for accepting the conclusion that rational theory preference for hypothetico-deductivism over inductivism (or *vice versa*) by a process of elimination is suitably different than in other contexts, perhaps, for example, by showing that there are in fact a large enough set of theories of reasons for belief that each survive criticism.

Whether this resolution to the dilemma is possible *in practice*, however, will not be discussed here, nor will there be an attempt to argue that this practice is truth-tracking rather than, as Darrell Rowbottom argues, solely *error eliminating*.

2.2 A failure to give a hypothetico-deductive account of rational decision making produce a problem for hypothetico-deductive accounts of rational theory preference

Our decisions are concerned with what will happen, or what has happened, but there is a lack of information about what will happen or what has happened, but is presently not known. Decision-making occurs, more often than not, in ignorance. While individuals may be ignorant, there must be effective planning for actions, otherwise individuals must trust in being fortunate in the face of ignorance. Thus, we must know something about the future, or at least have a suitably reliable way to make the right decisions when not in a position to know. Singular predictions about the future are of no use for future action after the singular prediction has passed—that is, they are unhelpful once they have been of use.

Hypothetico-deductivist theorists like Popper or Miller, however, do not give an account of scientifically informed decision making, or the accounts they have given are deficient. The deficiency is as follows: first, decision-makers use theories from science as a source of guidance to determine future action. There is an inference from premises consisting of scientific theories, auxiliary hypotheses and initial conditions to conclusions about decisions. We act ‘on the basis of’ our scientific knowledge, so the problem of practical action is reducible to theory-preference in much the same way as it has been reduced for the inductivist.

Thus, the reliance on theoretical reasoning during practical reasoning entails that hypothetico-deductivism accounts of rational theory preference are deficient, for it gives no account of which action to take. Instead, it gives an account only of what ought to be believed: hypothetico-deductive accounts of rational theory preference assert that there can be rational *preference* for one theory *A* over another theory *B* due to *B* being ranked as lower than *A* due to some disfavourable property of *B* (e.g., *B* is false, has less predictive content, is unable to be reconciled with other accepted theories that apply to other domains, and so on), while it is not presently decided whether *A* has these disfavourable properties (e.g., *A* may be true or false, have less or greater predictive content than *C*, be irreconcilable with other accepted theories applied to other domains, and so on).

Hypothetico-deductive rational theory preference lacks an account of rational preference for one theory over another due to one theory *A* being ranked *higher* than *B* due to some *favourable* property of *A* (e.g., *A* is true, or likely to be true, or gives reliable predictions that will be reliable in the future, or likely to be reliable in the future, and so on). Specifically, hypothetico-deductivism remains silent about any account of the truth or future reliability of *A*. Practical decision making must rely on theories that are true or likely to be true, but this is unavailable to the hypothetico-deductivist theorist.

Consider these two horns: Popper says that ‘we should *prefer* as basis for action the best-tested theory’ (Part I, section 2.III of *Realism and the Aim of Science* (1983)). But evaluating the past performance of a scientific hypothesis has, under hypothetico-deductivism’s lights, no bearing on its future success. Thus, as Feigl objected, and as Salmon (1981) repeated (Cf. Godfrey-Smith 2003, ch. 4, sec. 5), deductivism is unable to solve rational theory preference for future action. Unless the scientific theory a subject relies on for rational belief is well-confirmed, accepting the theory for practical action is a shot in the dark—and thus irrational. Even if it were the case that hypothetico-deductivism is correct that induction is superfluous in the theoretical sciences, it is indispensable for rational action in practical matters.

Furthermore, if hypothetico-deductivism is true, then we have no reason to think that a theory that is well-confirmed is more likely to be true than the theory that has been untested, and without epistemic reasons for belief (that is, that confirmation is taken as the primary or sole epistemic reason for belief), then rational theory preference is impossible for the hypothetico-deductivist in this instance. But this conclusion is absurd to the extreme, and applies *a fortiori* to all other cases of rational theory preference.

If we cannot base our everyday decisions on our scientific theories, then we cannot know how we ought to act. Epistemic reasons for beliefs are gone. Yet we have epistemic reasons for belief, namely empirical evidence, and from this evidence an inductive inference is made about the future success of scientific theories. Therefore hypothetico-deductivism is not a sufficient account of scientific method. Hume showed in his problem of induction, as Wesley Salmon says, only the obvious: induction is not deduction. (Wesley Salmon, ‘The Concept of Inductive Evidence’, *American Philosophical Quarterly* Vol. 2 No2, 1965, p. 265).

There is a great deal of theories that take scientific practice to be inductive in nature, and thus affirm that we ought to give more credence to scientific theories that are well-confirmed and ought give less credence to scientific theories that are not well-confirmed. This is supposing that we act ‘on the basis of’ scientific hypotheses. Under this account of the pragmatic problem of induction, the practical problem of preference of course of action reduces to the theoretical problem of theory-preference. Since practical decision making is reliant on scientific theories, and since practical decision making is inductive, rational theory preference must be inductive as well.⁵

⁵This interpretation of the pragmatic problem of induction will be addressed below and found to be too forceful in its conclusions: it goes too far, and opens itself to strong criticisms that other interpretations are not subject to; thus, this interpretation should not be accepted unless these criticisms can be overcome.

2.3 Rational decision making under total ignorance requires inductive inferences

The above interpretation of the pragmatic problem of induction is, I think, the strongest available in that if it is true then hypothetico-deductivism theories ought to be rejected as too limited to account for rational theory preference. However, there are other reconstructions of the pragmatic problem of induction that are suitably weaker and *almost* as effective: when faced with a choice when in *total ignorance*, that is, when a problem presents itself that does not share any obvious similarities with prior problems (thus no prior knowledge is clearly of use in this context), no past successful approaches to decision making stand out as plausible candidates.

When faced with a fork in the road and no information about which fork to take, for example, each choice is equally corroborated by past evidence (naturally, there is none that applies in this instance, since prior experience with forks in roads does not entail that the desired direction is related to past choices). In these novel situations there is total ignorance.

Acting in situations of total ignorance is therefore structurally identical to the underdetermination thesis as it applies to rational theory preference in the face of two equally corroborated scientific theories, just more pertinent for the subject: each choice is, given the available evidence *alone*, equiprobable, although as a matter of psychology the credence of a subject to any choice may be greater or lesser based on other reasons.

A scientific theory may be more aesthetically pleasing or parsimonious than its rivals, even if the evidence does not singularly pick out that theory or raise the credence in the theory; one path may look safer or well-trodden than the other to the traveller. Thus, the hypothetico-deductivism theorist and inductivist are, at least at first glance, in the same boat in between the horns of the dilemma: past empirical evidence *alone* in the face of novel problems is of no obvious help in choosing which decision should be accepted (thus this horn of the dilemma is unavailable), and assuming either an inductive or a hypothetico-deductive account that justifies a principle *P* is begging the question.

While at first the hypothetico-deductivist and inductivist sink together, the inductivist can respond that it is only the hypothetico-deductivist that will face Scylla and beg the question or fall for Charybdis and embrace inductivism. To the inductivist Charybdis is a *safe harbour*: they are permitted to make inductive inferences when in total ignorance, especially inductive inferences *based on* previous encounters of total ignorance. The inductivist is free to examine the present situation of total ignorance in light of past experiences of total ignorance and, while not relying on empirical evidence to inductively support their decision, can rely on whatever problem-solving methods they have used in the past to deal with

total ignorance.

Thus, no future encounters of supposed total ignorance are *in fact* in total ignorance, since the inductivist is free to consult past experience of how the inductivist has dealt with encounters of total ignorance and choose the past problem-solving method that has been most successful.⁶

This reconstruction of the pragmatic problem of induction leaves the conclusion open over whether rational theory preference is hypothetico-deductivist or not; rather, it is an intuition pump designed to show that under rational decision making, the only plausible approach is, presumably, an inductive method for dealing with total ignorance (i.e., an inductive inference *about* past choices made when in total ignorance, rather than inductive inferences *about* past situations of total ignorance), since hypothetico-deductivism theorists do not supply an account of rational decision making under total ignorance.

2.4 Rational decision making under partial ignorance requires inductive inferences

There are still more reconstructions of what the pragmatic problem of induction entails. Here is one more: rather than dealing with total ignorance, in many other situations that involve some sort of similarity to previous problems. In order for there to be guidance in practical decision making there must be some theoretical approach to future plans; there must be reliable rules of guidance when dealing with problems that are repeatable and have been (more or less) repeated. While there is rarely (if ever) any repeatable events in which what is repeated is *exactly* the same, there are certain properties of these events that share commonalities, and by discovering these commonalities, it is possible to create guiding principles on how to act based on these repeatable events sharing these commonalities.

Scientific knowledge often concerns itself with universal statements. Universal statements give a great deal of information about the future (and, in general, about the presently unobserved). It is therefore plausible that scientific knowledge should play an important role in pragmatic decision making. Thus, rational decision making is, at least in part, reducible to or reliant on scientifically informed decision making (i.e., rational theory preference)—or if rational decision making in most everyday contexts is not *de facto* reducible to or reliant on rational theory preference (that is, as a matter of our collective psychology humans rarely make rational decisions), there still exists an account of rational decision mak-

⁶Below I show that this approach to the horn is not as appetising as the inductivist may think, but for now it should show that there are, naturally, at least plausible inductivist approaches to this reconstruction of the pragmatic problem of induction that are immensely appealing to the inductivist.

ing that is scientifically informed. This account will necessarily be preferable to any current pragmatic decision making process by nature of its reliance on scientific theories, for any other approach will be unable to give an account of the commonalities of repeatable events.

The taxonomy of the pragmatic problem(s) of induction then includes the following: rational decision making in the face of problems that are similar to past problems requires a theoretical framework. The best candidates for a theoretical framework are our best scientific theories. Yet our best scientific theories are, if hypothetico-deductivism theories are adopted and inductivist theories rejected, not likely to be true, or not likely to be true if their likelihood is dependent on their past confirmations. Practical decision making is bound to admit inductive inferences. Thus, Popper's theory of corroboration in both rational theory preference and rational decision making surreptitiously becomes a pragmatic theory of confirmation, otherwise corroboration is no more than a report about the past performance of the theory, from which no inference can be drawn about future performance.

When an agent wants a theoretical framework to guide practical decision making, the theoretical framework is not valuable because of its explanatory power or its theoretical unity (although these properties may be helpful when considering whether to rationally prefer the theory), nor is its probability or verisimilitude, but rather its *reliability* in future events, and they are known to be reliable because these future events share commonalities with past events—but the Popperian approach is that there are no reliable methods, or at least no reliable methods known to be reliable *based on their past success*. This does not preclude the existence of reliable methods, only the ability to rationally decide which method should be accepted in any circumstance.

Of course, there is no guarantee that relying on a scientific theory for rational decision making will not fail, but the decision-maker is interested in *comparative* reliability. When choosing between two competing theories, she wants to know which is more worthy of adopting.

3 Replies from hypothetico-deductivism

There are several possible replies from hypothetico-deductivists, each reply accepting hypothetico-deductivism but leading to several different conclusions when faced with the above versions of the pragmatic problem of induction.

First, I will begin with a criticism about the possibility of producing an inductive theory of rational decision making. Proponents of the the pragmatic problem of induction often assume that rational decision making ultimately relies or reduces to rational theory preference, yet this assumption is doubtful, as Agassi

(Agassi, Joseph. *Technology: Philosophical and Social Aspects*. Dordrecht: D. Reidel Publishing Company, 1985) and Vicenti (Vicenti, W. *What Engineers Know and How they Know It*. Analytical Studies from Aeronautical History. Baltimore MD & London: The Johns Hopkins University Press, 1990) show.

Even assuming that this is true, the insistence that rational decision making must be inductive is as question-begging as hypothetico-deductive accounts. Inductivists do in fact share the same boat if rational decision making relies on rational theory preference. The first reconstruction of the pragmatic problem of induction as a criticism of hypothetico-deductivism is therefore equally effective as a criticism of inductivism.

I then address the second reconstruction of the pragmatic problem of induction, namely casting doubt on the further assumption that any epistemic reasons for rational decision making in total ignorance must *solely* be based on past experience rather than other reasons for belief. Basing solely on past experience rules out the possibility *a priori* of there being plausible frameworks that are not justified by past experience. Analogously, rational theory preference when considering two theories that are underdetermined by the available evidence is available to the inductivist and hypothetico-deductivist alike.

Even though past experience is unavailable to a subject there are still reasons for belief, for example, the scientific theory has greater predictive content than the other, is more precise than others in its predictions, fits better than its rivals into other theories, is more parsimonious, has greater explanatory content, and so on.

Therefore, if there are non-evidential (that is, non-inductive) reasons for *belief* (or, as explained above, reasons for *preferring*), there may be non-evidential (non-inductive) reasons for *action*, even if these reasons for action is arrived at by a process of elimination of rival courses of action.⁷

⁷The hypothetico-deductivist, however, cannot argue that acting on these non-evidential reasons for action should increase our credence in these courses of action without falling once more into inductivism. Rather, these non-evidential reasons for action give good reasons for action in *disfavouring*—in decreasing credence in courses of action.

However, there is the worry that by focusing on the negative aspects of reasons for belief leaves open the door to the pragmatic problem of induction once more: as with Goodman's new riddle of induction, on what grounds do subjects have reason to believe that a previously unsuccessful and demonstrably poor reason for action will not suddenly become a *good* reason for action in the future? The problem of induction comes back once more under a different guise: rather than giving good reasons for believing that past success should lead to future success in this case and not others, for it is refuted each time a species goes extinct, there must now be good reasons for believing that past *failure* should lead to future failures. This problem, however, targets not just the hypothetico-deductivist but the inductivist as well, so long as the problems that face inductivism within rational theory preference are not surmounted.

3.1 An initial criticism of the first formation of the pragmatic problem of induction

As a matter of historical analysis (see Agassi) there is substantial independence of theoretical and applied science from everyday decision-making. However, there is an independent argument that shows if the history of this independence is disregarded there still exists a problem showing that rational decision making relies on rational theory preference in the desired way. First, scientific theories that are universal in form do not, as Miller (2009) shows, prescribe; rather, they only proscribe. Scientific theories about aerodynamics, for example, say nothing about how to construct an aeroplane.

Instead, so long as they are true they place *limits* on how aeroplanes (or other modes of transportation in the air) can be built. There is therefore no logical relationship between relying on scientific theories and using the scientific theory to entail how one should construct an aeroplane, but rather how one should *not* construct an aeroplane. Thus, on these grounds the first formulation of the pragmatic problem of induction misconstrues the problem.

There is an 'out' for this interpretation, however, which relies on loosening this reliance on scientific knowledge to theoretical knowledge in general. We rely not just what our best scientific theories entail, for they entail only what is prohibited, but all our theoretical knowledge, for example, knowledge about initial conditions and auxiliary hypotheses, as well as knowledge in maths, engineering and philosophy.

3.1.1 The initial criticism continued: a pessimistic inductive argument for future failure

This approach of appealing to all our background knowledge—up to and including our past experience—I think, opens up a pessimistic inductive argument for many cases of rational decision making that is similar to the pessimistic meta-inductive argument for the likelihood of our present theories being false.

Once one admits background knowledge, not just empirical evidence that confirms a scientific theory, one includes evidence about how our theories (including theories about tools) have withstood criticism (including the durability of our tools). Based on past experience—namely, our background knowledge about light bulbs, bicycle tyres, bridges, computers, and all other sorts of tools—we know they often fail, and fail at the worst times imaginable. Richard Feynman expresses this pessimism in the *Appendix F* to the Rogers Commission into the Challenger Disaster:

We have also found that certification criteria used in Flight Readiness Reviews often develop a gradually decreasing strictness. The argu-

ment that the same risk was flown before without failure is often accepted as an argument for the safety of accepting it again. Because of this, obvious weaknesses are accepted again and again, sometimes without a sufficiently serious attempt to remedy them, or to delay a flight because of their continued presence.

So too does this increase in confidence over the past success of a particular decision within a specific context lead to decreasing strictness in testing whether the decision will continue to be more successful than its rivals. But to accept that decreasing the strictness in testing whether a decision will continue *just is* to accept that any increase in the credence of a decision over others is, at least in many cases, merely psychological.

There is no present method for determining whether increased credence tracks truth or is a psychological phenomenon other than to learn that increased credence does *not* in fact track truth—that is, it is purely psychological. Think of, for example, how the credence in every past *false* scientific theory continued to increase up to the point that the number of (Lakatosian) ‘monsters’ could no longer be explained away through monster-barring, that is, ruling out counter-examples. The only available method for discovering that there was a disjunct between expectation and result is to discover that the theory does not map on to reality. But there is no available method for discovering if theory maps reality, for this would require omniscience.

Otherwise, there is no way to tell whether the credence is a psychological phenomenon (the scientific theory is false, and subsequently fails sometime in a presently unexamined context, often when it is least expected) or in fact an epistemic phenomenon (the scientific theory is in fact true). In practical matters monster-barring can only go on so long before the subject is placed in peril, thus monster-barring is more often ends fairly quickly and is relatively decisive, as was the case in the Challenger disaster.

On the one hand optimistic inductive arguments show that past success following a choice ought to increase our credence in future success using that same choice, and thus decrease time spent wasted engaged in rational theory preference to see if this choice ought to be accepted once more. But pessimistic inductive arguments show that whenever there is a decreased strictness in testing there is a high likelihood that failure is not far off.

Thus, both inductive arguments give different answers for practical decision making: it is both rational to act by decreasing strictness in testing and keeping strictness in testing the same; it is both rational to increase credence and keep credence the same. Depending on the evidence that is accepted (i.e., whether the relevant class is the past success of a tool or the past failure of a tool), one ought to either prepare for the worst, knowing very well that the future is often unlike the

past, or be content in not preparing for the worst, knowing that the past success gives good reason to think that future success is likely. This is little more than to restate Hume's original problem of induction: if there is an inductive method, by which way is it possible to distinguish between good inductions and bad inductions? Within practical decision making the only way to distinguish between the two will be when the results of the decision has come to pass. One can know that they have made the correct induction only in retrospect. So too can one know that they have rationally decided in hindsight. There is therefore no foresight available to pick out which inductive method (i.e. pessimistic or optimistic) should be followed in any decision.

3.2 A second criticism of the first formation of the pragmatic problem of induction

If there are differing prior intuitions on whether it is possible to give a pragmatic solution to the problem of induction that does not reduce to a psychological solution (as shown in the previous section), it is likely that the hypothetico-deductivist will take hold of rational decision making made under total ignorance and use it as a cudgel to beat the inductivist. This worry is expressed as follows: Worrall's argument is equally effective in producing the dilemma in situations of total ignorance for the hypothetico-deductivist as the inductivist. By nature of being in a situation of total ignorance, there are no available non-question-begging reasons to think any choice is better than another.

But why think that any new situation is comparable to previous situations and not *superficially* similar? Or why not think that in a new situation that there are non-obvious similarities between the present situation and past situations? While it is generally agreed-upon that the colour of a lab coat does not influence the outcome of an experiment (i.e., the colour of lab coats is, all things being equal, irrelevant), this possibility is not excluded under inductivist accounts, for so long as past experience is to play a role, the inductivist cannot exclude without good reason factors that appear to be irrelevant.

While Hume's work on distinguishing between the 'accidental circumstances' from the 'efficacious causes', this work is unavailable in practical decision making without assuming what is 'accidental' and 'efficacious'. Some assumptions will naturally be correct, but this is an assumption, not an inductive inference. Or, if it should be an inductive inference, it is also likely that there will be inductive inferences that mistake the 'accidental' for the 'efficacious' and *vice versa*.

Any obvious irrelevancy is often attributed not to any inductive inference but on prior assumptions that have, more often than not, never been rigorously tested in the present context, for testing is necessarily *impossible* in total ignorance—once

there has been testing, there is no longer total ignorance—yet once the subject has already engaged in testing they are also engaged in decision-making, in this case the decision to engage in rational theory preference rather than rational decision making.

While in partial ignorance, however, the inductivist must be willing to make an assumption about which factors are ‘accidental’ and ‘efficacious’. This is perfectly permissible for the inductivist. Many assumptions are necessary during practical decision making, and there simply is not enough time for all assumptions to be subject to criticism. But this assumption is open for the hypothetico-deductivist to accept as well: a decision must be made, and whatever decision is made will be made under partial ignorance.

3.2.1 An issue for *de facto* and *de jure* reasons for favouring inductive inferences in rational decision making

Furthermore, the evidence that it is preferable to accept an inductive theory of rational decision making over a hypothetico-deductive theory of rational decision making rests on the *de facto* preferability of an inductive theory of rational decision making over non-inductive theories of rational decision making. But this *de facto* preferability does not make it *de jure* preferable. There is no provided justification for accepting an inductive theory of rational decision making unless this desire can be cashed out as attainable outside a *psychological* theory of decision making—namely, as providing *rational* decision making.

Frank Ramsey presented a similar reasoning for accepting an inductive theory of rational decision making as follows: ‘we are all convinced by inductive arguments, and our conviction is reasonable because the world is so constituted that inductive arguments lead on the whole to true opinions’. (Ramsey, Frank. ‘Truth and Probability,’ in Richard B. Braithwaite (ed.) *Foundations of Mathematics and other Logical Essays* (London: Rutledge and Kegan Paul, 1931, 156-198)

Yet Ramsey’s conviction that inductive arguments work, as explained above, is insufficient in explaining whether a pessimistic or optimistic inductive inference should be made so that it leads ‘to true opinions’ in any one case, or even that the world *is in fact* constituted in a way that it leads to true opinions ‘on the whole’ without (as explained in a previous footnote) expanding the use of ‘induction’ to cover almost all theories of learning, up to and including hypothetico-deductive models.

Ramsey’s claim is then trivially true. As restated, ‘we are all convinced [that there exists a prediction—either pessimistic or optimistic—that will determine the best decision in any singular instance], and our conviction is reasonable because the world is so constituted that [these pessimistic or optimistic predictions] lead on the whole to true opinions’. But there is no present method to determine if the

prediction ought to be optimistic or pessimistic.

3.3 Analogous hypothetico-deductive approaches to the pragmatic problem of induction and the problem of underdetermination

3.4 pessimistic hypothetico-deductivism

first, the pessimistic hypothetico-deductive option: agree with salmon that if hypothetico-deductivism is true we cannot base our everyday decisions on our best scientific theories, but deny that we have epistemic reasons for believing our best scientific theories. we are left with no way to rationally choose between two competing theories. embrace scientific anti-realism. if induction cannot be justified, inductive beliefs are conventional beliefs, reflecting the psychology or agreed-upon rules of a community, rather than any underlying arguments. So too must hypothetico-deductivism embrace conventionalism.

3.5 optimistic hypothetico-deductivism

optimistic hypothetico-deductivism, which denies conventionalism and in its place proposes several plausible heuristics for rational decision making—whether these heuristics are reliable will be addressed in a later section—namely, that optimism asserts that it is possible for rational decision making will maximise expected utility without attaching probabilities to the possible outcomes based on the past success of these heuristics—the heuristics may not be known to be reliable for other reasons, and attempts to conjecturally peer into the future by proposing a particular approach, subjecting this approach to criticism, and revising in light of criticism. this approach mirrors a hypothetico-deductive model of scientific practice that accepts scientific realism (of a sort): a conjecture-refutation model will over time converge on the truth, or at least on empirically adequate scientific theories;

second, the optimistic hypothetico-deductive option: agree with salmon that if hypothetico-deductivism is true we cannot base our everyday decisions on our best scientific theories, but deny that we do in fact base our everyday decisions on our best scientific theories. and when it comes to scientific practice, a Feyerabendian approach is appropriate: we do in fact do not have good reason to think our best scientific theories are true, so we ought to do our best to produce rivals. again, scientific anti-realism is accepted.

3.6 conservative hypothetico-deductivism

How are courses of action to be eliminated if their failure is not implied by the available empirical evidence? This is a difficult hurdle for the hypothetico-deductivist. Nothing within the available theories of rational decision making logically prohibits her from choosing a course of action that has not been subject to criticism. The new course of action could very well be superior to the present course of action. But what does make the decision to prefer this untested course of action over the present course of action *illegitimate*? One possibility is, at least in rational decision making, as opposed to rational theory preference, to take a solution that is sub-optimal. Satisficing is conservative.

third, the conservative hypothetico-deductive option: disagree with salmon that if hypothetico-deductivism is true we do not have reasons for belief—there may be pragmatic or psychological or methodological reasons, even though we may lack epistemic reasons for belief. we are free to accept scientific realism.

conservative hypothetico-deductivism, a Minimax theorem, trying to minimise losses does not attempt to peer into the future but consider which options are, in the face of present knowledge, considered the worst, and are prohibited on acting on these options. Whatever options remain are permitted, and any choice is made freely. This conservatism is prudential, relying more often than not on subjective judgments on willingness to bet on *insurance*, minimising the likelihood of, if a choice that leads to great losses is made, leading to a massive loss.