Notes for Week 2 of *Confirmation*

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1 Administrative Remarks

We have our roster set, and we should now be at a more manageable size. Also, I have changed the syllabus. Next week, we'll read *only* Stroud on Hume. I got so much out of the Stroud readings this time around (the last time around was my first seminar in philosophy — boy what a difference 15 years makes!) that I decided to devote an entire week to them (we'll be reading two chapters now — see section 3 below). After Stroud, we will read Keynes, Nicod, Hempel, Carnap, and Goodman, before moving on to cognitive science applications for the last two weeks. So, we will not do any subjective Bayesian confirmation theory *per se* (although, we'll actually see a fair amount of it in the cognitive science part of the course anyhow).

2 Notes on Milton

2.1 Footnote #1 on Hume

Footnote 1 of Milton's paper (51) is crucial for us. There, Milton points out that the view of Hume as an inductive skeptic is a rather modern one. In the first half of the nineteenth century, Mill, Whewell (and others) wrote extensively about induction, but they had little interest in Hume. Venn (1880's) seems to be one of the first to adopt this "inductive" reading of Hume. Keynes (*A Treatise on Probability*, page 272) is perhaps the first to assert that induction is Hume's *main* target (*e.g.*, in *Enquiry* Book IV). Popper has a similar take on Hume. As we will see next week, Stroud (a far subtler reader of Hume than Keynes or Popper) also sees induction as one of Hume's main targets. The "old fashioned" reading of Hume (more as a skeptic about *causation* than induction) is championed by few in the 20th century (Kemp Smith being one of those few). Milton also points out that Hume only uses the *word* "induction" *once* in the entire *Treatise*, and not in the sections that are nowadays thought to be about induction. Of course, we shouldn't put too much weight on *that*, since words like "induction" have been used in various odd ways historically (*e.g.*, *epagôgê* was used by Plato to mean incantation, and by Boyle to mean *reductio ad absurdum*). Stay tuned for much more next week on Hume. Stroud's subtle reading of Hume's writings will bring out their logical, epistemological, and psychological significance (see section 3, below for some pre-reading remarks on Stroud).

2.2 Aristotle

Milton's historical survey is quite interesting and useful (but also a bit perplexing in some ways). He starts §2 by noting that "inductive methods" appeared even in the old testament. But, his story really begins with Aristotle who — according to Milton — credits Socrates with "the introduction of inductive arguments". Milton cites — but does not quote from — *Metaphysics* 1078b28 in this connection. Here's that passage:

> But when Socrates was occupying himself with the excellences of character, and in connexion with them became the first to raise the problem of universal definition (for of the physicists Democritus only touched on the subject to a small extent, and defined, after a fashion, the hot and the cold; while the Pythagoreans had before this treated of a few things, whose definitions—e.g. those of opportunity, justice, or marriage—they connected with numbers; but it was natural that Socrates should be seeking the essence, for he was seeking to syllogize, and 'what a thing is' is the starting-point of syllogisms; for there was as yet none of the dialectical power which enables people even without knowledge of the essence to speculate about contraries and inquire whether the same science deals with contraries; for two things may be fairly ascribed to Socrates—inductive arguments and universal definition, both of which are concerned with the starting-point of science) but Socrates did not make the universals or the definitions exist apart: they, however, gave them separate existence, and this was the kind of thing they called Ideas.

It's not entirely clear *which two* things are being attributed to Socrates here (Ross translates them "inductive argument" and "universal definition"). Milton suggests (see below) these two things are concept formation and (in our terminology) universal induction. In any event, this seems to be the only place in the *Metaphysics* where "inductive argument" is mentioned. That's somewhat odd if it really is a "starting point of science"!

Be that as it may, Aristotle did introduce the technical term *epagôgê* for *some kinds* of "induction". In *Prior Analytics* II.23, Aristotle discusses what Milton calls "induction by complete enumeration". In our modern terminology, it sounds like Milton might be talking about the special case of *inverse induction*, where the sample is (and *is known to be!*) the entire population ($\mathcal{S} = \mathcal{P}$). Once again, Milton doesn't quote the salient passage, which is worth doing, because it indicates something a bit different I think:

> Now induction, or rather the syllogism which springs out of induction, consists in establishing syllogistically a relation between one extreme and the middle by means of the other extreme, e.g. if B is the middle term between A and C, it consists in proving through C that A belongs to B. For this is the manner in which we make inductions. For example let A stand for long-lived, B for bileless, and C for the particular long-lived animals, e.g. man, horse, mule. A then belongs to the whole of C: for whatever is bileless is long-lived. But B also ('not possessing bile') belongs to all C. If then C is convertible with B, and the middle term is not wider in extension, it is necessary that A should belong to B. For it has already been proved that if two things belong to the same thing, and the extreme is convertible with one of them, then the other predicate will belong to the predicate that is converted. But we must apprehend C as made up of all the particulars. For induction proceeds through an enumeration of all the cases.

As Milton says, this does seem to be a bit forced (into syllogistic terms). But, it is notable that the "instances" in Aristotle's example are not statements about *particulars* at all. In this example, C is assumed to be "made up of all the particulars". But, these "particulars" are themselves *kinds* (man, horse, mule). They are something like *all the kinds that fall under A* (the long-lived animals). This sounds a bit more like *argument by cases* to me than *inverse induction* (which is what is nowadays meant by "complete enumeration"). Milton later says that this is the only case he knows of in which this sort of induction is applied by Aristotle to an "empirical generalization" (all bileless animals are long-lived). And, he emphasizes that Aristotle requires "a survey of *all* the particular instances". But, this is misleading, because it makes it sound as if we need to survey all the *particular bileless animals*. But, that is clearly not what Aristotle intends here. He suggests we need to enumerate all the *kinds* of bileless animals, and (for all we know) this could be a *finite* enumeration. This is to be contrasted with "exhaustive enumerations" of particulars (mentioned later in Milton's history), which could, in principle, involve "surveying" an *infinite* number of *particulars*.

For Milton, the most important Aristotelian passage concerning induction is *Posterior Analytics* II.19. Milton says that here Aristotle "slides without explanation from an account of how we acquire universal concepts (100a3-b3) to an account of how we acquire knowledge of universal truths (100b3ff)." Here it is:

> When one of a number of logically indiscriminable particulars has made a stand, the earliest universal is present in the soul: for though the act of sense-perception is of the particular, its content is universal—is man, for example, not the man Callias. A fresh stand is made among these rudimentary universals, and the process does not cease until the indivisible concepts, the true universals, are established: e.g. such and such a species of animal is a step towards the genus animal, which by the same process is a step towards a further generalization. Thus it is clear that we must get to know the primary premisses by induction; for the method by which even sense-perception implants the universal is inductive. Now of the thinking states by which we grasp truth, some are unfailingly true, others admit of error-opinion, for instance, and calculation, whereas scientific knowing and intuition are always true: further, no other kind of thought except intuition is more accurate than scientific knowledge, whereas primary premisses are more knowable than demonstrations, and all scientific knowledge is discursive.

Here, we finally get to some claims that *might* fit more neatly into our modern taxonomy of kinds of induction. Primary premises have universal form, *e.g.*, "Everything that lives, moves". So, when Aristotle speaks of knowing the truth of a universal premise by induction — he *might* be talking about universal induction in our sense. But, it's not completely clear to me that he is. After all, he seems to think it's obvious that because universals are "implanted" by induction (universal concepts are acquired by induction), we must also get to know primary premises by induction. It's not clear what "induction" could mean that would have this consequence, but I doubt it includes universal induction in our sense. Moreover, note that induction is used in an *epistemic* sense here. We're talking about *knowing by induction*. This doesn't (*sensu strictu*) require the existence of a *logical* sense of induction. And, given what Aristotle says about "syllogisms that spring out of induction" (in *Prior Analytics*, above), he *could* consistently maintain a distinction between *logical* induction (*i.e.*, the *Prior Analytics* stuff, which sounds more like a species of *argument by cases* to me anyhow) and *epistemic* induction (a process by which *knowledge* of universals and universal truths is obtained). Finally, note that it is unclear whether Aristotle thinks of induction (in its epistemological sense) as involving anything like *inference* — it seems to be something rather more direct or immediate. At any rate, these passages from Aristotle are not so easily squeezed into our modern taxonomy.

Milton only briefly discusses Aristotle's *Rhetoric*, in which there are many examples of various types of induction. For instance, in *Rhetoric* 1398b, Aristotle gives a pretty clear example of (our) universal induction:

> Another line is based upon induction. Thus from the case of the woman of Peparethus it might be argued that women everywhere can settle correctly the facts about their children.

Indeed, *Rhetoric* is a rich source of inductions, largely of an epistemic and/or psychological nature. I highly recommend Chapter 1 of James Allen's book *Inference from Signs* (now posted on the syllabus page) for a very detailed and scholarly discussion of various varieties of induction in Aristotle.

2.3 Epicureans, Stoics, Galen, Sextus Empiriucus

Moving along in Milton's history (up to the first few centuries B.C.), the Epicureans were strong advocates of induction (mainly, *analogical induction*). Philodemus' treatise *On Signs* is a central text in this regard (again, see Allen's book for very rich historical discussion of this and other ancient writings involving induction and, more specifically, inferences from signs). Milton suggests that Philodemus was reacting to the Stoics, who were quite hostile to the very idea of induction. Here, Milton quotes Burnyeat as saying:

> The upshot is that Stoic logic guarantees to Stoic epistemology that the only warrant which one proposition can confer on another is the warrant of conclusive proof.

This presupposes a strong connection between inductive *logic* and inductive *epistemology*. But, it does seem clear that the main worries the Stoics had were *epistemological* in nature. As Milton says:

> Merely fallible inferences cannot provide us with knowledge of anything, for according to Stoic doctrine we only know something when we have an intellectual grasp of it which cannot be weakened by further evidence or argument.

The idea that knowledge (as opposed, say, to mere true belief) is "stable", "firm", or "tied down" is a very old one (see, *e.g.*, *Meno* 96d-100b). And, this seems to be close to the general worry about induction that is being attributed to the Stoics here. It's not entirely clear what this should have to do with "induction", say, as opposed to "deduction". *Truth* is the only thing that is guaranteed to be preserved (*per se*) by deductive relations. Why should the property of "being tied down" (or any other property besides truth, for that matter) be preserved by deductive relations? And, if it needn't be, then the worry here can't be peculiar to *induction per se*. If you don't know that the premises of your argument are true, then *de*ducing something from them — as opposed, say, to *in*ducing something from them — won't magically generate knowledge, will it? Moreover, is there *any* process by which one can come to (truly) believe something such that said belief *couldn't — in principle —* be undermined by *any* subsequent events? Even if there are (and I'm not sure that would be a *good* thing!), I suspect this distinction between "good" and "bad" ways of coming to hold true beliefs will *cross-cut* the inductive/deductive distinction (however that distinction is to be drawn).

The idea that inductive inferences are "inherently insecure" is a repeating theme in the history. But, what does this mean, exactly? One version of the complaint involves the fact that "we can't survey *all* the instances of the conclusion of a universal induction" (for one thing, they are *potentially infinite* in number — see the quote from Sextus Empiricus on page 56 of Milton, which articulates this worry). *Even if we could*, I'm not sure how that would help. First, we must be assuming that "surveying" an instance means coming to *know* something *is* an instance of a universal claim (*i.e.*, that some claim about a *particular* is true). I guess we're assuming that this part does *not* involve "induction" (let's take that to be direct knowledge, say, *via* perception). So far, so good. But, even if we were able to survey all the instances of a universal claim (as S.E. wants), wouldn't we still also need to *know that* all the instances of said universal claim have indeed been surveyed? How do we get to know *that*? More surveying won't help here, will it? [This strenghening of S.E.'s worry is given by Arnauld and Nicole in the Port Royal *Logic* — see page 59 of Milton.] This seems to be a compelling worry, but I don't see what it's got to do with induction *per se*. What *other* way could there be to come to know an empirical universal claim? And, is this other way *non*-inductive? If there isn't a *non*-inductive way to achieve such knowledge, then the fact that the method under consideration is *inductive* seems rather beside the point. As Milton notes, Arnauld and Nicole insist that this worry is probative. And, they also think that all scientific knowledge is obtained by deductive inference from indubitable axioms. As we'll see next week, Hume doesn't see this as a viable general solution to the problem of induction.

Interestingly, S.E. did not seem to abhor inductive inference generally. He seemed content to make use of natural signs, *e.g.*, as from smoke to fire or from a scar to a wound. Milton claims that S.E. was worried specifically about "inferences from observables to unobservables, such as Epicurean atoms or Aristotelian elements." That doesn't quite explain his scepticism about universal induction. After all, one need not *inductively* infer anything about unobservables when one inductively infers a universal claim from (observable) instances. This is a common conflation: universal induction *vs* predictive induction. It is true that the universal claim may *entail* things about unobservables. But, just because something is *entailed by* an inductive conclusion does mean that it is *supported by* (confirmed by) the inductive premises *for the universal claim*. This is a very important issue that we will see again next week with Stroud (who at times may also fall prey to this conflation), and we will discuss extensively when we get to Hempel, Carnap, and Goodman.

Another interesting argument Milton mentions concerning universal induction is attributed to Galen:

> If n observations are insufficient to establish reliably the truth of a generalisation, where $n = 1$ or some other small number, then $n + 1$ observations must also be insufficient. If it were the case that (say) 49 observations were not enough, whereas 50 were, then it would follow that one observation, the 50th, would in itself be sufficient, which is both implausible and contradicts the initial assumptions.

This sounds a little like a sorities argument. Is the conclusion here merely that "instantially well confirmed" is *vague*? I think there is something more to this worry. Surely, *mere numbers* of instances can't be crucial for universal induction. Some of the *individual* instances must themselves be "good" in some sense. We'll see this issue arise again later when we read Keynes (and subsequent authors on instantial confirmation).

2.4 Bacon

Bacon was not a fan of enumerative (or naïve instantial) induction. He said that it was 'utterly vicious and incompetent' and 'gross and stupid'. Nonetheless, Bacon advocated various inductive methods. But, he was committed to some strong metaphysical assumptions, which Milton characterizes as follows:

- A one-to-one relation between the observable natures of bodies and the forms which are their causes.
- That the number of different forms to be found in nature is manageably finite (Principle of Limited Variety).

It's not entirely clear to me how these metaphysical assumptions are supposed to help with the (alleged) epistemological problems associated with naïve induction. This is worth thinking about. Keep this sort of question in mind when you're reading about Hume for next week.

2.5 Leibniz and Locke

Leibniz and Locke were not opposed to the use of non-deductive arguments (or to non-dedcutive inferences). But, they seemed to think that such inferences wouldn't lead to *knowledge*. This seems to rely on the assumption that knowledge requires *certainty*, *and* that we're talking about cases in which we *were certain* of the premises to begin with. If we weren't certain of the premises, then the fact the the inference doesn't lead to a certain conclusion has nothing to do with its *inductive* character. If we were certain of the premises to begin with, then one wonders how we managed that in the first place (concerning empirical claims).

Interestingly, Milton (63) dismisses Leibniz's call for "a new logic" (which sounds like a call for *inductive logic* — see the Hailperin readings for this week), by saying that Leibniz is really just talking about deductive reasoning about probability statements, rather than inductive reasoning grounded in probability relations. This distinction between beliefs/knowledge about probability statements *vs* degrees of belief (or inductive probabilities) is a subtle one. And, the distinction between "probability logic" (deductive relations between probability statements) and "probabilistic inductive logic" (probabilistic relations between statements) is also a subtle one (Hailperin is talking about probability logic, and Keynes/Carnap are talking about probabilistic inductive logic). It's unclear which Leibniz had in mind, but I think both readings are plausible.

2.6 Milton's Four Kinds of Worries About Induction

1. Reservations about induction which arise merely because inductive arguments are not deductively valid.
2. The view that inductive arguments are inherently and irredeemably fallible: although such arguments may make their conclusions probable, they can never make them certain.

3. The view that genuinely universal propositions can never be given a probability greater than zero by any inductive argument.
4. The view that no inductive arguments, whether to particular or to general conclusions, can be given any rational foundation whatever.

Of these four, only (1) seems to be *solely* about *logical* properties of induction. As such, the connection of (1) to epistemology seems somewhat unclear. I think (2) – (4) can be read as having both logical and epistemic significance (the words “fallible” in 2 and ”rational” in 4 suggest something epistemic is intended). Only (3) is specific to *universal* induction. And, it is peculiar to the modern inductive-logical literature. Really, (3) is largely an artifact of a certain way of thinking about inductive probability (we’ll see this when we get to Carnap). The others could apply to all of our types of induction.

Milton claims that, before Hume, (2) was the most commonly held view (he gives various examples, leading up to this section). On the other hand, Milton says that Hume was committed to (4). This is not an uncommon view (much more on this next week!). But, Milton’s historical explanation of how this stronger sort of skepticism came about is somewhat confusing (although, perhaps superior to Hacking’s).

2.7 Hacking’s Explanation and Milton’s Alternative Explanation

Hacking wonders why the transition from (2) to (4) happened with Hume (assuming, for now, that it did). He offers a two-pronged historical explanation:

(i) The emergence of a concept of what Hacking calls ‘internal evidence’ — that is, evidence other than testimony. It was this that enabled the modern concept of probability to emerge, and with it the analytic problem of induction.

(ii) Once the concept of internal evidence was established by 1660, the final transformation needed for the sceptical problem of induction was this transference of causality from knowledge to opinion.

Making (i) more precise, Hacking says:

> Arbitrary and conventional signs are carefully distinguished in the Port Royal *Logic*, the same book from which I took my terminology of internal and external evidence. Hobbes also very sharply distinguishes ‘arbitrary’ and ‘natural’ signs. Once natural signs have been distinguished from any sign of language, the concept of internal evidence is also distinguished.

As Milton points out, the claim that the distinction between arbitrary and natural signs and the concept of internal evidence emerge together around the middle of the seventeenth century is subject to an important objection: *it is not true.* Indeed, the distinction between arbitrary and natural signs is an ancient one. Here, I refer you again to Allen’s book *Inference from Signs.* I won’t bother to discuss (i) further.

As stated, (ii) seems to be a kind of skepticism about causal connections (and/or necessary connections). But, skepticism about causal/necessary connections dates back long before hume, and so it doesn’t seem to explain why inductive skepticism arose with Hume in particular. Milton suggests that what set Hume apart from his predecessors was not so much fundamentally new premises of philosophy, but:

> . . . a greater readiness and ability to pursue certain lines of argument to their ultimate conclusion, a temperament sympathetic to the construction of a systematic kind of philosophy . . . and a notable freedom from many of the philosophical and theological constraints which guided most of his predecessors.

Philosophically, Milton traces the modern “Humean” problem of induction to a different source — ultimately to nominalism and the problem of universals. This is where things get a bit confusing for me. Milton begins this alternative explanation by saying:

> The problem of induction is at bottom a problem about inference from particular to universal propositions. It would seem therefore reasonable to suppose that there may be some usefully close connection between this problem and the metaphysical problems about the nature and existence of universals which have become known as the problem of universals.

This is odd in several respects. First, recall that Milton’s own characterization of what makes Humean skepticism new is how sweeping a skepticism it is. Remember, (4) is what we’re talking about here. And, (4) is — and this is Milton’s own taxonomy remember — explcitly the claim that no inductive arguments, *whether to particular or to universal conclusions*, can be given any rational foundation whatever. It is precisely the fact that Humean skepticism is so broad that makes it the "most severe" in the historical progression. So, offering an explanation of its genesis that trades specifically on *universal* induction seems odd. At best, this might explain the genesis of Humean *universal* inductive skepticism. The lack of unification in this explanation is unfortunate. But, putting that to one side, there is another non-trivial problem with this line. Hume doesn't seem to be interested primarily in universal induction in his most skeptical writings. As will become clear next week (see the next section) — to the extent that Hume was worried about induction at all — he was primarily concerned with *singular predictive induction* (going back to *our* taxonomy now). It is certainly true that modern commentators have a tendency to slide back and forth between these (or, perhaps more accurately, to suppose that skepticism about universal induction somehow "implies" skepticism about singular predictive induction, and so it is therefore OK to focus primarily on the former). But, this is unfortunate, since the two are really quite distinct. We'll return to this point several times throughout the semester. To be fair to Milton here, though, since he's offering a *historical explanation*, he could claim that Hume was himself unclear about this distinction and may have himself *believed* that universal inductive skepticism "implied" singular predictive inductive skepticism. If that is true (we'll be in a better position to judge this next week), then Milton's explanation may yet be saved from my worries *qua explanation*. But, I will want to insist that *qua rationalization or rational reconstruction* of Hume (or others since Hume), Milton's story does face some challenges on this score. Of course, Milton is not alone in this, as we'll see.

3 Next Week's Readings: Stroud on Hume on Induction

OK, next week's readings are really terrific. We're reading chapters 3 and 4 of Barry's *Hume*. Here's what I want you to focus on (caution: there is *a lot* going on in these chapters!). In chapter 3 (the negative phase), I want you to see how carefully Barry teases apart the *logical* and *epistemological* strands in Hume's skeptical arguments. Many modern readers interpret Hume in a way that has him making some rather naïve assumptions about the relationship between the logical properties of an (inductive) argument from P to C and the epistemological status of *inferring* C from P. I think Barry is clearly right to look for a reading that doesn't need such assumptions, and one which focuses directly on the epistemological credentials of the inferences in question. It is interesting that Barry only rather tentatively offers this direct epistemological reading (see the last paragraph of chapter 3). This indicates how inclined people have been to conflate logic and epistemology in Hume's skeptical arguments. In chapter 4 (the positive phase), I want you to focus on the last several pages, where Barry uses Goodman's "grue" example as a counterexample to Hume's positive *psychological* thesis about how people (*actually*) tend to be led to certain sorts of "inductive" conclusions. It is fascinating (and clever) how Barry puts Goodman's example (which Goodman used primarily for *epistemic* and *logical* purposes) to work as a *psychological* counterexample. Also, pay attention in both chapters (though especially toward the end of chapter 4) to the subtle slide Barry makes from talking about singular predictive induction to talking about universal induction — as if what is true of universal induction must also be true of singular predictive induction (in logical, epistemological, *and* psychological senses?). This is the issue I raised above in connection with Milton, and it will be a recurring theme throughout the semester. Thus, in general, we should watch for presuppositions about the relations between our three kinds of confirmation (logical, epistemological, psychological) and our five kinds of induction (direct, predictive, analogical, inverse, and universal). This applies to next week's readings, and all subsequent readings.