Brian Skyrms – The Goodman Paradox and the New Riddle of Induction[1]

IV. 1 Introduction

- Skyrms has presented in the previous chapter some general specifications for a system of scientific inductive logic. These were :-
    1. A system of rules for implying inductive probabilities to arguments
    2. Different levels of rules correspond to different levels of argument
    3. The system must accord with common sense and scientific practise.
    4. It must presuppose at each level that nature is uniform and that the future will resemble the past.

  This was sufficient to survey the traditional problems of induction and the attempts to solve or dissolve them.
- We need to know precisely what the rules of scientific inductive logic are if it is to be applied as a rigorous discipline. However, it is such a difficult subject that, despite the attentions of some of history's great minds, it remains in the same state as deductive logic before Aristotle. The difference between the two is that deductive logic is yes/no while inductive is a matter of degree, measuring rather than classifying.
- Some philosophers have given up on the job and maintained that predicting the future is an art not a science, relying on the intuitions of experts.
- Even appeal to experts won't do, as we have to sort the genuine from the charlatans. To do this we must assess the evidence that his predictions will be correct, and to do this requires recourse to the second level of inductive logic.
- All hope is not lost, but to put the problem in perspective we look at one of the main obstacles in our way.

IV. 2 Regularities and Projection

- Why is induction a problem ? Specification 4 (uniformity) seems to confer high probability on the conclusion that the next emerald will be green from the observation that all observed emeralds have been green. Scientific induction projects an observed regularity into the future, whereas counter-induction[2] confers high probability on the next emerald *not* being green.
- Skyrms asks why we cannot give the following form for a rule governing scientific induction :

  Rule S : N % of observed X's have been Y ⊦ the next X will be Y with inductive probability N/100.
- The main problem with this formulation is that it makes no reference to the size of the sampled population, ie. whether 90% of 10 or 1,000,000 emeralds have been observed to be green. Any scientific formulation must assign greater assurance to predictions taking into account more evidence than those using less.
- Another problem is that the rule doesn't tell us how to assign inductive probabilities depending on the circumstances in which the regularity had been found. Skyrms gives examples of a drug producing no ill effects when (a) given to young, healthy people and (b) given to a full cross-section of the population.

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[1] This is Chapter IV of *Choice and Chance*.

[2] The thesis – like the gambler's fallacy – that the future will not be like the past.

Scientific inductive logic should take into account the diversity of the population samples and encourage the wider samplings.

- So, the rule would have to have a complex structure. Moreover, Rule S doesn't help us to differentiate between predictions based on law-like regularities (the freezing-point of water) and suspected chance conjunctions (economic depressions occurring at the time of high sunspot activity). This leads us to posit a distinction between projectible and non-projectible regularities, with scientific inductive logic only projecting the former into the future. It assumes the uniformity of nature and the resemblance of the future to the past only in certain respects. Only certain types of patterns are expected to be repeated.

IV. 3 The Goodman Paradox

- Projectibility is a matter of degree, and just how unprojectible a regularity can be is illustrated by Goodman's grue-bleen paradox.
- Grue and bleen are to act like ordinary colour words, where things are a certain colour at a certain time and can change colour. Skyrms's choice of definition is as follows :-
  X is grue at time t iff X is green at t < 2100 or x is blue at t ≥ 2100[3].
  X is bleen at time t iff X is blue at t < 2100 or x is green at t ≥ 2100
  Hence is a green grasshopper is seen before 2100 it is grue, but thereafter is not, though a blue sky would be.
- Skyrms asks us to imagine a chameleon on a green cloth just prior to 2100 being transferred to a blue one as the new century dawned. While it would change from green to blue it would remain grue, though a piece of green glass would change "colour" from grue to bleen. Before 2100 things are grue just when green and bleen just when blue, and vice-versa thereafter.
- We are asked to imagine a tribe whose basic colour words are grue and bleen; in their terms, a green object changes colour (from grue to bleen) at year 2100, though from our perspective it remains green. Consequently, Skyrms claims, whether a certain situation involves change may depend on the language used to describe it.
- Sryrms counters the obvious objection that grue and bleen are not acceptable colour words. He acknowledges that in our language, definitions of grue and bleen not only involve "basic" colour words but also a date. However, if we choose grue and bleen as basic we can define green and blue in terms of *them*, as follows :-
  X is green at time t iff X is grue at t < 2100 or x is bleen at t ≥ 2100.
  X is blue at time t iff X is bleen at t < 2100 or x is grue at t ≥ 2100.
  So, defining the old colour words in terms of the new requires a specific date just as much as the contrary definitions[4]. The formal structure of the definitions of grue and bleen gives us no reason to believe they are illegitimate colour words, just unfamiliar ones.
- We now consider projectibility based on these new colour words. Just before 2100 a gem expert uses Rule S to project that the next emerald he observes will be green, because 100% of those observed hitherto have been green.

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[3] This is not Jackson's D_3, nor, according to Jackson, Goodman's definition.
[4] But the date "cancels", as it is in both the definition and the meaning of grue and bleen. As an exercise, Skyrms notes that we can define grue as (green v blue) & ¬bleen, when references to 2100 appear to have disappeared.

- He also notes that all the emeralds observed hitherto have been grue, and uses the same rule to project that the next emerald observed will be grue.
- So, he is predicting on the one hand that emeralds will remain green but on the other that they will change to blue at year 2100. No-one is suggesting that the second prediction ought actually to be made, only pointing our that Rule S says that it ought to be made ! The regularity of emeralds being grue is totally unprojectible and our gem expert's predicament is an extreme case of what happens when we try to project unprojectible regularities via a rule such as S[5].
- Skyrms notes that the contradiction arises for emeralds only on the assumption that all emeralds are not destroyed prior to 2100, but assumes we have inductive evidence to support this assumption.
- Projecting the unprojectible not only leads to ridiculous predictions but to the contradiction of a legitimate prediction based on the same set of data. An acceptable system of scientific inductive logic must provide means to escape incorporate rules telling us which regularities are projectible so that this situation is avoided. We already knew the problems with projectibility from the "economic sunspot" example, but Goodman's examples provide urgency by showing how unprojectible a regularity can be and how serious are the consequences of making predictions on its basis.
- Skyrms summarises the show so far :-
    1. Whether or not we find change in a certain situation depends on our linguistic machinery used to describe it.
    2. Regularities found in a sequence of events depend on our linguistic machinery.
    3. We may find two regularities in a sequence of occurrences, one projectible, the other not, that produce contradictory predictions.

IV. 4 <u>The Goodman Paradox, Regularity and the Principle of the Uniformity of Nature</u>

- The summary in the preceding section (especially 3) dramatises the need for determining projectibility in scientific induction, which might be achieved by specifying the most fruitful language for describing scientific events.
- Sryrms points out an even more startling result, that for any prediction whatever, we can find a regularity (usually unprojectible, but for which we need elimination rules) whose projection licences it.
- Skyrms now gives three examples which will help us to re-examine the principle of the uniformity of nature.
- Example 1 : we are to imagine four boxes (each named *Excelsior!*) containing 4 completely difference objects. We know the random colours of the first 3 and are asked to predict the colour of the 4th. We define a *snarf* as just one of these objects in a box with that silly name, and a colour, *murkle*, that applies to an object just in case it is one of the first three objects coloured the way it actually is, or the 4th object coloured the way we want to predict. So, all snarfs have been murkle, the 4th object is a snarf, is murkle so can be predicted to have the colour we chose. While the regularity is unprojectible, we've shown the arbitrary results of projecting it; and, Skyrms claims this can be done with less exotic vocabulary than snarf or murkle, or even grue or bleen.

[5] Need to check out why Jackson thought that, for definitions other than Goodman's own, there wasn't even a prima facie problem for projection.

- Example 2 : this is an extrapolation / interpolation case. We imagine population growth that appears to be linear, but there are infinitely many non-linear graphs that could be drawn through our statistical points which when extrapolated or interpolated could lead to any prediction whatever.
- Example 3 : we are to imagine three simple IQ-test style sequences with obvious generating functions k, 2k and 2k-1. However, Skyrms points out that an equally acceptable generating function for the first 3 terms of the first example would be (k-1)(k-2)(k-3)+k, which would predict 10 rather than 4 as the 4th term. In fact, for any finite string of numbers, there is a generating function for that string that yields whatever next number we like. So, if we were just looking for the projection of a regularity, any answer would do – but what is required is the projection of an intuitively projectible regularity[6].
- The purpose of the three examples is to illustrate Goodman's point that it is pointless to say that valid predictions are based on past regularities without saying which regularities is pointless because regularities can be found anywhere.
- We now turn to the bearing of this discussion of regularities and projectibility on the uniformity of nature. By analogy with Goodman's remark above, we need to say *in what respects* nature is supposed to be uniform, it being trivial to say it is uniform in some respects and self-contradictory to say it's uniform in all.
- We saw that the future cannot to be held to resemble the past both with respect to the observed greenness and grueness of emeralds. The future cannot resemble the past in all respects, which is why it is self-contradictory to say that nature is uniform in all respects.
- Retreating to saying that nature is uniform in *some* respects is no use either, because we have seen that there are regularities to be found however chaotic the data. This applies just as much to nature, where the regularities could be contrived as in the excelsior! or grue/bleen examples, or "fiendishly complex". There will always be some uniformity, whether natural, artificial, simple or complex, which is why it is trivial to say that nature is uniform in *some* ways. To convey information, our theory must say in what respects nature is uniform.
- The projection of regularities and the presumption of the uniformity of nature are two sides of the same coin. We can rescue scientific induction if we can specify rules of projectibility for scientific inductive logic. We could then reformulate the principle of the uniformity of nature to mean that nature is such that projecting regularities that meet these standards leads to correct predictions most of the time. The problem of formulating precise rules for projectibility is the new riddle of induction.

IV. 5 <u>Summary</u>

- The characterisation of scientific inductive logic as the projection of observed regularities into the future was seen to fail for at least three reasons (1) there are too many regularities (2) different regularities found in the same data lead to contradictory predictions and (3) we can find regularities to justify any prediction we care to make.
- The new problem of induction is specifying just which regularities are projectible.
- Saying that nature is uniform in some respects is trivial, while saying it is uniform in all respects is self-contradictory. We need to say in which respects nature is

[6] I don't agree – all these regularities are projectible; what is required is the *simplest* regularity.

uniform, which makes the principle of the uniformity of nature another facet of the problem of projectibility, the new riddle of induction.

- Though the new problem has not yet been solved, there have been developments in the history of inductive logic which constitute progress towards a system of scientific inductive logic.