Nelson Goodman – The New Riddle of Induction

Summary

In §1 Goodman raises Hume’s problem of induction, supports his descriptive or psychological approach and reports the “dissolution” of the problem in §2. In §3 he summarises Hempel’s work on confirmation theory, including the problems that arise – Hempel’s famous “Raven” paradox - which is deemed solved. However, in §4, Goodman introduces his “Grue” paradox, which exposes deeper flaws in confirmation theory as (then) developed. Finally, in §5, he points out that the then current problem was with which hypotheses are confirmable and which not. Where Hume fell short was not in focusing on regularities, but in not discriminating between projectible from non-projectible regularities. Regularities can be found anywhere.

Detailed analysis

§1. The Old Problem of Induction

• The problems of induction as traditionally understood have been solved or dissolved.
• Today’s problems are new, but to approach them we must run over familiar ground.
• The problem of the validity of judgements about future or unknown cases arises because such judgements are neither reports of experience nor logical consequences of past experience.
• This is Hume’s dictum - that there are no necessary connections between matters of fact. Though challenged, it has withstood attack.
• Hume’s answer to the question of how predictions relate to past experience is that a habit is formed in the mind when it is observed that events of one kind regularly follow those of another. The mind passes from events of the first kind to an idea of those of the second, and this transition is taken impulsively to be necessary.
• Why one prediction rather than another? Hume’s answer is that it is the habit formed from past regularity that makes us choose a prediction in accord with it.
• Is this adequate? Doesn’t it only describe the source of predictions rather than argue for their legitimacy? Isn’t the key question not the psychological one of why a prediction is made but how it can be justified.
• As this objection implies that Hume (“the greatest of modern philosophers”) missed the point completely, revisionists claim that Hume didn’t take his “solution” seriously, but thought the problem unsolved or insoluble.
• Goodman rejects the revisionist line, considering Hume’s answer reasonable and relevant, if not entirely satisfactory. He protests against restricting “Hume’s problem” to the normative rather than the psychological.

1 Text: Nelson Goodman, Fact Fiction and Forecast, Chapter III, esp. §3 (pp. 72-81)
2 Goodman is inclined to go further and deny any necessary connections; ie. along with Quine, to deny or ignore the analytic-synthetic distinction.
3 See §5 for Goodman’s explanation of Hume’s shortcomings
• Goodman rejects the approaches to answering the problem based on positing a law of the Uniformity of Nature. This law itself requires justification; the lazy just take it as an indispensable assumption while the energetic try to justify it but without convincing anyone.
• The assumption of a prediction far more general than any we actually have to make is an odd way of carrying on.

§2. Dissolution of the Old Problem

• More critical thinkers have concluded there’s something wrong with the problem we’re trying to solve.
• Just what would justify the principle of induction? If it’s to know how we know certain predictions will turn out correct, then the answer is that we don’t know anything of the sort! If the problem is to find a method to tell us which propositions about the future are true or false, this is asking for a provision rather than a philosophical explanation.
• Goodman also denies that what we’re after is probabilities – ie. even though we can’t tell which throw of the die will come up next, at least we can tell what is probable. For, what can this mean? If it’s a correlation with frequency distributions, Goodman denies that we can know actual frequency distributions in advance. Alternatively, if the probability judgement has nothing to do with future occurrences, we must ask in what sense a probable prediction is more justified than an improbable one.
• Clearly, the problem cannot be about attaining unobtainable or non-existent knowledge. Goodman suggests the way forward is to think how deductive arguments are justified. A deductive argument is valid if it conforms to the rules of inference even though its conclusion is false, and is invalid if it does not even though its conclusion is true; no knowledge of the facts is required. So, Goodman suggests we should proceed likewise for induction – ie. follow the rules of induction.
• Yet the rules of both deduction and induction need to be justified. The validity of deduction depends on not just any rules, but valid rules (whether the valid rules, or some valid rules). And why are these rules valid? As for induction, some philosophers maintain that either the rules of deduction follow from a self-evident axiom or that the rules are grounded in the workings of the human mind.
• Goodman has a more radical response – the rules of deductive inference are justified by their conformity with accepted practice - with the deductive inferences we actually make and sanction. The general deductive rules are derived inductively from the judgements we actually make in rejecting or accepting particular inferences.

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4 This doesn’t seem a fair response, and I’m not sure what Goodman means here.
5 This just brings back the problem of induction – we only know these frequency distributions empirically for past experience, and we’re assuming the future will be like the past (however, we have an intuitive feel about dice that seems a priori).
6 Frege would not support this latter idea!
7 There’s something profoundly unsatisfying about this approach – as though we can vote in what is to count as valid inference.
8 Goodman doesn’t use this term.
• Is this circular? Deductive inferences are validated by conformity to the rules of deductively valid arguments, while these rules are themselves validated by conformity to deductively valid arguments. Goodman thinks that the circle is virtuous. Rules and inferences are brought into conformity with one another – we amend rules that give unacceptable inferences and reject inferences that violate a rule we’re unwilling to amend. This conformity is the only justification either needs.

• Goodman claims the same is true of inductive reasoning – predictions being justified if they satisfy the rules for inductive inference, and these rules being chosen because they justify what we perceive as valid inductive inferences (“accurately codify accepted inductive practice”).

• This approach stops us asking unanswerable questions and justifies Hume’s answer to the problem of induction – for by asking what we do, he was dealing with inductive validity and not just with psychological questions.

• While clearing the air, this leaves much to be done. Deductive logic has highly developed laws of logic, but there’s nothing comparable for induction. Goodman thinks treatises on probability don’t address the fundamental issues, but now turns to the (then) recent advances of confirmation theory.

§3. The Constructive Task of Confirmation Theory

• Goodman uses the analogy of defining the meanings of terms with established English usage for the process of formulating rules for valid inductive inference. We’d reject any definition of “tree” that accepted as trees what we agree aren’t trees or rejected those we all agree are trees. Where the process of definition helps is in the border cases where there’s no general agreement; usage informs the definition and the definition guides usage.

• We sometimes reject common usage on theoretical grounds, as in refusing to categorise whales as fish. Similarly, we may reject as valid some inductive inferences commonly deemed satisfactory.9

• Goodman now turns to Hempel. Both inductive and deductive logic are concerned with relationships between statements, independent of those statements’ truth value. In the case of deductive logic it is the consequence relation, for inductive logic it is that of confirmation. The problem of induction is to define the relation between two statements, S1 and S2 where S1 to some degree confirms S2.

• Goodman suggests our first two common-sense expectations would be that:
  1. induction might involve the reverse of deduction – namely the “the converse consequence condition” (CCC) that whatever confirms B in (A ⊃ B) confirms A12; and
  2. the “consequence condition” (CC) holds, ie. that whatever confirms a given statement confirms whatever that statement entails (in (A ⊃ B), evidence for A confirms, or is evidence for, B).

9 Hence, can we get the virtuous circle going for inductive inference as we can for deductive?

10 Goodman doesn’t give an example, but refers us to Chapter One (“Constructional Definition”) of The Structure of Appearance.

11 aka material implication

12 Effectively this comes down to what in deductive logic would be the fallacy of “affirming the consequent”.

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• However, Goodman points out that these two claims lead to absurdity. **Proof**: take any statement $S_1$ and any other statement whatever, $S_2$. Clearly, $(S_1 \& S_2) \supset S_1$. So, $S_1$ is a consequence of $(S_1 \& S_2)$ and by CCC, confirms $(S_1 \& S_2)$. However, $(S_1 \& S_2) \supset S_2$ as well. So, by CC, evidence for $(S_1 \& S_2)$ confirms $S_2$. But $S_1$ was evidence for $(S_1 \& S_2)$, so $S_1$ confirms $S_2$. Hence, any statement confirms any other statement.

• The response to this paradox can be to drop one or other of CCC and CC – Carnap drops both while Hempel drops only the CCC. However, Goodman proposes defining the CCC more carefully. The key point is that not all consequences of a general hypothesis confirm it. Take the conjunction $(S_1 \& S_2 \& S_3)$, which has all of $S_1$, $S_2$ and $S_3$ as consequences. While the truth of $S_1$ can be said to support the truth of the conjunction by reducing the undetermined portion, it does not necessarily confirm it. If one of the conjuncts is false, no amount of support from the others will make the conjunction true. Basically, confirmation of one of the conjuncts does not in general provide confirmation for the others.

• Goodman agrees with Hempel’s solution, which is to restrict CCC so that evidence only confirms a restricted version of the hypothesis. That is, that the hypothesis is deemed to be confirmed only in the restricted version where its quantifiers range over items of the same type and structure as the evidence. With this restriction, CCC and CC together don’t give the paradox of any statement confirming any other.

• There are other problems, one of which is Hempel’s Raven paradox. The paradox is that the hypothesis that all ravens are black is logically equivalent to the hypothesis that all non-black things are non-ravens; evidence for the one hypothesis ought to be evidence for the other; therefore, this white sheet of paper confirms not only that non-black things are non-ravens but that all ravens are black.

• Goodman’s answer to the paradox – which makes “the prospects for indoor ornithology vanish” is that the example unfairly relies on undisclosed background information. The fact that a given evidential object is neither black nor a raven confirms two hypotheses – that everything that is not a raven is not black and that everything that is not black is not a raven. From our background information, one of these hypotheses (the former) is obviously false and the other equally obviously true, but we ignore the false one because we are familiar with lots of black non-ravens. We are not allowed to assume this background knowledge, nor to reject the confirmation of the much stronger hypothesis that nothing is either black or a raven (as our evidential fact is a non-black non-raven). Given that our evidence confirms that there are no ravens, it’s not surprising that it confirms that, if there were any ravens, they would be black – but it also confirms the hypothesis that if there were any ravens, they would not be black.

• Our approach also falls short in not forcing us to take into account all the **stated** (rather than merely background) evidence. Goodman gives an example.

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13 Presumably by CC, as well as common sense.
14 Contrast this with Dorothy Edgington’s preferred solution of the use of Bayes’ theorem.
15 Presumably CCC. Goodman refers here and elsewhere to a “definition”. This is a definition of what counts as acceptable inductive inference. The use of the term definition is tendentious in my view, in that it presupposes that there’s no way of agreement on what counts as valid inference beyond the virtuous circle of refined definition and application.
Let $E_1$ and $E_2$ be two non-contradictory evidence statements that respectively confirm hypotheses $H_1$ and $H_2$. Then, they ought to confirm $(H_1 \& H_2)$. However, suppose $E_1$ is the statement that some thing $b$ is black, and $E_2$ is the statement that some other thing $c$ is non-black. Individually, these pieces of evidence support the hypotheses, $H_1$ – that all things are black - and $H_2$ – that all things are black – respectively. However, collectively the evidence cannot be said to confirm the self-contradictory hypothesis $(H_1 \& H_2)$ that all things are both black and non-black.

- To escape from this problem, Goodman suggests that we have to generalise from (ie. seek confirmation from) the total evidence rather than from parts of it. So, the improved definition (which I call CCC-modified) states, roughly, that whatever is true of the narrow universe of evidence statements is true of the whole universe of discourse. In the case of our example, the narrow universe \{b, c\} supports neither $H_1$ nor $H_2$.

- Hempel has done further clarificatory work on this, but more needs to be done to develop confirmation theory further. Goodman now goes on to other problems.

§4. The New Riddle of Induction

- Goodman points out by an example that confirmation of a hypothesis by evidence depends on the features of the hypothesis under consideration. In particular, only law-like hypotheses (regardless of truth, falsity or scientific importance) are capable of confirmation by instances – hypotheses of contingent or accidental generality are not. The examples he gives are the law-like “all copper wires conduct electricity” and the non-law-like “all men in this room are third sons”. However, there is more to this than a few odd cases.

- Goodman now gives his “grue” example. We start off straightforwardly with the hypothesis that all emeralds are green, and our approach to confirmation goes fine because, up to a certain time, all emeralds we’ve examined \{a, b, c, …\} have indeed been green and confirm the general hypothesis.

- Suppose, instead of the hypothesis that all emeralds are green, we have another – that all emeralds are “grue”. Whether a thing is grue or not depends on the time it is examined, a particular fixed time $t$. Prior to $t$, a thing is grue iff it is green, after $t$ iff it is blue. So, when we get to time $t$, all the emeralds we’ve examined have, as before, been green and we can expect all those
inspected after time $t$ also to be green, by CCC-modified. However, all emeralds we’ve inspected up to time $t$ have been grue, and so, by CCC-modified, we might expect all emeralds inspected after time $t$ also to be grue. But, if inspected after time $t$, to be grue a thing must be blue, and we know that no emerald is blue, on account of them all being green, and this second prediction is falsified.

- What has gone wrong with this? Well, there are two possible predicates for our emeralds – greenness and grueness, both of which are supported by the abundant evidence of green / grue emeralds prior to time $t$. The fact that we happen to know which predicate to apply is of no help given our “definition"\textsuperscript{20}, which allows either equally. Goodman claims that by choosing an appropriate predicate, we can make any prediction whatever about other emeralds that is supported by our evidence.

- We can equally make any prediction we like about anything. Goodman’s example is the prediction that all roses inspected after time $t$ will be blue. He does this by introducing the concept of “emeroses". A thing is called an emerose if it is examined before time $t$ and is an emerald or if it is examined after time $t$ and is a rose. Since before time $t$ the universal greenness of emeralds confirms that all emeroses are grue, we expect those inspected after time $t$ also to be grue – i.e. that all roses inspected\textsuperscript{21} after time $t$, then being emeroses, are predicted to be blue (the colour of grue objects inspected after time $t$).

- Goodman notes that our hypotheses have to be law-like in order to be subject to confirmation, but we have not made clear what “law-like" means. Without this, our definition is worthless as, virtually, anything confirms anything. This is the point of the grue and emerose examples.

- Are there easy ways of dealing with the difficulty? It is sometimes alleged, says Goodman, that the problem is the same as Hempel’s ravens – background information is being smuggled in illicitly. Goodman doesn’t directly apply the counter-argument to his grue or emerose examples but to the earlier distinction between law-like copper wire and un-law-like third sons. He notes that we know that samples of the same materials are alike in conductivity, whereas random samples of men aren’t alike in their number of elder brothers. While Goodman agrees that this is true, it doesn’t, he says, solve the problem in the immediate way that (he says) it solves the raven paradox. In the new case, acknowledging the background information about the conductivity of other materials or the occupants of other lecture theatres doesn’t in the least affect the application of CCC-modified, which is insensitive to such information.

- A better explanation is that the background information affects our hypotheses indirectly via other hypotheses that it directly confirms. So, our experience of materials in general confirms that samples of the same material are of similar conductivity. Consequently, we can believe that the conductivity of copper is

\textsuperscript{20} This is “CCC-modified” as a definition of what is to count as acceptable inductive inferredence (ie. the converse consequence condition, taking into account all the available relevant evidence simultaneously).

\textsuperscript{21} Note to be careful – roses inspected before time $t$ remain the colour they were; there is no suggestion that they change to blue at time $t$. However, according to this definition understood in the spirit of Sryrsm’s interpretation of grue, at time $t$ all emeroses change to emeralds (or maybe rosalds) and roses change to emeroses. This seems to spoil the example somewhat, as if we know this it would over-ride our inductive expectation that all emeroses would be grue after time $t$. 

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law-like and confirm that copper conducts electricity by our CCC-modified definition. On the contrary, our experience of lecture-theatres in general disconfirms the hypothesis that people in lecture theatres are third sons, making this hypothesis accidental. However, this still leaves us with the problem of how precisely to select hypotheses with similar law-like properties.

- Why does evidence for the hypothesis that all pieces of iron conduct electricity enhance the law-likeness of the hypothesis that all pieces of zirconium conduct electricity but not that all things on my desk conduct electricity? What’s the different between the broad hypothesis $H$ - that all pieces of the same material conduct electricity similarly (satisfied by the two hypotheses about the similar conductivity of, respectively, pieces of iron and zirconium) and the narrower hypothesis $K$ – that all pieces of the same material or all on a desk conduct electricity similarly (satisfied by the two hypotheses about the similar conductivity of, respectively, pieces of iron and the things on my desk)? It seems that confirmation of the property for one substance covered by $H$ increases the credibility of confirming instances for other substances covered by $H$, whereas the same isn’t true for things covered by $K$. However, Goodman thinks that this just boils down to saying that $H$ is law-like while $K$ isn’t, which is the problem we started off with.

- It is popularly thought that the solution to the riddle is that the problem cases – the accidental hypotheses - involve reference to restrictions such as particular individuals, times or places, whereas law-like hypotheses involve complete generality. However, making this distinction precise is difficult; the grue example doesn’t involve a particular thing or place and (Goodman says) we can change our predicates to take away this particularity while picking out the same individuals. We can’t get round the latter problem by rejecting hypotheses all of whose equivalents contain particulars because that would exclude nothing, while if we reject hypotheses for which any equivalent contains a particular we’d reject everything.

- Can we get out of the problem by outlawing predicates of certain kinds? The favoured approach (eg. of Carnap) is to define “law-like” as “non-positional” or “purely qualitative”. This won’t work if we adopt the method in the previous bullet, but the suggestion is that we can simply inspect the meanings of predicates to see whether they are purely qualitative. Goodman thinks this is impossible – that we can’t tell whether a predicate is qualitative or positional without begging the question as to law-likeness.

- At last we get to the main objection to Goodman’s grue example! Doesn’t the definition of “grue” include reference to a particular time, and so the hypothesis that emeralds are grue can be rejected as ill-formed? However, Goodman has a trump card. While he admits that green and blue are law-like while grue and bleen are not, it’s not because green and blue are “purely qualitative”. The problem is that green and blue can themselves be defined in terms of grue and bleen – for instance, green applies just to emeralds examined before time $t$ that are grue and those examined after time $t$ that are

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22 I’m not totally satisfied by this - the “grue” example does refer to a particular time and the redefinition approach is obscure (to me) and could do with an example.

23 Because, says Goodman, there’s always one equivalent that doesn’t.

24 Because, in Goodman’s example “All grass is green” is equivalent to “all grass in London and not in London is green”.

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bleen\textsuperscript{25}. It just depends which predicates we start with as basic, an entirely relative matter.

- If our definition of confirmation works apart from a few anomalies\textsuperscript{26}, why worry? For practical purposes, we don’t, but it is fatal to a theory. Why bother with a theory of induction in this case if we decide to ignore gross anomalies that “display the symptoms of a widespread and destructive malady”?  
- We have no way of distinguishing law-like confirmable hypotheses from non-law-like non-confirmable ones. This major obstacle, rather than mere technical difficulty, is the new riddle of induction.

§5. The Pervasive Problem of Projection

- The problem of justifying induction has been replaced by the problem of confirmation, which reduces to distinguishing between confirmable and non-confirmable hypotheses. The question “what is a positive instance of a hypothesis” replaced “why does a positive instance of a hypothesis give grounds for predicting further instances”, with the outstanding question being “what hypotheses are confirmed by their positive instances”.
- The original problem of induction was that anything could follow from anything. Then, CCC implied that anything could confirm anything, and the modifications to it make no difference\textsuperscript{27}. We can make no distinction between valid and invalid inductive inferences until we take control of our hypotheses.
- The problem with Hume’s account of induction is with his actual description, not with his descriptive method. According to Hume, habits of expectation arise as we note regularities in experience; however, he failed to note that some regularities give rise to valid predictions while others don’t. Goodman gives another example – every word so far in his lecture is prior to the final sentence, but the words of the final sentence itself won’t be. Green emeralds confirm that future emeralds will be green, but grue ones don’t confirm the grueness of emeralds after time $t$. It is pointless to claim past regularities are a guide to the future unless we can say which regularities, for we can find regularities anywhere.
- Confirmation theory is currently circular. It works when it works. We still need to determine a way of distinguishing law-like hypotheses, to which the definition\textsuperscript{28} of confirmation applies, from accidental ones, to which it doesn’t.
- The problem of induction is a special case of projection from one set of cases to another, to which troublesome problems of disposition and possibility reduce. This explains the importance of the new riddle of induction, which reduces to distinguishing between projectible and non-projectible hypotheses.
- The conclusion of Goodman’s lecture is that law-like or projectible hypotheses cannot be distinguished from less well-behaved ones simply on the basis of syntax or pure generality. He proceeds to give a new approach in the next lecture.

\textsuperscript{25}This seems to involve the “cancelling out” of a particular in the same way that London cancelled out in the “all grass is green” case. Is this significant?  
\textsuperscript{26}Grue and accidental hypotheses. Goodman claims that “grue” is a pure case, but doesn’t the fact that it has time embedded in it make it suspect, despite the fact that green can be defined in terms of grue and bleen?  
\textsuperscript{27}As the grue / bleen / emerose examples make clear.  
\textsuperscript{28}CCC-modified, again