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A PARTIAL SOLUTION TO THE GOODMAN PARADOX*

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In an earlier paper (Stemmer, 1971), I proposed a solution to the Hempel and the Goodman paradoxes.[1] In the meantime, however, I have realized that although the solution solves the Hempel paradox (with certain qualifications), it does not solve the Goodman paradox.

In the present paper, I shall first state the main ideas of my earlier solution. Then, I shall show why it does not solve the Goodman paradox. Finally, I shall propose a new solution to this paradox. This solution, however, is only a partial one, and our discussion will suggest that it is unlikely that a complete solution to the Goodman paradox can be obtained.[2]

1. INNATE GENERALIZATION CLASSES

Psychological experiments show that the instinctive generalizing behavior of well-developed species, including the human species, agrees with very specific classes. Thus, a young child, who is burnt by a fire, normally learns to avoid only certain kinds of entities, say, those belonging to the class F. Hence, the child 'uses' the specific class F in order to generalize from the original fire to other entities. F is a specific class because the original fire is an element of a very large number of classes, e.g., of the class of non-ravens, non-emeralds, of the class containing fires and emeralds, etc.

The classes that are used by the normal members of a species in their instinctive generalizing behavior will be called *innate generalization classes.*[3]

Since innate generalization classes are used in instinctive generalizing behavior, we can now describe a basic class of inductive inferences that are intuitively correct.

C1. If P and Q are innate generalization classes of humans, then the inductive inference of 'All P are Q' from the observation of a P that is a Q is intuitively correct (provided there is no other evi-

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dence available which suggests the inference of a different hypothesis).[4]

Since the inferences of C1 reflect instinctive behavior, we can draw a further conclusion. According to biology, instinctive behavior normally had survival value. This suggests that it was normally useful to draw the inductive inferences of C1. Now, the drawing of an inductive inference was useful only if, at least in many cases, the inference was reliable. Hence, biology suggests that, through evolutionary processes, the generalizing drives of well-developed species adapted themselves to the nature of our world in such a manner that, in general, they enabled the organisms to make reliable generalizations; in the present terminology, reliable inductive inferences.[5] It follows that by deriving plausible conclusions from evolutionary theory we become able to explain why many of the intuitive inferences of C1 were indeed highly reliable. (Note, in particular, the force of the indirect argument that if instinctive generalizing behavior had usually been *un*reliable, the drive to generalize would have disappeared; it would have been detrimental.) Moreover, these conclusions also show that people were justified in trusting their well-adapted innate generalizing feelings. This then also enables us to justify the inferences of C1.[6]

We thus arrive at our second conclusion:

C2. If P and Q are innate generalization classes of well-developed species, then the observation of a P that is a Q justifies the inductive inference of 'All P are Q' (provided there is no other evidence available which suggests the inference of a different hypothesis).[7]

C2 can be considered as a solution to the Hempel paradox.[8] By making the plausible assumption that the class of ravens and of black objects are innate generalization classes for many well-developed species, or at least very close to such classes, we can justify the inductive inference of 'All ravens are black' from a black raven. On the other hand, C2 does not justify the inductive inference of 'All non-blacks are non-ravens' from a non-black non-raven. Consequently, C2 does not commit us to the justification of the counterintuitive inference of 'All ravens are black' from a non-black non-raven.

Notice that our 'evolutionary' solution to the Hempel paradox is a justificatory solution. It enables us to justify a basic set of intuitive inductive inferences without committing us to the justification of counterintuitive inferences. Of course, the justification presupposes the validity of many scienti-

fic conclusions. But since this paper is written from an empiricist point of view, this is all right, so long as the conclusions are well supported.[9]

C2 states only a sufficient condition for justified inductive inferences. The reason is clear. Although evolutionary theory claims that, in general, innate dispositions were useful, it does not maintain that all dispositions that might have been useful have actually found their way into the genes of living beings. Therefore, evolutionary theory cannot give us a necessary condition for justified inductive inferences.

2. THE PARADOX

But the evolutionary solution does not solve the Goodman paradox. Let us say that an object is *grue,* if it is green and the time is prior to 2000 A.D., or blue and the time is not prior to 2000 A.D. It is easy to see that the class of grue objects has so far played the same role in evolution as the class of green objects. It follows that evolutionary theory cannot justify our preference for the latter class over the former in inductive inferences.[10]

Still, the fact that the solution does not solve the Goodman paradox does not imply that the idea behind it is incorrect. For it is one of the few plausible solutions to the Hempel paradox that are justificatory. Therefore, instead of abandoning this approach, the right thing to do is to investigate why, despite solving the Hempel paradox, the solution does not solve the Goodman paradox.

To this effect, it is important to distinguish between two kinds of inductive inferences: inductive inferences concerning the past and inductive inferences concerning the future. In the former, the inferred hypothesis has the form 'All P were Q' while in the latter it has the form 'All P will be Q'.

Now, it can be seen that the Goodman paradox does not affect the inductive inferences concerning the past. If the sentence 'All emeralds were green' is true, then the sentence 'All emeralds were grue' is also true. Therefore, if evolutionary theory justifies the inference of 'All emeralds were green' from the observation of a green emerald, it is right that it also indirectly justifies the inference of 'All emeralds were grue' from this observation. The Goodman paradox, unlike the Hempel paradox, affects only inductive inferences that refer to the future.

The Hempel paradox affects both the inductive inferences concerning the past and concerning the future. It can be seen, however, that our solution to

this paradox holds only for the former inferences. We recall that the solution is based on conclusion C2. But C2, which derives from evolutionary conclusions, is actually too strong. Evolutionary theory indeed claims that instinctive behavior *had* survival value. Yet, the past tense is decisive here. For the theory cannot tell us whether instinctive behavior will *continue* to have survival value. Hence, it cannot justify inductive inferences concerning the future. It follows that, with respect to such inferences, the evolutionary solution fails to solve not only the Goodman paradox but also the Hempel paradox.

C2 is thus too strong. We can justify only inductive inferences of hypotheses of the form 'All P were Q'. In the following, it will be assumed that in C2 '"All P are Q"' has been replaced by '"All P were Q"'.

3. INDUCTIVE INFERENCES CONCERNING THE FUTURE

What can we say about inductive inferences that refer to the future? First, let us note that with the help of our notion of innate generalization class we can describe a basic set of these inferences that are intuitively correct. This is possible because generalizing behavior usually concerns the future. A child who is burnt by a fire expects *from now on* that the elements of the class F are hot. Hence, we can formulate the following conclusion:

C3. If P and Q are innate generalization classes of humans, then the inductive inference of 'All P will be Q' from the observation of a P that is a Q is intuitively correct (provided there is no other evidence available which suggests the inference of a different hypothesis).

C3 describes a basic set of inductive inferences concerning the future that are intuitively correct. Notice that C3 does not include the counterintuitive inference of 'All emeralds will be grue' from the observation of a grue emerald, since the class of grue entities is not an innate generalization class.[11]

But the difficult problem is the *justification* of inductive inferences concerning the future. We have seen that evolutionary theory alone cannot justify such inferences. We therefore need additional means. I shall now argue that if we assume the validity of a very modest postulate, we become able to justify the inferences of C3.

Let me first return to the inductive inferences concerning the past that are

described in C2. We recall that these inferences can be justified because, according to evolutionary theory, the instincts that stand behind them reflected, so to say, part of the uniform nature of our world. Now, this uniformity has so far been a specific uniformity, namely, it was a uniformity that ensured the reliability of the intuitive inferences of C2. Let me therefore call it an *intuitive uniformity*. If we now assume that in the future the nature of the world will continue to be intuitively uniform, we can then justify the intuitive inductive inferences of C3.

More formally, I introduce the postulate:

(P) The nature of the world will continue to be intuitively uniform.

If postulate (P) is accepted, we can justify the inductive inferences of C3. The postulate ensures the future reliability of these inferences.

(P) is supported by the fact that in the past, at least in the recent past, the nature of the world has been intuitively uniform to a high degree. It ensured, in general, the reliability of the intuitive inferences of C2, and it did not, in general, ensure the reliability of certain non-intuitive inferences such as those about non-ravens or about objects that are gruex (i.e. green and the time is prior to 1900 A.D., or blue and the time is not prior to 1900 A.D.). Yet, there are two reasons why the support is only partial. Firstly, the nature of the world has so far also ensured the reliability of some other non-intuitive inferences such as those about grue objects.[12] Secondly, the evidence that supports (P) belongs in its totality to the past while (P) refers to the future.

If postulate (P) is accepted, one can thus justify the inductive inferences concerning the future of C3. Of course, people do not justify these inferences because they consciously accept (P). They justify them because the inferences agree with their innate generalizing feelings. I am therefore not interested here in defending this postulate. I have introduced (P) only for clarificatory purposes. It spells out the minimal assumptions that have to be made in order to justify the intuitive inductive inferences of C3.

It is therefore important to realize that (P) is a very modest postulate. Since it does not intend to justify inferences of generalities from particulars, it does not have the force of a real 'rule of induction'. Our rule of induction is C2 which indeed justifies certain inferences of generalities from particulars. But C2 is based on well-supported evolutionary conclusions. (P), on the other hand, merely transfers past generalities into the future. Note in particular that (P) is much weaker than Mill's principle of the uniformity of nature. For this

principle is supposed to justify inductive inferences in general, including all inductive inferences concerning the past.[13]

4. A PARTIAL SOLUTION

Our conclusions can be viewed as a partial solution to the Goodman paradox (and to the part of the Hempel paradox that affects the inductive inferences concerning the future). Firstly, they enable us to justify a basic class of inductive inferences that are intuitively valid, namely, the inferences concerning the past that are described in C2. Secondly, they show that with the help of the modest and partially supported postulate (P) one can also justify the intuitive inductive inferences concerning the future that are described in C3. Yet, the solution is only partial because our justification of the inferences of C3 depends on the validity of (P). Our discussion suggests that a complete solution to the Goodman paradox should not be expected, since in order to justify inductive inferences concerning the future it will always be necessary to assume the validity of some postulate of this kind.[14] But if one already needs such a postulate, then (P) seems to be one of the most modest and best supported postulates that achieve this.

Our conclusions also have clarificatory value. They show the importance of distinguishing between inductive inferences concerning the past – part of which can be justified with the help of evolutionary theory – and inductive inferences concerning the future – whose justification requires further means.[15]

5. PROJECTIBLE PREDICATES AND A GENERAL SOLUTION TO THE PARADOXES

Instead of speaking of Goodman's paradox, one can also speak of Goodman's project. This project consists of two parts. The first is to give a general characterization to the predicates that are intuitively projectible. The second is to justify the use of these predicates in inductive inferences.

With respect to this project, the following has been achieved here. A basic class of intuitively projectible predicates has been characterized. They are the predicates whose extensions are innate generalization classes of humans. By relying on evolutionary conclusions, the use of these predicates (or of their extensions) in inductive inferences concerning the past can then be justified.

That is to say, these predicates are not only intuitively projectible; they also were actually projectible. Finally, with the help of the modest and partially supported postulate (P) it is possible to justify the use of these predicates in inductive inferences concerning the future.[16]

It is important to note that our results make it possible to give a *general* solution to the paradoxes of confirmation. According to our analysis, the counterintuitiveness of the inferences that are discussed in both the Hempel and the Goodman paradoxes is attributed to the same cause, namely, to the fact that some or all of the predicates that appear in the inferences are not intuitively projectible. Their extensions are not innate generalization classes for humans.

6. A FIRST STEP

Our conclusions C1, C2 and C3 deal only with inductive inferences of an elementary type. We would, of course, prefer a solution to the paradoxes which covers all kinds of inductive inferences.[17] But this does not diminish the value of the solution, for it is intended to be just a *first step* towards a general theory of inductive inferences. Yet, the step is a decisive one, because of the crucial role which the inferences described in our conclusions play in scientific inquiry. For it is by making such inferences that the child – that is, the future scientist – begins with the acquisition of his empirical knowledge. Moreover, history (or prehistory) suggests that human knowledge, too, started with such inferences. And therefore the conclusions we derived from evolutionary theories are so important. Since they explain why many of these elementary inductive inferences were highly reliable, they explain, at least in part, how scientists arrived at the reliable scientific theories of present time. They had a good starting point.

7. A COMPLETE SOLUTION?

I said earlier that my solution to the Goodman paradox is only a partial one. And even the title of this paper is phrased in this manner. But it is possible to make a stronger claim. One can argue that the solution is a complete one.

I stated above that the solution is a partial one because one needs the continuity postulate (P) in order to justify the inductive inferences concerning the future of C3; yet, there is no way to prove the truth of (P). But the

demand that a solution to the Goodman paradox should include a proof that (P) is true seems to give a too wide interpretation to this paradox.[18] It is almost like demanding that it should also include a solution to Hume's problem. Goodman raises a more restricted problem. He wants a criterion for distinguishing between projectible and non-projectible predicates which is justified, as far as possible, by empirical data and plausible conjectures. Now, with respect to such a formulation of the paradox, our conclusions C1, C2, and C3, together with the modest and partially supported postulate (P), can be considered as a complete solution.[19]

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NOTES

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[1] See also Stemmer (1975).

[2] But see Section 7.

[3] In Stemmer (1975), I describe an experiment which makes it possible to give an operational definition to the notion of innate generalization class.

[4] Actually, an additional condition has to be fulfilled, namely, that the observed P and Q be salient aspects of the whole situation. But in order to avoid too many complications, I shall ignore this here.

[5] The same conclusion was also arrived at by Quine (1969). See also Quine and Ullian (1970, p. 58).

[6] We shall see later that this conclusion is actually too strong.

[7] Since an instinct may have become genetically established in a species even if it was useful only in a large number of cases, the observation actually justifies only the inductive inference of 'Many P's are Q'. However, in order to avoid too many complications, I shall ignore this here. In Stemmer (1971, p. 298f), I discuss how additional evidence may enable us to go from 'Many P's are Q' to 'Most P's are Q' and eventually to 'All P's are Q'.

[8] We shall see later that the solution holds only for so called inductive inferences *concerning the past.*

[9] Cf. Quine (1969, p. 14): "I see philosophy not as an *a priori* propaedeutic or groundwork for science, but as continuous with science ... . There is no external vantage point, no first philosophy. All scientific findings, all scientific conjectures that are at present plausible, are therefore in my view as welcome for use in philosophy as elsewhere."

[10] This was pointed out by Goodman (1972, p. 358) when criticizing Quine and Ullian's (1970, p. 54ff) solution to his paradox.

[11] If this class were an innate generalization class for humans, the inference of 'All emeralds will be grue' from the observation of a grue emerald would not be counterintuitive.

[12] It has also ensured the reliability of certain 'theoretical' inferences like those about mammals or electrons. But the continuation of this aspect of the uniform nature of the

world does not imply the unreliability of the inferences of C3. (Of course, it is important to investigate why these inferences were reliable. But this goes beyond the scope of the present paper which intends to deal only with the reliability of inferences of an elementary type; inferences, that are based on the observation of just a few positive instances.)

[13] Cf. Mill (1868, III/iii/1): "It is not from the past to the future, as past and future, that we infer, but from the known to the unknown ... . In this last predicament is the whole region of the future; but also the *vastly greater portion of the present and the past* [my italics]."

[14] But see Section 7 below.

[15] We obtain a spatial version of the Goodman paradox by defining 'grue' as 'green and located on the earth, or not so located and blue'. The treatment of this version would follow essentially the same lines as the one discussed here for the temporal version, since in this case, too, evolutionary theory alone cannot justify our preference for green over grue in inductive inferences.

[16] Psycholinguistics enables us to give a direct characterization to these predicates. They are *ostensive* terms, i.e. terms that humans can learn to understand or to produce by being exposed to a *few* ostensive pairing situations. For the extensions of such terms are innate generalization classes for humans, or very close to such classes, (See, e.g., Quine (1969, p. 11f) or Stemmer (1973, p. 50ff).) For example, the terms 'raven' and 'green' are ostensive, while 'non-raven' and 'grue' are non-ostensive.

[17] In Stemmer (1971, p. 298f), I studied a more advanced type of inductive inferences. In these inferences, the antecedent generalization class is a so-called *restricted* subclass of an innate generalization class.

[18] Cf. Goodman's comments on his own solution to the paradox: "... we do not by any means know that they [the projections of entrenched predicates] will turn out to be true ... . We have no guarantees (1965, p. 98f)."

[19] Of course, the solution is incomplete because, as remarked in Section 6, it does not cover all kinds of inductive inferences. But this is another type of incompleteness.

BIBLIOGRAPHY

Goodman, N., 1965, *Fact, Fiction, and Forecast*, Bobbs-Merrill, Indianapolis, (2nd edition).

Goodman, N., 1972, *Problems and Projects*, Bobbs-Merrill, Indianapolis.

Mill, J. S., 1868, *A System of Logic*, Longman's, London.

Quine, W. V., 1969, 'Natural Kinds', in N. Rescher (ed.), *Essays in Honor of Carl G. Hempel*, D. Reidel, Dordrecht.

Quine, W. V. and Ullian, J. S., 1970, *The Web of Belief*, Random House, New York.

Stemmer, N., 1971, 'Three Problems in Induction', *Synthese* **23**, 287–308.

Stemmer, N., 1973, *An Empiricist Theory of Language Acquisition*, Mouton, The Hague.

Stemmer, N., 1975, 'A Relative Notion of Natural Generalization', *Philosophy of Science* **42**, 46–48.