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**One: Introductory**

1. Empirical knowledge may be regarded as built up by means of nondemonstrative inference: inference in which premises (which are evidence that experience provides) support but do not imply conclusions (which are empirical hypotheses).

2. Nondemonstrative inference deserves investigating because many writers leave unclear the status of its basic principles, because it is intimately bound up with the philosophical issue of realism versus subjectivism, and because it is requisite for critical understanding of developments in science.

3. What mode of nondemonstrative inference is fundamental, and what reasons are there for trusting it? The skeptical view that no method is any more reasonable than any other is not seriously tenable, nor need this question be set aside as self-contradictory.
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IV The question cannot be answered by empirical investigation. 15

V Nor can this question be settled by arbitrary linguistic convention or just by appeal to the ordinary use of language; and it will not do to say that the evaluating of nondemonstrative arguments is an unprincipled art. 18

VI The question is a philosophical one; some reasonable account of the basic principles of nondemonstrative inference is what we should seek. 23

Two: Hypotheses and Evidence

I What is the nature of empirical hypotheses and of the empirical evidence on the basis of which they acquire varying degrees of credibility? 26

II Hypotheses may be statements of any truth-functional or quantificational form; but it seems wiser not to require them to embody any notion of causal necessity. 27

III As for empirical evidence, some philosophers maintain that it ought to be known with certainty and ought therefore to be descriptive of immediate sense-experience. Others prefer the view that the evidence is not certain and that it should consist of physicalistic statements. 31

IV The proponent of either of these views can levy objections against the other. 36

V These two schematizations seem to reflect different concerns. Perhaps neither is illegitimate. 40

In any case, the observational statements in which empirical evidence is couched ought not to be universal statements, nor should they contain singular terms; they should be existential statements. Predictions have no special efficacy. 44
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Three: Eliminative Induction

Induction, the most frequently advocated mode of non-demonstrative inference, may be held to proceed by simple enumeration of instances, or it may be held to proceed by elimination of rival generalizations. 48

Eliminative induction could confirm a generalization provided the generalization had a finite antecedent probability and provided favorable instances increased its probability. 52

These conditions would be fulfilled if Keynes's principle of limited variety were true. 55

But no reason can be offered for assigning any definite degree of probability to Keynes's principle or for selecting any definite formulation of the principle itself. Moreover, this theory of induction would preclude the confirming of relational hypotheses. 58

Four: Enumerative Induction

Enumerative induction, if one attempts to base it upon presuppositions about the world, seems equally unsatisfactory. 62

Reichenbach's theory of induction claims to involve no presuppositions, but is subject to various difficulties. 65

Williams' theory, based upon the statistical syllogism, does permit an a priori justification of enumerative induction. 70

This justification is free of the defects which some critics have imputed to it. 72

But the statistical syllogism is capable of yielding paradoxical results if employed in an unguarded way; and if restricted so as to prevent these results, it ceases to be very useful. 75
Indeed, any informal rule of enumerative inductio
seems capable of yielding unreasonable results, nor
the notion of “concatenated inductions” rectify this.

Carnap’s formalized theory is free from this difficult
it has some inconvenient features, but these disapp
e if the theory is slightly recast into a more attractive form

But Carnap’s theory does not allow for the confirmi
of generalizations, and singular terms must be employe
if even “instance confirmations” are to be obtainabl
Nor is it clear how even instance confirmations could b
obtained for relational hypotheses.

Five: Induction and Simplicity

Any theory of induction would have difficulty in explain
ing why we should prefer the simplest of competi
hypotheses about functional relationships between quan
titative attributes.

Moreover, many important hypotheses imply the exist
ence of unobserved entities, and it is not clear how mere
induction can account for their confirmation.

Such hypotheses, if they contain “theoretical” terms,
cannot be confirmed by any form of induction; even if
they do not, it would seem that they cannot be con-
irmed by eliminative induction or by enumerative in-
duction.

Nor can this difficulty be avoided by the supposition that
a hypothesis may be confirmed by making an induction
concerning the class of all its logical consequents. To
invoke some notion of simplicity here would be to
abandon the purely inductive point of view.

Six: Reductionism

In order to avoid the difficulty concerning hypotheses
which imply the existence of unobserved entities, the
proponent of induction might adopt the reductionist
view that unobserved things are logical constructs.
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I. It is out of place to object that reductionism is committed to a wrong view of experience or that it illegitimately refuses to seek explanation for the occurrence of what is observed.  

II. The most promising reductionist proposal is that statements about unobserved things be translated into disjunctions of conjunctions of ‘if . . . then . . .’ statements about what is directly observed.  

III. But if these translations are not finite in length, then they cannot be carried out—and even if they could be carried out, they all would have the same meaning.  

IV. To maintain that these translations are finite is to advocate debilitating ambiguity.  

V. There does not seem to be available any way of modifying the form of translation so as to avoid these defects.  

VI. Furthermore, reductionism is incompatible with belief in other minds; and it errs through failing to understand that it is as a system, not in isolation, that hypotheses are confirmed.  

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### Seven: Formalism

I. The proponent of induction might fall back upon the "formalist" doctrine that hypotheses about unobserved entities are merely inscriptions from which observational sentences can be derived according to rules of the game.  

II. Hypotheses which imply the existence of unobserved things and which contain theoretical terms would be said to have no meaning at all by some formalists; others would allow them an indirect significance.  

III. The doctrine that these hypotheses containing theoretical terms may have indirect significance, even when combined with a criterion of significance as ingenious as Carnap’s, seems to blur the distinction between sense and nonsense.
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iv It seems odd to contend that uninterpreted marks play a necessary role in scientific knowledge or that rituals with them can explain observed phenomena. 142

v More important, the formalist cannot offer any plausible account of how we ought to choose among competing theories. And there is no logical reason for using any theoretical terms at all. 144

vi Nor is the formalist doctrine any more plausible with regard to hypotheses which are about unobserved entities but which do not contain theoretical terms. 149

Eight: The Method of Hypothesis

i It seems necessary to seek a noninductive mode of inference which will enable us to confirm hypotheses about unobserved things; the only candidate seems to be the method of hypothesis, according to which a hypothesis is better confirmed the more of its logical consequents are verified. 152

ii But when uncritically stated, this method has two principal defects: it does not yield any direct way of confirming many hypotheses that do deserve confirmation, and it allows the confirming of many that do not. 154

iii Using the notion of falsifiability, Popper has proposed what may be regarded as a version of the method of hypothesis. But his theory also permits the confirming of nonempirical hypotheses, and it does not rank empirical hypotheses correctly with regard to their degrees of confirmation. 156

iv We should ordinarily invoke some notion of simplicity in order to avoid these difficulties. But this notion is imprecise and needs working out. 161
Nine: Simplicity and Confirmation

1 The two principal defects of the method of hypothesis perhaps can be overcome; the first, by considering hypotheses not in isolation but as grouped together in systems. 165

II The second defect might be overcome through the notion of logical simplicity. One hypothesis may be regarded as better confirmed than another if and only if it can be combined with the evidence so as to form a system simpler than any to which the other hypothesis and the evidence belong. 169

III The mere number of its postulates or of its primitive predicates is not an accurate clue to the degree of simplicity of a system. 171

IV Nor can Goodman's important theory of logical simplicity be applied to the problem of confirmation. 174

V One of Kemeny's notions of simplicity, explained in terms of logical measures, seems more promising. 176

VI A criterion of confirmation employing this notion of simplicity seems to make possible the confirming of generalizations, of relational hypotheses and of hypotheses about unobserved entities, and of hypotheses about mathematical relationships between quantitative attributes. 182

VII A seemingly serious objection to this criterion of confirmation can be avoided if hypotheses which merely limit the size of the universe are set aside as nonempirical. 186

VIII Goodman's puzzle about "grue" emeralds need not constitute a difficulty for this sort of criterion of confirmation, provided we may assume that there is a genuine difference between statements that are observational statements and those that are not. 188
Ten: Concluding Remarks

I In deciding whether to accept the criterion of confirmation which has been tentatively suggested, we ought to contrast it with its rivals over the whole range of issues at stake.

II If this criterion be accepted, we shall want to hold that a legitimate scientific explanation must effect some simplification and also that primitive terms not occurring in the evidence ought not to occur in confirmed empirical hypotheses, since they can contribute nothing to simplicity.

III Moreover, we shall not want to regard the entities mentioned in confirmed hypotheses as fictional constructions; the merit of scientific hypotheses is precisely that there are good grounds for believing them to be true.

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