CHAPTER 7

CONFIRMATION AND INDUCTIVE EQUIVALENCE

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A. NICOD'S CRITERION - INSTANCE THEORY OF CONFIRMATION

'A entails B' is a formula or a law. How can a fact affect its probability? According to Jean Nicod, if this fact consists in the presence of B in a case of A, it is favourable to the law 'A entails B'. On the other hand, if it consists in the absence of B in a case of A, it is unfavourable to this law. Nicod's criterion implies that a fact that may affect the probability of any empirical hypothesis must satisfy its antecedent. It is then, and only then, relevant to the confirmation or disconfirmation of the hypothesis. Otherwise, the fact is irrelevant to its confirmation or disconfirmation. If the fact that satisfies the antecedent of the hypothesis satisfies the consequent as well, then the fact confirms the hypothesis. If it satisfies the antecedent but not the consequent, then it disconfirms the hypothesis.* Thus everything is not relevant to the confirmation or disconfirmation of a hypothesis. This principle of limited relevance, as Max Black

would call it, is a necessary consequence of Nicod's criterion of confirmation. Nothing other than an instance of A is relevant to the confirmation or disconfirmation of the hypothesis 'A entails B'.

B. RIVAL THEORIES AND THE PARADOX

Hempei points that the confirmation of a hypothesis should be independent of the way in which it is formulated. So a necessary condition for the adequacy of any proposed criterion of confirmation is:

'Whatever confirms (disconfirms) one of two equivalent sentences, also confirms (disconfirms) the other' *

'Otherwise', holds Hempei, 'the question as to whether certain data confirm a given hypothesis would have to be answered by saying: "That depends on which of the different equivalent formulations of the hypothesis is considered" - which appears absurd'. ** Nicod's criterion of confirmation, i.e., his instance theory, is inconsistent with the said equivalence condition. They cannot be true together as their joint truth


generates the following paradox known as 'The Raven Paradox', 'The Paradox of Confirmation' or 'Hempel's Paradox':

1. The existence of a white handkerchief confirms the hypothesis 'All non-black things are non-ravens'.

2. For any evidence e, and any pair of hypothesis $h_1$ and $h_2$, if $e$ confirms $h_1$, and $h_1$ is logically equivalent with $h_2$, then $e$ also confirms $h_2$.

3. The hypothesis 'All non-black things are non-ravens' is logically equivalent with the hypothesis 'All ravens are black'.

4. Therefore, the existence of a white handkerchief confirms the hypothesis 'All ravens are black'.

This is how P.K. Sen has formulated the paradox. The first premise of the argument is an application of Nicod's criterion. The second premise is just a statement of Hempel's equivalence condition considered to be a necessary condition for the adequacy of any proposed criterion of confirmation as explained above. The third premise is a case of logical equivalence between a statement and its contrapositive.

Let us agree with Sen to call this paradox generating

argument 'Argument A', for convenience. Prima facie, the argument A contains an inconsistent triad:

(P) The argument A does not violate any rule of logic.
(Q) All the premises of argument A are true.
(R) The conclusion of the same argument is false.

The fact that a valid argument with a set of true premises leads to a false conclusion is paradoxical. The only way to escape the paradox is to reject one or the other of the inconsistent triad P, Q, R. The validity of the paradox generating argument A is beyond all scope of doubt. This compels us to accept P. But then either Q or R must be rejected. This may be done only by proving that some one or other of the premises under Q believed to be true is really false, or that the conclusion believed to be false is really true.

According to Hempel, the constituent R of the inconsistent triad must be rejected, because the conclusion of the argument A is really true. A white handkerchief that confirms the hypothesis 'All non-black things are non-ravens' must also confirm 'All ravens are black' which, being a contrapositive of the said hypothesis, is only a different formulation of it. The two hypotheses, the original and its contrapositive, have the same logical content and are equivalent. Hempel's
necessary condition for adequacy of any criterion of confirmation described above necessitates that the evidence of a white handkerchief confirm the hypothesis 'All ravens are black'. Otherwise, confirmation would depend not only on the content of the hypothesis but also on its formulation. The two hypotheses:

\[ S_1 : \neg \exists x \text{Raven}(x) \implies \text{Black}(x) \]
\[ S_2 : \neg \exists x \text{Black}(x) \implies \neg \text{Raven}(x) \]

are different formulations of the same hypothesis, one being the contrapositive of the other. They are logically equivalent and so whatever fact confirms the one must also confirm the other.

J.L. Mackie is substantially in agreement with Hempel in holding that given no additional information the paradox is to be solved in Hempel's way. Qualitatively considered, the evidence of a non-black non-raven is not irrelevant to the confirmation of the hypothesis 'All ravens are black'. The evidence rather confirms it. Even if there is any additional information, it can only create a mistaken intuition in favour of the constituent R of argument A.

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C. ROM HARRÉ'S SOLUTION OF THE PARADOX

Rom Harre rejects Q (that all premises of argument A are true). Harre is against writing scientific hypotheses simply as universally quantified statements and accepting the third premise of argument A. Harre thinks, a genuine natural law expressing the relation, say, between an emerald and its colour (green) would be associated with some idea of the generative mechanism at work in the differential reflection of light by gem stones. The universally quantified statement of the form \((x)(\text{Emerald } x \supset \text{Green } x)\) fails in this respect. It expresses nothing more than a mere conjunction of properties. Even Nicod's instance theory of confirmation has been considered unsatisfactory by Harre, because no number of instances can throw any light on the generative mechanism at work. A genuine law of nature having reference to the generative mechanism at work cannot be equivalent to its contrapositive. Harre, therefore, opposes application of the equivalence condition on the so-called equivalence between a natural law and its contrapositive. Nicholas Griffin while commenting on Harre's thesis observes, "On occasions he seems to be denying that a generalisation and its contrapositive are logically equivalent. Elsewhere he suggests that though they are logically equivalent

they are not equivalent from the point of view of confirmation".*

Possibly, what Harre** likes to hint at is that an empirical
hypothesis asserts some natural necessity operating between
events and objects. Standard quantification logic leaves out
much. It leaves out this concept of natural necessity contained
in the empirical hypothesis. This is why an empirical hypo­
thesis cannot be equivalent with the contrapositive of its
quantified logical form, at least for the purpose of confir­
mation. The evidence that confirms the contrapositive may not
confirm the total content of the original hypothesis.

But is this total cognitive content of a natural hypothesis
confirmable? If so, what should be the character of the confir­
mimg evidence that is capable of supporting a necessary connec­
tion between objects and events? An empirical evidence, say,
of a green emerald shows only the joint presence of emeraldness
and greenness. It never shows any necessary connection,
causal or natural, between them. It can only confirm the
hypothesis 'Something is emerald and not green, is not the case',
or symbolically, \( \neg (\exists x)(\text{Emerald } x \land \neg \text{Green } x) \) which is
the other way of saying \((x)(\text{Emerald } x \rightarrow \neg \text{Green } x)\). Any attempt
to confirm a content involving the concept of necessary

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* Nicholas Griffin: 'Has Harre*/ Solved Hempel's Paradox?'
  Mind, LXXXIV, 1975, P. 428.
connection would be chasing a wild goose. Had the scientists not remained satisfied with this and preferred to suspend all their pronouncements till a content other than the truth-functional or quantificational be confirmed, civilisation would not have advanced a step beyond its starting point. Harre\(^1\) (together with E.H. Madden) justifies his belief in natural connections thus: "And though reason is unequal to the task of proving that the external world exists and that there are necessary connections between objects and events, still it is equally incapable of proving these things impossible. This plus the fact that the instinct which compels us to believe these things is useful, shows that it would be foolhardy to believe otherwise".\(^2\) I believe Madden and Harre\(^4\) have succeeded in putting forward a non-logical instinctive base for our belief in necessary connections between objects and events. But this, at the same time, is an admission that we cannot have a logic of confirmation to support necessary connections, as 'reason is unequal to the task of proving' necessary connections. The attitude is typically dogmatic.

Griffin criticises Harre\(^4\) from a different standpoint. He points out that if natural laws throwing light on the generative mechanism be not logically equivalent with their

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\(^1\) E.H. Madden and R. Harre\(^4\): 'In defence of Natural Agents', The Philosophical Quarterly, 23, 1973, P. 130.
contrapositives because the latter do not contain the generative mechanism, accidental generalisations and protolaws which have no obligation to generative mechanism must be logically equivalent to their contrapositives. The paradox remains. If Harre still presses that a generalisation and its contrapositive, though equivalent, are not equivalent from the point of view of confirmation, Griffin, like Hempel, would point out that "this immediately leads to counter-intuitive results, for the confirmation of a hypothesis should surely not depend upon the way the hypothesis is stated".

D. SEN'S SOLUTION OF THE PARADOX - CONTRAPOSITION CONDEMNED

Sen, however, thinks that "it is not possible to justify Hempel's Equivalence Condition by saying that logically equivalent hypotheses are nothing but alternative formulations of the same hypothesis". His attack on Q (i.e. all the premises of the argument A are true) is both elaborate and direct. Sen does not think it worthwhile to challenge the instance theory. In his opinion, its rejection "does not help us in resolving the paradox of confirmation if it is taken all by itself". In an answer to Goodman's criticism of the

theory, Sen concedes that an accidental generalisation cannot be confirmed by its instances. But the raven hypothesis and its contrapositive cannot be said to be accidental generalisations. They are law-like generalisations. So this drawback of the instance theory cannot affect their confirmation.

Sen also accepts many of the shortcomings of the instance theory pointed out by Hempel. According to Sen, in spite of these shortcomings, the criterion is appropriate for all universal conditional hypotheses to which the raven hypothesis and its contrapositive belong. I believe the instance theory cannot claim this much as well. The principle of relevance (or the principle of limited relevance as it is sometimes called) as explained by Sen in section viii of his paper is a necessary correlate of Nicod's instance theory such that they sink or sail together. This principle of relevance is not acceptable for reasons I propose to place later.

One of the main targets of Sen's attack is the third premise of argument A which asserts the equivalence between a hypothesis and its contrapositive. He accepts Strawsonian theory of presupposition and argues that 'All ravens are black' presupposes existence of ravens which its contrapositive does not.

Again the contrapositive 'All non-black things are non-ravens' presupposes the existence of non-black things which the original hypothesis does not. So they do not have the same cognitive content and without the same cognitive content the two cannot be cognitively equivalent. This cognitive equivalence is all important in matters of confirmation. Sen, like Strawson, is of opinion that \((x)(\text{Raven } x \implies \text{Black } x)\)' is not a correct translation of 'All ravens are black' as it leave out the existential presupposition of the latter. I discussed Strawson's theory of presupposition in two of my earlier chapters and tried to show some of its major weaknesses. Hempel too has discarded the notion of an existential component of general hypothesis as this would invalidate many of the accepted inferences of science. Empirical sciences clearly do not include any existential component in their hypotheses and many universal hypotheses cannot be said to have any such component at all. On the other hand, the validity of contraposition is so obvious that even a presupposition philosopher while arguing against contraposition takes recourse to it in his ignorance. To cite an instance, Sen's tables of relevance (in section viii of his paper) are, I believe, based upon the following contraposition:
All events relevant to the confirmation of a hypothesis $h$ are instances of the hypothesis $h$.

All non-instances of the hypothesis $h$ are events irrelevant to the confirmation of the hypothesis $h$.

Another presupposition philosopher, P.H. Donnell who argues that "'S' is false' entails 'S is not truth-valued'" follows from "'S is truth-valued' entails S'" clearly takes recourse to contraposition.

E. CONCEPT OF PRESUPPOSITION UNACCEPTABLE - CONTRAPOSITION HOLDS

Strawson's presupposition theory is inconsistent with the instance theory of Nicod. 'All ravens are black', according to the presupposition theory, presupposes existence of ravens, and cannot be true if all things are non-ravens. Therefore, whatever evidence supports the hypothesis 'All things are non-ravens' must be an evidence against the hypothesis 'All ravens are black'. In terms of the instance theory a lotus may be viewed as an evidence that confirms the hypothesis 'All things are non-ravens', because it is both a thing and a non-raven. But as 'All ravens are black' cannot be true according to presupposition philosophers, if 'All things are non-ravens' be true,

the existence of a lotus that confirms 'All things are non-
ravens' must thereby contribute to the disconfirmation of the hypothesis 'All ravens are black'. So, the observation of a lotus which is surely not a raven cannot be out of relevance to the confirmation or disconfirmation of the raven hypothesis, if the presupposition theory is true. Further like confirmation, disconfirmation also turns out to be a matter of degree. This shows, either the presupposition theory of Strawson is wrong, or, the instance theory of Nicod along with the principle of relevance is defective. Sen is surely wrong in upholding both. This I claim to be an unanswerable point against the presupposition philosophers.

I have other serious objections against the presupposition theory. According to it, the truth-or-falsity of 'All spaniels are faithful' presupposes the truth of the statement 'Some dogs are spaniel' or the falsity of the statement 'No dogs are spaniel'. But this presupposition itself presupposes the falsity of the statement 'No mammals are dogs'. This in its turn presupposes the falsity of the statement 'No vertebrates are mammals', ... and so on ad infinitum. This means that the truth or falsity of a statement depends on an infinite number of presuppositions with the consequence that no statement can be
known to be true or false without determining the truth-value of an infinite number of statements. If this is so, no science would be possible. That science is possible is enough to conclude that the presupposition theory is unacceptable.

Presupposition theory is really a paper tiger against the validity of contraposition of empirical hypothesis or our 2-valued formal logic. Contraposition has entered deep into ordinary as well as scientific thinking. No scientific thought has yet misled us simply because it has used contraposition. If contraposition is valid, principle of bivalence has to be accepted.

There are certain examples of arguments that tend to make contraposition a suspect. To mention a few:

(i) If the U.S. halts the bombing, then North Vietnam will not agree to negotiate.

\[ \text{If North Vietnam agrees to negotiate, then the U.S. will not have halted the bombing.} \]

(ii) If the general surrenders, the army will not surrender.

\[ \text{If the army surrenders, the general will not surrender.} \]
(iii) If John has children, all his children are not asleep.

If all John's children are asleep, John has no children.

All these arguments challenge the validity of contraposition. They are held as counterexamples of contraposition. As a matter of fact these examples rather show how ordinary language falls an easy prey to the ambiguities of our words and sentences. It often contraposes what is not contraposable. It is misled by the outer form of language and is ignorant of the deep logical structure of our propositions. John A. Barker has shown that the premises of these arguments are not genuine conditionals which alone are contraposable.* Those of (i) and (ii) are counterconditionals (i.e., denial of genuine conditionals, which should be introduced by 'Even if' instead of 'If'), and that of (iii) is a conditional assertion (i.e., an 'if' - statement in the making of which the speaker does something which has the result that (a) if the protasis is true, then the speaker is committed to the assertion of the apodosis, and (b) if the protasis is false, then the speaker is not committed to the assertion of anything). (iii) is a very rare use of the

hypothetical form and not a genuine conditional. Presupposition philosophers are inclined to reduce all general conditionals into such conditional assertions. Sen has developed his theory of non-material conditional taking a conditional to be such a conditional assertion. Barker divides hypotheticals (i.e., 'if'-statements) into conditionals and theticals. A genuine conditional is an 'if'-statement that involves an assertion that the state of affairs described by the apodosis is conditional upon, or a consequence of, the state of affairs described by the protasis. All other 'if'-statements are theticals. Theticals are not genuine conditionals though they may outwardly look like conditionals. Important types of theticals, as listed by Barker, are: (a) Counter-Conditionals, (b) Semi-factuals, (c) Indirect Categoricals, (d) Conditional Assertions, (e) Linguistic Hypotheticals, and (f) Adversative Assertions. Theticals of all types resist contraposition while genuine conditionals are subject to all logical processes including contraposition. A detailed discussion on theticals which are ways of ordinary expression is, however, outside the scope of this chapter.

* Sen: 'Analysis of General Propositions', Indian Philosophical Quarterly, January 1978, P. 146-160. Also in Jadavpur Studies in Philosophy - 2, Edited by K.K. Benerjee, (Macmillan Company of India). Sen takes cue from W.V.O. Quine who refers to such 'If ..., then....' statements as those often used in ordinary speech in his Methods of Logic, P. 12.
F. EXISTENTIAL PRESUPPOSITION EXTERNAL TO LAW-LIKE STATEMENTS

Mood's formulation of a law as 'A entails B' is a general conditional form (genuine) which may be expressed as

\((\exists x)(Ax \supset Bx)\). If Sen allows that the raven hypothesis is a law-like statement, then it must be translatable into

\((\exists x)(Rx \supset Bx)\), because an existential component, even if there be any, is neither a law nor any part of a law. Any statement to be law-like must express a context-free proposition. If 'All ravens are black' be a law-like generalisation, then it means that ravens are black wherever they may be, whenever they may exist or have existed or have yet to exist. On the other hand, 'Ravens exist' or 'I presuppose that ravens exist' cannot have anything to do with genuine laws. A genuine law must make a universal statement expressing a context-free relation of two class-concepts. Such a law is a genuine conditional which is surely contraposable.

G. INDUCTIVE EQUIVALENCE

Sen now proceeds to examine the equivalence condition, i.e., the second premise of argument A. In this conjunction he develops his theory of inductive equivalence. His two
definitions of inductive equivalence are:

Definition 1. Any pair of hypotheses \( h_1 \) and \( h_2 \) are inductively equivalent if and only if they are interchangeable in every statement of confirmation or disconfirmation.

Definition 2. Any pair of evidences \( e_1 \) and \( e_2 \) are inductively equivalent if and only if they are interchangeable in every statement of confirmation or disconfirmation.

According to Hempel's equivalence condition, if two hypotheses \( h_1 \) and \( h_2 \) are logically equivalent, then they are interchangeable in every statement of confirmation. From this, along with the above definition 1, it follows that if \( h_1 \) and \( h_2 \) are logically equivalent, then they must also be inductively equivalent. In other words, logical equivalence entails inductive equivalence. This, according to Sen, is unacceptable. It appears quite possible to him "that two hypotheses are logically equivalent, in the sense of being interchangeable in all entailment statements, but are not inductively equivalent, in the sense of being interchangeable in all confirmation statements". So, Sen

thinks, this is enough ground for rejection of Hempel's equivalence condition. Two hypotheses $h_1$ and $h_2$ are interchangeable in every statement of confirmation or disconfirmation if and only if they have propositional identity. Two inductively equivalent hypotheses must have propositional identity which two logically equivalent statements may not have. Two different hypotheses expressing two different propositions and having different cognitive contents may be logically equivalent. Therefore, there is no guarantee that if $e$ confirms $h_1$ and $h_1$ is logically equivalent with $h_2$, then $e$ confirms $h_2$ as well.

I find it difficult to accept Sen's argument. Sen must accept that two hypotheses $h_1$ and $h_2$ are logically equivalent if and only if they have the same truth-value under all conceivable circumstances. According to Jeffrey, "Sentences are logically equivalent if and only if they have the same truth-values in all cases regarding the joint truth and falsity of the sentence letters that appear in them". * Jeffrey is also of opinion that two logically equivalent sentences make the same statement. ** But two sentences can make the same statement only if they have propositional identity. This is a direct opposition

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** Jeffrey: Ibid. - P. 19.
to Sen's standpoint. Confirmation-process aims at assessing the truth-value of hypotheses by means of some evidence. Thus both 'logical equivalence' and 'confirmation' are understandable in the language of truth-value. So, we may suspend our consideration of the problems of propositional or cognitive contents of sentences for the time-being. Now, if we know that $h_1$ and $h_2$ have the same truth-value and we, by an examination of an evidence $e$, come to know that $h_1$ is most likely to be true, does not $e$, on the strength of this very examination become an evidence in favour of $h_2$ to confirm that $h_2$ is also most likely to be true? If not, this would contradict the very fact that $h_1$ and $h_2$ have the same truth-value as two logically equivalent hypotheses. It is just a contradiction in terms to hold that they are logically equivalent and yet there is some scope for the one to be true and the other to be otherwise. The evidence that testifies to the truth of the one must ipso facto testify to the truth of the other. Similarly, the evidence that disconfirms the one must ipso facto disconfirm the other. To disconfirm a hypothesis is to prove it to be false. It is just impossible for any evidence to testify to the truth of $h_1$ and falsity of $h_2$, or be neutral to the truth-value of the one and relevant to the truth-value of the other, when the two hypotheses are logically equivalent. If contraposition
is valid as we have shown above, an attack on equivalence condition is not likely to solve the paradox. Logical equivalence does entail inductive equivalence.

What is there in an evidence that enables it to confirm a particular hypothesis? If we take up the evidence of a black raven, hereinafter referred to as evidence \( r \), we find that it shows the following facts:

(a) A black raven \( r \) exists.
(b) Raveness and blackness co-exist in raven \( r \).
(c) That \( r \) is black and not a raven is not the case.
(d) That \( r \) is a raven and not black is not the case.

The fact (a) is the existential aspect of \( r \). This aspect of raven \( r \) may be taken to be an evidence that confirms an existential statement like 'There are ravens in the world'. This confirmation is final. But such a statement is not law-like.

Facts (b), (c), and (d) emphasise a non-existential aspect of \( r \), each suggesting some connection between two properties. Each of (b), (c) and (d) confirms different law-like statements. Thus (b) confirms statements like 'All ravens are black and all black things are ravens', (c) confirms statements like 'All black things are ravens', and (d) confirms those like
'All ravens are black'.

Truly speaking, as fact (a) cannot confirm any hypothesis. Existence of r as a closed event and cannot certify the existence of anything else, if taken all by itself. It is only when our background knowledge (i) that ravens are gregarious and that one raven cannot come into existence unless other ravens existed, be added to it, it confirms the existential statement, 'There are many ravens in the world'. But for the further background knowledge (ii) that r might be the last lingering specimen of a dwindling tribe, the confirmation could have been final. Here the evidence plus the first set of background knowledge entails the hypothesis, 'There are many ravens in the world'. The former is true and the latter is false cannot be the case. But the facts under (b), (c) and (d) are only entailed by the hypotheses they confirm. The hypotheses are true and the evidences are false cannot be the case. The evidence-statements are the consequents and their truth cannot guarantee the truth of the hypotheses but can only make it probable. On the other hand, anything that contradicts any of the evidence-statements under (b), or (c), or (d) must also contradict and cancel the particular hypothesis that entails the evidence-statement concerned. Such a cancellation is final, not provisional. Thus, any black non-raven or
non-black raven would finally disconfirm the hypothesis 'All ravens are black and all black things are ravens', any black non-raven would contradict the hypothesis 'All black things are ravens' and disconfirm it, and any non-black raven would disconfirm the hypothesis 'All ravens are black'. But any evidence, like that of a red rose, which fails to show the existence of a black raven cannot disconfirm the hypothesis 'There are many ravens in the world' because the hypothesis did not entail any assertion that would contradict the evidence turning out to be a red rose.

The above discussion points to an important fact about confirmation and disconfirmation of hypotheses that are law-like. A law-like hypothesis entails the evidence report that confirms it, and an evidence report confirms the law-like hypothesis that entails it. Since the truth of the evidence report does not entail the truth of the hypothesis, confirmation does not amount to final proof. The evidence report that contradicts the confirming evidence entails the negation of the hypothesis and thus disconfirms the hypothesis. The falsity of the hypothesis logically follows from the truth of the disconfirming evidence. Thus disconfirmation is final.

Now, if $h_1$ and $h_2$ are two logically equivalent hypotheses
in the sense of being interchangeable in every entailment statement, they must, ex hypothesi, entail the same evidence-statements and the same evidence-statements must confirm both $h_1$ and $h_2$. $h_1$ and $h_2$, then, must also be interchangeable in every statement of confirmation. They must be inductively equivalent. In other words, logical equivalence must entail inductive equivalence. But Sen refuses to accept this.*

However, Sen's tables of relevance permit us to infer that an evidence $e$ disconfirms a hypothesis $h_2$, if $e$ disconfirms another hypothesis $h_1$ which is logically equivalent with $h_2$.

Sen's concept of inductive equivalence is indeed confusing. To confirm the hypothesis 'All ravens are black' one has to find out a raven first and then examine if it is black. If it is, then the evidence confirms the hypothesis 'All ravens are black'. But if one first finds a black thing, he has to throw it out as something irrelevant to the confirmation or disconfirmation of the hypothesis. Nicod's criterion does not leave any scope for examination of this black thing and seeing if this black thing is also a raven. Thus, if a raven on examination turns out to be black, it confirms the hypothesis 'All ravens are black', but if a black thing be not recognised as a

raven at first sight, there is no scope for its further examination to discover if it is a raven. It has to be thrown out. It is irrelevant to the confirmation or disconfirmation of the same hypothesis. This means that the evidence of a raven that is black is not interchangeable with the evidence of a black thing that is a raven in any statement of confirmation of the hypothesis 'All ravens are black'. This leads to the paradoxical conclusion that the evidence of a raven that is black is not inductively equivalent with the evidence of a black thing that might be a raven. It is not the factual character of the evidence but the order of observation that becomes all-important. A similar argument shows that the evidence of a raven that is non-black disconfirms the hypothesis 'All ravens are black' while the evidence of a thing first seen to be non-black must be set aside as irrelevant to the confirmation or disconfirmation of the same hypothesis even though the non-black thing might, on examination, be found to be a raven. Thus, the evidence of a raven that is non-black and the same of a non-black thing that is a raven are not inductively equivalent. This again places the order of observation above the factual character of the evidence. The two evidence-statements:

This raven is black (RB) ..................(1)
This black thing is a raven (BR) ..........(2)
have the same propositional content. They have the same cognitive content as well. Both give us exactly identical knowledge about a present object. Are they then cognitively equivalent without being inductively so? Similarly, the evidence-statements:

This raven is non-black (R\bar{B}) \ldots \ldots \ldots \ldots (3)
This non-black thing is a raven (\bar{B}R) \ldots \ldots (4)

seem to be cognitively equivalent without being inductively equivalent. In the light of the above discussion, it appears that the instance theory of confirmation does not authorise Sen to hold the following identities though he takes them for granted:

(i) R-B = B-R
(ii) R-\bar{B} = \bar{B} -R
(iii) \bar{R} -B = B-R
(iv) R-\bar{B} = \bar{B} -R

(R-B stands for a raven that is black; B-R stands for a black raven; R-\bar{B} stands for a raven that is non-black; \bar{B} -R stands for a non-black thing that is a raven; \bar{R} -B stands for non-raven that is black; B-\bar{R} stands for a black thing that is a
non-raven; $\overline{\text{R}} - \overline{\text{B}}$ stands for a non-raven that is non-black; 
$\overline{\text{B}} - \overline{\text{R}}$ stands for non-black thing that is a non-raven; - each according to the order of observation)*

But without these identities his tables of relevance loses relevance.

Let us now consider the question of confirming the following three universal hypotheses:

Possibly, all ravens are black .......... (5)
All ravens are black .......................... (6)
All ravens must be black .................... (7)

The evidence of a raven that is black confirms all these hypotheses and the evidence of a raven that is non-black disconfirms all of them. (5), (6) and (7) are therefore interchangeable in all statements of confirmation or disconfirmation. (5), (6) and (7) are therefore inductively equivalent. Are they cognitively equivalent as well? No, they are not. This is obvious. Here we get three inductively equivalent hypotheses which are not cognitively equivalent. We are thus under obligation to conclude that cognitive equivalence neither entails, nor is entailed by, inductive equivalence. Sen is, however, of opinion that

cognitive equivalence 'does imply inductive equivalence'.

The so-called inductive equivalence that fails to ensure

(a) Propositional identity,
(b) Cognitive equivalence,
or, (c) Logical equivalence

is logically sterile. The main weakness of the concept lies in the fact that it owes its meaning to the concept of confirmation which cannot be a criterion of any sort of equivalence useful to science. An evidence confirms different hypotheses in different degrees which are never exactly measurable. To establish an inductive equivalence of any practical use we should compare the various degrees in which different evidences confirm different hypotheses.

There is nothing wrong in trying to confirm the total propositional content of a hypothesis. But an established hypothesis has an obligation to be unambiguous. The most unambiguous part of a hypothesis is its logical content. Therefore, confirmation as a scientific method can aim at establishing this logical content of a hypothesis and no more. To pursue anything more would be chasing a wild goose. The concept

of propositional identity beyond formal contexts is the philosopher's black cat. Nicholas Griffin has rightly said, "There seems to be little to be said for denying the logical equivalence unless some alternative to standard quantification logic is proposed".*

In the light of above discussion, the two conclusions drawn by Sen - (a) inductive equivalence is both necessary and sufficient for replacing one hypothesis by another in any statement of confirmation (or disconfirmation), and (b) the question of confirmation is logically prior to the question of inductive equivalence - look unconvincing. This concept of inductive equivalence is, however, the main pivot on which Sen's strategy rests. J.N. Mohanty observes, "Sen's strategy is to reject Hempel's equivalence condition. ... In order to show that the equivalence condition is not valid, Sen introduces the concept of inductive equivalence as distinguished from logical equivalence. A major point of his argument is that logical equivalence does not entail inductive equivalence".**

But this concept of inductive equivalence is logically useless.

II. TABLE OF RELEVANCE

I reproduce Sen's table of relevance III as below:

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>R-B</th>
<th>R-B</th>
<th>G-B</th>
<th>G-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁</td>
<td>Relevant (+)</td>
<td>Relevant (-)</td>
<td>Irrelevant</td>
<td>Irrelevant</td>
</tr>
<tr>
<td>H₂</td>
<td>Irrelevant</td>
<td>Relevant (-)</td>
<td>Irrelevant</td>
<td>Relevant (+)</td>
</tr>
</tbody>
</table>

H₁ = All ravens are black
H₂ = All non-black things are non-ravens
R-B = A black raven
R-B = A non-black raven
G-B = A black non-raven
G-B = A non-black non-raven
'+' indicates 'positively'
'-' indicates 'negatively'

Apart from being vitiated by an inadmissible set of identities on which this table is based, the table is inconsistent with time honoured methods of science and valid thinking.
(a) The Nyaya school of Indian thought accepts a non-fiery non-smoky lake as an evidence supporting the universal statement 'All smoky things are fiery'. This is just analogous to accepting the evidence of a white handkerchief as confirming the hypothesis 'All ravens are black'. While the evidence of a lake shows that something is smoky and non-fiery is not the case, the evidence of a white handkerchief shows that something is a raven and non-black is not the case.

(b) The case of a white handkerchief is a case of absence of ravenness where blackness is absent. This supports the universal statement 'All ravens are black' in terms of Mill's joint method of agreement and difference.

(c) Scientists have confirmed most of their hypotheses about localisation of different functions in different parts of the brain with the help of evidences of animals having specific parts of the brain removed with the resulting loss of some specific functions. The hypotheses 'Cerebrum is the seat of sensations in animals' has really been confirmed by the evidence of decerebrated animals...
devoid of sensations. Many mysteries of animal organisms have been unveiled with the help of the method of ablation. This method, in essence, is similar to confirming 'All ravens are black' by the evidence of a white handkerchief considered irrelevant by Sen to such a confirmation. The former shows, specific parts of the organism cannot be removed without loss of some specific functions, the latter shows that blackness cannot be removed without loss of ravenness. Neither the former nor the latter can be said to satisfy either the instance theory of Nicod or the table of relevance of Sen. A blind dog without occipital lobe is not an instance of an occipital lobe and sight found together.

I. CONCLUDING REMARKS

I consider the presupposition philosophers' opposition to Hempel's confirmation theory and introduction of concept of inductive equivalence to be subtle ways of rejecting 2-valued logic. It is therefore, considered necessary to examine the arguments and concepts of the presupposition philosophers and assess their merit.