

issue written by its convenor and organizer, Professor Richard Paul: "An Agenda Item for the Informal Logic/Critical Thinking Movement." In the last issue of this Newsletter (ILN, v.i, "From the Editors"), we wrote of the need for those interested in informal logic/critical thinking to develop an overview which would allow the formulation of an agenda of issues and problems that should be tackled. No discipline or area of research can develop coherently without such an agenda or research program. In his Discussion Note, Paul is responding to our call by tabling for the agenda an item which we had not mentioned: the need for informal logicians to get more actively involved in the design of educational programs. It has become fashionable to emphasize "basics" in the curriculum, and we hear a lot about the fourth "R"—Reasoning. Paul urges us to become more involved and knowledgeable about what schools are doing, what packages are being offered, and where we can provide input. Our own experience this spring with our local school board suggests to us that there is a receptivity to hearing from informal logicians and those who teach critical thinking at the university and college level. Thus we endorse Richard Paul's suggestion and encourage readers to look at his Note and consider attending the SSU conference in August.

in this issue

We are pleased to welcome four new contributors to the articles department of ILN. For those who thought we had closed the book on the inductive-deductive question: we were wrong! James Freeman's article, "Logical Form, Probability Interpretations, and the Inductive/Deductive Distinction," is a closely-reasoned response to Perry Weddle's challenge to the inductive-deductive distinction. (Weddle may claim respondent's rights in the near future.) The article by A.J.A. Binker and Marla Charbonneau, "Piagetian Insights and Teaching Critical Thinking," harkens back to last year's article by Richard Paul, "Teaching Critical Thinking in the 'Strong Sense'" (ILN, iv.2) and attempts to show how Piaget's work on egocentric and ethnocentric tendencies can be integrated into a critical thinking course. Daniel Rothbart's article, "Towards a Structured Analysis of Extended Arguments," deals with an important problem for informal logicians which has not yet received the attention it deserves: the problem of displaying, and teaching students how to display, the structure of an argument.

Though it is a brief item, we draw readers' attention to the abstract of the article, "The Speech Acts of Arguing and Convincing in Externalized Discussions," by F. H. van Eemeren and R. Grootendorst, which appeared in the *Journal of Pragmatics*. Worth reading in its own right, this article is also evidence that informal logic has a presence outside of North America, and it signals the need for all of us to become more familiar with work being done by colleagues in other parts of the world. We need to avoid, once again, the dangers of being insular. (Forgive us if, in saying this, we merely project our own sense of provincialism.) We can think, for example, of the work of Perelman and the School of Brussels (on the new rhetoric) in Belgium, and of the work of Habermas (on communicative competence) in Germany. The Discussion Note by Professor Vedung in this issue is evidence that there is activity in Sweden. We also remind readers of an informal logic tradition in Australia, which shares space amicably with formal logic in the *Australian Logic Teachers Journal*. The fine article by

T.J. Richards, "Attitudes to Reasoning" which ILN reprinted in iii.2 originally appeared in that journal. Who knows what other centres of work there are? This is not a rhetorical question; it is an invitation to our readers to send in information about, and samples of, work being done in other parts of the world as well as in cognate subjects, from which we all may profit.

We apologize for the delay in the publication of this issue. A rash of problems—e.g., preparations for the Second International Symposium, and a typesetting breakdown—intervened. Again we have had to place our trust in the patience of our readers.

articles

Logical Form, Probability Interpretations, and the Inductive/Deductive Distinction

James B. Freeman
Hunter College, CUNY

The *Informal Logic Newsletter* contains much discussion concerning whether the traditional division of arguments into inductive and deductive is viable. Skepticism has been expressed on two grounds. First, is the distinction exhaustive? Given any argument, can we assign it either to the inductive or deductive category? The leading skeptic here is Trudy Govier, who maintains we must admit a further distinct class of arguments, the conductive. The second type of skepticism is more radical: the induction/deduction distinction is just not viable. We cannot adequately mark the distinction or intelligibility give a criterion for distinguishing inductive from deductive arguments. Perry Weddle leads the attack here. Since, as he points out, this charge is more fundamental, we shall be concerned

with his arguments in this paper. We hope in a future discussion to address Govier's concerns.

Weddle's claim has philosophical plausibility. Whewell's classic distinction is generally regarded as inadequate. The current standard textbook claim, typically expressed by Copi, that deductive arguments claim that their premises guarantee the truth of the conclusion, while inductive arguments claim only that the premises give support to the conclusion, seems hard to apply at least on some occasions. In (6), p. 11, Govier presents some sample arguments where it is hard to see just which claim is being made about the strength of the premises' support. On other occasions, our intuitions about whether an argument is deductive or inductive may conflict with the standard criterion, as Fohr illustrates in (4), p. 7.

In (14), Weddle presents four arguments against the standard view. One is that allegedly inductive arguments become deductive when the premises are suitably filled out. This argument has been assessed in Hitchcock (8) and (9), and we shall not discuss it here. Weddle also argues that we cannot understand what it is for an argument to make such a claim about strength of support, that the proper categorization of invalid deductive arguments is obscure, and that when the conclusion of an allegedly inductive argument is properly "hedged," the argument becomes deductive. We contend that these latter three arguments all involve questions of logical form, questions which need to be clarified but have not been addressed in the previous discussion of the problem. We contend that once these issues are clarified, Weddle's arguments are no longer convincing. Seeing this for the third argument, on hedging, raises the problem of probability interpretation. We shall argue that on none of the four current interpretations of probability (the personalistic, classical, statistical, or logical) do Weddle's arguments go through. This discussion of form leads directly into our concrete proposal for distinguishing deductive from inductive arguments.

II

In (14), p. 2, Weddle argues that the standard view's notion of claim about strength of support apparently does not make sense. He uses this example:

A found scrap of paper containing some sentences and then the transition, "therefore, it absolutely must be the case that" followed by another sentence, involves the claim that its premisses provide conclusive grounds for the conclusion. But what precedes and follows the transition could be virtually anything: arguers, not arguments, make claims about their conclusions... Copi seems to intend by "involves the claim" not that an arguer claims something about the conclusion but that the premises and conclusion just are related in a certain way – a funny sort of thing to be called "claim".

Weddle points out that frequently arguers may be overmodest or immodest about how much support their premises gave their conclusions. Hence to base the inductive/deductive distinction on such subjective appraisals is unsatisfactory.

It is hard to assess Weddle's point here. In the quote above, he seems to admit first that in at least some sense there is a claim on the paper that the premises necessitate the conclusion. But then he seems to deny it by his assertion about arguers. Apparently because the premises and conclusion may be unrelated, Copi's notion of claim is

somehow uninteresting or funny. But is **this** claim true? Suppose I find a piece of paper. On it is written the sentence:

(1) George Washington was the second President of the U.S.

Can't we say that an historical claim is being made here, albeit a false one? The sentence expresses a proposition and in this sense makes a claim. That the proposition expressed is false does not change the fact that a proposition has been expressed. Is it funny to say that (1) makes a claim?

Now suppose I find a sheet of paper with the following on it:

(2) The moon is a lifeless mass of rock. Therefore, it must be the case that mice have hearts.

Doesn't this paper involve three claims: the propositions expressed by the premise and the conclusion, and the claim that the premise necessitates the conclusion? Although the latter claim is false, does this any more affect the fact that it is made than (1)'s falsity affects the fact that (1) makes a claim, i.e. asserts a proposition?

Although a claim's being false does not show that it isn't a claim, there may still be misgivings. The claim that the premises support the conclusion is metalinguistic. It is of a different order than the claims made by the premise or the conclusion or the claim made in (1). These are straightforward factual claims about the world. They are all in the object language. (2) asserts (metalinguistically) a relation between the premise and the conclusion. We might make this completely explicit by saying

(3) "The moon is a lifeless rock" supports necessarily "Mice have hearts."

This shows clearly that a claim is being made. Could it be that because of this metalinguistic dimension, some philosophers regard the claim as funny?

(3) highlights a factor which is crucial in our discussion. The expression "supports necessarily" makes the deductive claim in (3). Here "necessarily" directly modifies "supports." Hence the two parallel elements in (2) combine to make the deductive claim—the word "therefore" and the expression "it must be the case that." As (3) makes explicit, "it must be the case that" modifies "therefore" in (2). "Therefore" asserts that the premise supports the conclusion. In traditional terminology, it is a sign of illation; it is metalinguistic. "It must be the case that" is a metalinguistic illation sign modifier, attaching directly to "therefore." This should be pointed out, since the surface grammar of (2) does not make it plain. Indeed, reading (2) we might take "it must be the case that" as a modal operator in the object language, part of the conclusion. But is the conclusion of (2) the proposition that mice must have hearts, that the assertion they do is necessarily true, true in all possible worlds, a tautology? Clearly, that does not seem intended.

Symbolically, we can indicate this distinction quite perspicuously. We take \mathbf{N} as a metalinguistic symbol for any sign of illation.

(4) $P_1, \dots, P_n \mathbf{N} \cdot \therefore Q$

asserts a relation between (P_1, \dots, P_n) and Q , that (P_1, \dots, P_n) supports Q . It is non-committal as to how strong that support is. We take \mathbf{N} as a metalinguistic operator, an illation sign modifier. $\mathbf{N}(\cdot \therefore)$ symbolizes "supports necess-

arily' or "guarantees the truth." On the other hand, we take \Box as a symbol in the object language. \Box is the modal operator, "is necessarily the case that." We may distinguish then these two patterns of argument:

$$(5) P_1, \dots, P_n \ N(\bullet \bullet) \ C$$

$$(6) P_1, \dots, P_n \ \bullet \bullet \ \Box \ C,$$

where in (6) $\Box C$, not just C , is the conclusion. Clearly we can introduce parallel notation to symbolize "supports probably," "supports to some extent," "makes likely," or "it is likely that." We shall see that these distinctions are crucial when we discuss Weddle's hedging argument below.

III

Before proceeding with that, we want to examine Weddle's argument against the induction/deduction distinction concerning the status of invalid deductive arguments. Are they deductive or inductive? Weddle maintains that a number of invalid deductive arguments do give some evidence for their conclusions, and this then constitutes grounds for regarding them as inductive. This, of course, would endanger the view that the inductive/deductive distinction divided arguments into mutually exclusive classes. To illustrate his claim, Weddle cites two arguments ((14), p. 3):

- (7) (1) Some elms in the County are infected.
 (2) All infected elms ought to be removed.
 (3) Therefore all elms in the County ought to be removed.
- (8) (1) Walter Raleigh was an Elizabethan, English, educated, Latin-reading, worldly-wise genius.
 (2) The author of Shakespeare's plays was an Elizabethan, English, educated, Latin-reading, worldly-wise genius.
 (3) Therefore, Walter Raleigh was the author of Shakespeare's plays.

Of (7), Weddle remarks "the premisses, though failing to provide conclusive grounds for the conclusion do provide some, perhaps the beginnings, of such grounds." ((14), p.3.)

Now we agree with Weddle here that the premises give some evidence for the conclusion, but we may question whether when we see that the premises give evidence, we are reasoning according to the deductive pattern presented in (7). If we were to explain why the premises gave some reason for the conclusion, I believe we might reconstruct the reasoning to include the following arguments:

- (7') (A) (1) E_1, \dots, E_n, E_{n+1} are elms in this County.
 (2) E_1, \dots, E_n are all infected. (Some elms are infected.)
 (3) Therefore possibly E_{n+1} is infected also.
 (4) Therefore possibly all elms in the County are infected. (E_{n+1} was an arbitrary elm.)
- (B) (5) All infected elms ought to be removed.
 (6) All elms in the County are infected.
 (7) Therefore all elms in the County ought to be removed.

Now (1) – (3) is clearly an argument from analogy, one of the standard inductive families. This should be sufficient

to show that some inductive reasoning is involved in moving from the premise about some elms in the County to making a statement about all elms in the County. Once we make this explicit, can we maintain that the fact that the premises in (7) give some support to the conclusion shows (7) to be inductive? Doesn't it rather show that we readily supply another argument, which itself is inductive?

Weddle regards (8) as a syllogism in Barbara, second figure, an invalid deductive form. But it is hard to see why, in the light of modern logic, we would want to construe (8) this way. When proper names or constants, and definite descriptions, are logically available, then why should the component statements of (8) be rephrased as A-categorical propositions? The motive for making such a transformation in traditional logic is to be able to incorporate singular propositions in categorical syllogisms, and so show how certain arguments involving proper names are valid. But if our logical machinery is expanded to handle sentences with referring expressions without this transformation, which may be regarded as misrepresenting the form of propositions involving referring expressions, then why apply the device just to claim that (8) is a syllogism in Barbara, second figure? Unless we rephrase the component statements of (8) as A-categoricals, it is hard to see why (8) is a deductive argument. Adding the obviously assumed premise

(2') The author of Shakespeare's plays wrote Shakespeare's plays.

The argument seems to fit the classical form of arguments from analogy. Can Weddle show us that there are syllogisms in Barbara, second figure, where the subject terms are ordinary class terms, which apparently give evidence for their conclusions, but may not be viewed as involving arguments from analogy or any other type of inductive argument?

We have not shown that there cannot be invalid deductive arguments which may plausibly be constructed as inductive, but just that, when careful attention is paid to form, Weddle's examples do not show us that there are such arguments. We doubt whether we can find a general account which would show conclusively that no invalid deductive argument could be construed as inductive. If we are skeptical of the claim that this can be done, we may have to be content with refuting it on a case by case basis, as we have done here. However, our constructive proposal for distinguishing inductive from deductive arguments has a bearing on this question, which we shall develop in the course of discussing our criterion. The discussion here underscores the importance of attention to logical form for properly assessing whether an argument is inductive or deductive.

IV

Weddle's third argument, that when the conclusion is properly hedged, an inductive argument becomes deductive, is perhaps the most interesting, and the one we wish to treat at length. Recall that in discussing questions of form in connection with how an argument makes a deductive claim, we distinguished between a metalinguistic use of "must" to modify the illative operator, and its use as a modal operator in the object language. We pointed out that parallel distinctions were available on the inductive side. This may be applied in analysing the pair of examples Weddle examines in (14), p.3:

- (9) It is likely that all A's are B's, and X is an A; hence, it is likely that X is a B.
- (10) When a low pressure ridge moves down from the Gulf of Alaska (etc.) we usually get rain the next day, and a low pressure ridge is moving down right now (etc.); hence, it is likely to rain tomorrow.

Weddle feels that despite the presence of 'likely' in (9), it "seems deductive," while tradition would lead us to say that (10) was inductive. Yet apparently (10) "differs little" from (9). But do (9) and (10) have the same form? True, there are similarities. But is this sufficient to establish that the forms are the same? That would be a powerful reason for counting both as either deductive or inductive.

The presence of "it is likely that" in the first premise of (9) and its parallel use in the conclusion clearly indicate that it is a modal operator. Hence, where L symbolizes "it is likely that," we formalize (9) as

- (11) (1) $L((x) (Ax \supset Bx))$
 (2) AX
 (3) $\therefore L(BX)$

By contrast, it seems that (10) may be symbolized in several ways. Both "usually" and "now" are modal operators "it is usually the case that," U, and "it is now the case that," N. But what about "likely"? And what about the first premise? Does it assert that

- (12) If a low pressure ridge moves down from the Gulf of Alaska, then it is usually the case that we get rain the next day,

in symbols

- (13) $P \supset UR$

or

- (14) It is usually the case that if a low pressure ridge moves down from the Gulf of Alaska, then we get rain the next day,

in symbols

- (15) $U(P \supset R) ?$

In (13), Weddle explicitly opts for the first alternative. "The argument ... instantiates the deductive form, 'When x, y is likely; and x; so y is likely.'" ((13), p. 12.) In (4), Sam Fohr also opts for the first alternative. After presenting (10), he remarks "It certainly must be admitted that in any inference of the sort 'If p then probably q; p; hence probably q' the premises necessitate the conclusion." ((4), p. 8)

I cannot agree that (12) is the proper interpretation of (10)'s first premise or that (13) correctly pictures the form. For in asserting the first premise, we are **not** asserting that if some condition holds, then some other condition is the usual state of affairs universally, but rather that two conditions are usually connected. To highlight this difference, contrast the following examples:

- (16) John is usually unhappy about something.

In symbols this is

- (17) $U(\sim H)$

If this statement is true, then during most of John's waking moments, he is annoyed, grouchy, grouching about something. Now consider:

- (18) If John comes, he is usually unhappy about something.

Analogously to Weddle and Fohr, we should symbolize (18) as

- (19) $J \supset U(\sim H)$.

But suppose John comes infrequently. Suppose also that during most of his conscious moments, he is rather contented and cheerful. Hence (16) and (17) are false. Suppose John also does come. Then (19) is false. But suppose that most times when John comes, he is unhappy while he's here. That would tend to make us count (18) true, which goes to show that (19) is not the proper symbolization of (18). Rather it is

- (20) $U(J \supset \sim H)$

That is, most cases which are times when John comes are times when he is unhappy. That is what (19) asserts, not that his general unhappiness is conditional on his coming. Hence (14) correctly paraphrases the first premise of (10) and (15) pictures its form.

Given this, there are two possible symbolizations for (10):

- (21) (1) $U(P \supset R)$
 (2) NP
 (3) $L(\therefore R)$
- (22) (1) $U(P \supset R)$
 (2) NP
 (3) $\therefore LR$

How may we decide between (21) and (22)? Does (10) assert as its conclusion that it will rain tomorrow, and claim that the premises give strong support for this (21), or does (10) conclude that it is likely that it will rain tomorrow (22)? Notice that even if we say the latter, we are not forced to say that (22) is deductive because it has the same form as (11), and we want to count (11) deductive. For clearly, our symbolization shows that there are differences in form. Also, the mere fact that the conclusion of (10) reads "it is likely to rain tomorrow" where "it is likely" apparently functions as a modal operator, is not a decisive reason for preferring (22) to (21). For we have already seen in (2) that the word "must," although occurring in the conclusion, does not function as a modal operator in the object language, but as a metalinguistic modifier. Might not the situation be analogous in (10)?

Weddle's further discussion suggests that he would regard (22) rather than (21) as properly (or at least more adequately) symbolizing the argument, at least if the argument is to be interesting. And he regards this as giving a decisive reason why the argument is deductive rather than inductive. As he says, 'likely' is a hedge, and "when an arguer properly hedges the conclusion of a traditionally inductive argument, the result assumes the role held to belong exclusively to deduction." ((14), p. 3) Weddle seems to be enunciating a general principle here, which we can make perspicuous with our symbolism. Apparently, for each "traditionally inductive" argument

- (23) P_1, \dots, P_n
 $L(\therefore) C_n$

there corresponds a deductive argument

- (24) P_1, \dots, P_n
 $\therefore LC_n$

Why does Weddle feel that arguments of form (24) are deductive? He continues ((14), p. 3):

The meteorological inference above stated a probabilistic connection between its premisses and rain. But the arguer only said that it was likely to rain. The connection between those premisses and the **likelihood** of rain is not similarly probabilistic. We could not reasonably grant those premisses, understanding meteorology, and yet deny that it is likely to rain. In other words, "it is absolutely impossible for the premisses to be true unless the conclusion is true also."

Here again, what Weddle says is unclear. If the meteorological inference asserts a probabilistic connection, do we have an inductive argument here, but one which is somehow uninteresting, and which should be traded-in for what the arguer actually said? Given Weddle's remarks concerning careful argument immediately preceding his discussion here, this seems a likely interpretation. Hence, since asserting LC is to make a weaker statement than asserting C categorically, when the conclusion is properly modalized, the premisses guarantee its truth, and this is sufficient reason to count the argument deductive. Furthermore, since such modalization shows careful arguing, these are the only interesting or worthwhile arguments.

In (8), p. 9 and in (9), p. 10, Hitchcock presents counterexamples to Weddle's claim that such arguments are valid deductive arguments. We find these counterexamples convincing, and so are not going to discuss this aspect of Weddle's argument here. Rather, we want to question the more fundamental move from (23) to (24). The key question is what does 'likely' in (24) mean? We contend that the very familiarity of the term may mask the illegitimacy of this move. Presumably, 'likely' is to be cashed out in terms of probability. To say

(25) it is likely that P

means

(26a) it is highly probable that P

or

(26b) it is more probable that P than that \sim P.

Perhaps we might want to reduce that vagueness here by specifying some numerical probability value.

But here lies the problem. There are various interpretations of probability. In suggesting that we may move from (23) to (24), Weddle is asserting a very general principle. For this principle to be viable, a statement of the form LC, the conclusion of (24), must always be meaningful when (23) is meaningful. But this raises the question: Is there one interpretation which will guarantee the meaningfulness of LC? In fact, can we be sure that when confronted with an argument of form (23), we can find some interpretation of probability which will render LC meaningful? If we can show that this is doubtful in the general case, then the whole plausibility of Weddle's suggestion becomes questionable.

V

In (12), Salmon discusses five interpretations of probability: the subjective, personalistic, classical, relative frequency, and logical (although not in that order). The subjective interpretation involves such problems that we shall not discuss it here. The personalistic interpretation involves the distinction between fundamental and derived probabilities. Given that certain probabilities have been ascertained, the probability calculus allows us to compute further probabilities. But we always must start from some probabilities which have not been supplied by the calculus.

We must have something to apply our operations to before we can calculate. Now according to the personalistic theory, these "fundamental probabilities are purely subjective degrees of actual belief, but the probability calculus sets forth relations among degrees of belief which must be satisfied if these degrees are to constitute a rational system." ((12), p. 79) Now if the premisses of an argument contain probability expressions and the conclusion is derived by calculation of those probabilities, then the argument clearly is deductive. It is a mathematical argument. But as our formal analysis of (10) shows, should (22) be the form of (10), we can clearly have premisses with no probability expression. In those circumstances, could the 'likely' in the conclusion be interpreted as expressing a purely subjective degree of actual belief? This seems unintuitive. For by citing premisses, reasons, isn't one trying to justify his conclusion objectively and so give some objective evidence for his probability statement? Is one merely suggesting how he came to hold a certain belief? Consider (10). When a weatherman says "it is likely to rain tomorrow," having just expressed his reasons, is he just expressing his subjective degree of belief? This interpretation does not seem plausible.

Salmon points out a feature of the personalistic interpretation which is quite apposite here. This interpretation allows a great deal of freedom in assigning fundamental probabilities. As long as the relations among degrees of belief satisfy the probability calculus, we can assign fundamental probabilities any way we wish. In particular, past experience does not provide any rational constraint on this assignment.

You can believe to degree 0.99 that the sun will **not** rise tomorrow. You can believe with equal conviction that hens will lay billiard balls. You can maintain with virtual certainty that a coin that has consistently come up heads three quarters of the time in a hundred million trials is heavily biased for **tails!** There is no end to the plain absurdities that qualify as rational. It is not that the theory demands the acceptance of such foolishness, but it does tolerate it...The personalistic theory therefore leaves entirely unanswered our questions about inductive inference. It tolerates **any kind** of inference from the observed to the unobserved. ((12), pp. 81, 82)

But these are precisely the inferences we are trying to analyse! In the light of the above remarks, it seems highly implausible that arguments like (10) may be structurally analysed according to (24), where the modal operator L in the conclusion is to be interpreted personalistically.

On the classical interpretation, probability is understood as the ratio of favorable outcomes to all equally possible outcomes. (Compare (12), p. 65.) Many authors have pointed out one major flaw in this theory, which is also telling against regarding it as a general interpretation of L in (24). As Salmon points out in (12), p. 66, to apply this interpretation, we must be able to analyse a situation into a set of equally possible alternatives. In some circumstances this can be done. If a coin is fair, it is equally possible that it will come up heads or tails. But what if the coin is not fair? Where are the equally possible alternatives here? Suppose that the coin were biased so that 3/4 of the time it came up heads and only 1/4 of the time tails. Can we analyse this into equally probable alternatives? Salmon concludes: "To suppose it is always possible to reduce unequal probabilities to sets of equiprobable cases is a rash and unwarranted assumption" ((12), p. 66). But in cases where this assumption does not hold, it becomes hard to see how L could meaningfully be interpreted according to the classical view. In particular, we could not apply this in

(10). Is rain equally probable or not probable tomorrow? For these cases some other interpretation of probability must be found.

This brings us to the remaining two interpretations of probability, the statistical or relative frequency and the logical interpretation. Both have been taken seriously in recent discussions of probability. Carnap, in particular, regards both as legitimate although distinct notions. (See (1), Chapters 2 and 3, and (2).) Statistical probability involves the notion of a ratio of the number of occurrences actually displaying a certain property to the total number of cases in a given class or population. For example, if a coin were not fair, in 100 flips we might discover that it actually displayed heads 75 times. On the statistical interpretation, at least as proposed by Reichenbach and von Mises, the value of the probability is defined as the limit of the relative frequency of favorable cases in an infinite series of trials. In general, such a value is determined empirically. We saw that the coin came up heads 75 times in 100 throws. In theory, we could extend the series of trials to any number, not just 100. But at some point, we shall extrapolate the ratio of heads to total number of trials in the infinite series from observing finite series. We must make this inference, since it is only with reference to this infinite series that the notion of statistical probability is meaningful.

Can L in (24) refer to statistical probability? More precisely, given any argument of form (23), we can find a corresponding argument of form (24) where L in the conclusion is to be interpreted as statistical probability? There are two grounds for significant skepticism of this claim. First, consider the inference we have just seen necessary, from observed finite frequencies to the limit in an infinite series. To be concrete,

(27) In 100 observed flips, this coin came up heads 75 times. Therefore, it is likely that $p(F,H) = .75$.

where p is interpreted statistically. This is an inductive argument. The premise does not guarantee the truth of the conclusion, but only gives evidence for it. If someone were to make that claim explicit, the argument might read

(27') In 100 observed flips, this coin came up heads 75 times. Therefore, $p(F,H) = .75$,

In symbols, we have

(28) $O(F,H) = 75/100$
 $L(\dots) p(F,H) = .75$.

But is there an intelligible corresponding argument

(29) $O(F,H) = 75/100$
 $\therefore Lp(F,H) = .75?$

What does the L mean? Could a statistical interpretation make sense here? What relative frequency would it refer to? This seems obscure. Hence, the claim that the statistical interpretation will work generally is self-defeating. To apply the concept of statistical probability, there must be ampliative or inductive inferences from observed frequencies to postulated limits of such values. Such inferences cannot be rephrased according to the move from (23) to (24) where another expression of statistical probability occurs in the conclusion, contradicting our assumption that the statistical interpretation will work generally.

Although we find this line of reasoning convincing, we may object to the general use of the statistical interpretation from another angle. By definition, probability refers to the

relative frequency of an attribute in an infinite series. Hence there is a problem, on this interpretation, for ascription of probability to singular events. What does it mean to say that there is a 90% chance of rain tomorrow? Precisely because there is a problem here, there is a problem for the view that in general, we can move from arguments of form (23) to those of form (24), where L means statistical probability. For clearly, an argument of form (23) may have a conclusion referring to a single occurrence. What, then, should LC mean in (24)?

In (1), Carnap discusses how Reichenbach approaches the problem. Given Carnap's remarks, and Salmon's discussion in (12), several moves seem available here. First, we may understand attributions of probability to single events as elliptical. For example, suppose a meteorologist says

(30) The probability of rain tomorrow is 2/3.

Fully expanded, this means that

(31) According to our past observations, states of weather such as that we have observed today were followed, with a frequency of 2/3, by rain on the following day. ((1), p.27)

Hence the alleged ascription of probability to the single event is really not talking about that event but about an observed ratio of certain occurrences to a total population.

Now if this is what ascription of statistical probability to single events means, and the move from (19) to (20) is legitimate, then we would expect that someone who put forward an argument of form (19) would also regard (20) as an acceptable rendering of his intentions. But need this be the case? Let's return to our specific example, (10). What should the conclusion "it is likely to rain tomorrow" really mean? Isn't it

(32) According to past observations, when a low pressure ridge moves down from the Gulf of Alaska, which we are observing to happen today, we usually get rain the next day.

If (32) really is the conclusion of (10), then (10) is a deductive and rather trivial argument. But is (32) the conclusion of (10)? Does someone who asserts "it is likely to rain" as a conclusion of (10) mean just (32)? Doesn't the trivialization of (10) show that this is not what is intended?

Salmon's discussion in (12) suggest Reichenbach had another possibility for understanding statistical probability applied to singular events. "We find the probability associated with an infinite sequence and transfer that value to a given single member of it" ((12), p.90). According to Reichenbach, this would give a "fictitious" meaning to the probability assignment. Whether or not we should be satisfied with a fictitious meaning of "likely," at least on some occasions, is one issue. There is another problem for this approach, related to the issues Salmon discusses in (12), pp. 91-92. At this point we must make clear that although such expressions as "it is likely that" or "it is probable that" seem to function as unary modal operators, and we have been using them that way intuitively, probability is a relative or relational notion. (See (12), p. 58.) If we are using probability correctly, we should ask what is the probability that something has attribute A (belongs to attribute class A) given that it belongs to reference class B? Applying this specifically to the arguments we have been discussing, the conclusions

should read

(33) it is likely that C given that some conditions R obtain,

in symbols

(34) $L(R, C)$.

Let us call the condition or reference class which R schematically indicates the reference condition. But what reference condition should be indicated in the conclusion of a specific argument? The only obvious answer seems to be the condition mentioned in the premises. In (10) that would be the class of days following a day when a low pressure ridge is moving down from the Gulf of Alaska. It is hard to see what other reference condition could be cited, and if none could be, the conclusion would not be meaningful.

But if the condition mentioned in the premises is the proper reference condition, then such arguments, contrary to Weddle's assertion, can not be deductive. For to say, "it is likely given that R that C," on the basis of observed evidence that C usually follows R, involves extrapolation, just as we extrapolated the limit relative frequency from the observed frequency. We extrapolate that C usually follows R generally, or would follow usually in an infinite series. "Usually" then is a vague and nonquantitative way of expressing relative frequency. Since our move to the conclusion involves this step, the argument is inductive. So, although this move allows "likely" to have a fictitious meaning, it defeats Weddle's purpose of properly hedging the argument to make it deductive. These considerations should show that in general we cannot move facilely from (23) to (24), making the interpretation of L statistical probability. The move is fraught with problems.

What of the logical interpretation? We cannot apply this to interpreting the conclusion of (24) since, as Carnap points out, statements of logical probability are metalinguistic. To say that "likely" expresses logical probability is just to opt for (23) over (24). This is not to criticize the logical interpretation here. It is only to point out that it cannot interpret the object language modal operator. We feel that this is the correct interpretation for "likely" in (10) and that frequently it is the correct interpretation for similar expressions in "traditionally inductive" arguments. But this is just to reject Weddle's move from (23) to (24), and to claim that such expressions as "likely" often function analogously to the way necessitative expressions function in "traditionally deductive" arguments, that is as metalinguistic illative operator modifiers.

What has this discussion shown? First, we have not established that the expression "likely" or "probably" in the conclusion of an argument can never be interpreted as personalistic, classical, or statistical probability. Indeed, if the conclusion of an argument presents a computed probability, calculated on the basis of more fundamental probabilities in the premises, then these interpretations may very well be legitimate and the argument deductive. But such arguments intuitively would not be counted as inductive. Distinguishing modal from metalinguistic expressions helps to clarify why. Statements of statistical probability may certainly occur in the conclusion of an argument, especially when the premises report some empirically observed frequency. In these cases, however, the argument is inductive. We could elaborate this discussion further, considering examples where "likely" in ordinary English may be ambiguous between a metal-

linguistic modifier and a modal operator. Our discussion should underscore the legitimacy of both interpretations and show why we cannot dismiss the metalinguistic use of "likely," as Weddle suggests. This point is important, for it leads us directly into our constructive proposal for distinguishing inductive from deductive arguments.

VI

I would like to suggest that there is an analogy between deciding whether an argument is deductive or inductive and deciding what is our obligation, or what action it is our duty to perform, on the basis of what *prima facie* duties (in the sense of Sir W. David Ross in (11)) hold in given circumstances. I want to propose that there are *prima facie* deductive argument indicators and *prima facie* inductive argument indicators. Just as on the basis of certain *prima facie* duties holding, we may give a good reasons argument that a certain action is an overriding duty, so also the presence of these indicators in an argument may give us good reasons to say that the argument is deductive or inductive.

First, our whole discussion of the logical role of expressions like "must" and "likely" indicates that the traditional textbook lists of deductive argument indicators and inductive argument indicators are genuine *prima facie* indicators of whether the argument is deductive or inductive. They modify the metalinguistic sign of illation, and so when present in an argument constitute grounds for saying that the argument explicitly claims either that the conclusion follows with necessity or that the premises give some support for the conclusion. That an argument makes such a claim is a *prima facie* reason for saying that it is deductive or inductive, as the case may be. Hence we may call expressions standardly cited to indicate deductive arguments **explicit prima facie deductive argument indicators**. Similarly those standardly cited to indicate inductive arguments are **explicit prima facie inductive argument indicators**. Notice the force of "*prima facie*" here. We are not saying that the presence of these indicators or the fact that the argument claims its premises guarantee or just support the conclusion is an overriding reason for saying that the argument is deductive or inductive. We are not forced to make such a judgement mechanically. An explicit deductive indicator could be present in an argument inductive or *vice versa*, if other *prima facie* indicators are present and we judge them to override the explicit indicators. This allows us to reply to a point Govier makes in (7), p. 7. She points out that since the concept of logical entailment is a philosopher's concept, such words as "must," "therefore," and "shows conclusively" do not guarantee that the arguer claims his conclusion follows necessarily from the premises. We are not claiming that they do. If the context gives indication that the arguer is using these words in an informal sense, then these are marks against taking the argument as deductive. But are these words not *prima facie* indicators that he does make the deductive claim?

Frequently, perhaps in the majority of cases, there will be no explicit indicator occurring in an argument, either deductive or inductive. But this does not mean that there are not other *prima facie* marks to indicate the status of the argument. Arguments belong to families, the members of which are traditionally assessed by either deductive or inductive standards. Membership in such a family is an implicit *prima facie* indicator of the argument's status. On

the deductive side, we may obviously cite the families of truth-functional propositional arguments, of quantificational arguments, and of mathematical arguments. On the inductive side, we have such families as inductive generalizations, analogies, causal arguments, and good-reasons arguments. Belonging to one of these families is a **prima facie** indicator that the argument is deductive or inductive, depending on the family. This in effect accommodates Hitchcock's insights in (8).

We are not claiming that this is an exhaustive list of **prima facie** indicators. The fact that an argument is intuitively and obviously deductively valid or that its premises clearly give good inductive support to the conclusion could be a **prima facie** mark that the argument is deductive or inductive. Notice that if, as with (7), we had an invalid deductive argument where apparently the premises gave some support to the conclusion, we would have a conflict of **prima facie** indicators. (But notice that we can also have a conflict of **prima facie** duties.) However, in this case, wouldn't the mark that the argument belonged to a traditional deductive family override the mark of the premises supporting the conclusion?

We speculate whether, when the conclusion of an argument is stated categorically, not qualified or hedged by any explicit inductive indicator, this constitutes a mark that the argument is deductive. Consider

- (35) Every woman is an object, sexually speaking. No woman has a satisfactory feminine experience, so no sexual object has a satisfactory feminine experience. ((3), p. 14)

Now the fact that this is a quantificational argument is one (here strong) **prima facie** mark that it is a deductive argument, albeit invalid. But does the fact that the conclusion is stated categorically, without any inductive modifier, further signal (although this may not be a very strong signal) that the argument is deductive?

We have already seen how **prima facie** indicators may conflict. In (7), in effect, we have a conflict between two types of implicit indicators. Conflict between explicit and implicit indicators is especially important, since, as we discuss below, philosophers' intuitions on how to adjudicate these conflicts differ, and, in the pages of the **Informal Logic Newsletter**, this has motivated different solutions to the inductive/deductive problem. Consider the following argument:

- (36) (1) Sue's parents are demanding, egocentric, status-hungry, social climbers. They have wealth and recognition, and they want more. They express no affection for Sue.
 (2) Jane's parents are exactly the same way.
 (3) Sue has **anorexia nervosa**.
 (4) Therefore, Jane must have **anorexia nervosa** also.

Is this argument deductive or inductive? The indicators conflict. The word "must" in the conclusion is an explicit deductive indicator, while clearly the argument is analogical, which marks it as inductive. Although I have no conclusive argument to present for it we might adopt the following as a rule of precedence:

- (*) Explicit **prima facie** indicators always take precedence over implicit indicators.

Proceeding according to (*), we would judge (36) deductive. This seems intuitively justifiable. For wouldn't we accuse

anyone who put forward (36) of making a logical mistake?

There is one other alternative. Following Govier in (7), we might say that "must" is being used in an informal or nonstandard sense, and so we disagree that there is an explicit deductive indicator here. But suppose "must" really were intended here in the philosopher's sense, which we could argue is what should be intended if these words were used precisely. Hasn't the arguer, by using the word "must" in the conclusion, actually claimed too much? Hasn't he claimed that the premises guarantee the truth of the conclusion, when at most they make it likely to some extent? Isn't this precisely where the argument goes wrong, and can't we say that the problem with this argument is that it makes the deductive claim, when at most an inductive claim is warranted? Being able to criticize (36) by saying that it is an invalid deductive argument gives a reason for (*), although we are not claiming that it is a decisive reason.

We should note that this seems in accord with Fohr's view in (5), p. 7, where he says

Rather than ignoring a person's expressed intentions when we feel that person is misguided, we should say such things as, "You seem to think that your premisses are conclusive, but they really aren't." We might go on to say if the example allowed, "If you would change your conclusion to a weaker statement, if you said 'It was likely that such and such,' you would have a strong argument."

In effect (*) captures the intuitions of people like Fohr and Fred Johnson (10) who want to take intentions seriously. It would surely be opposed by Hitchcock, for whom just how much support the premises give the conclusion is paramount. Notice that (*) is not part of our **prima facie** view, but an added, supplementary principle. Hence, we can reject (*) without rejecting the overall criterion we are developing. The fact that the view may allow disputes over particular cases and yet maintain that the inductive/deductive distinction is viable is a distinct advantage.

How should we judge the reverse situation? Should we judge arguments which belong to deductive families yet contain explicit inductive indicators as being inductive or deductive? For example,

- (37) All wildebeests are animals native to Africa.
 All animals native to Africa are wild animals.
 Therefore, probably, all wildebeests are wild animals.

According to (*), we should count (37) as inductive. Frankly, we regard (37) as a freak. Does anything important hinge on whether it is declared deductive or inductive? If not, then the fact that (*) requires to judge it inductive is not an argument against (*).

Given this discussion, we may now formulate an explicit criterion for distinguishing between deductive and inductive arguments:

An argument is to be judged deductive (inductive) as the balance of deductive indicators outweighs the balance of inductive indicators (the balance of inductive indicators outweighs deductive indicators). In particular, all things being equal, when an argument specifically claims that its premises guarantee the truth of its conclusion or when it belongs to a deductive family, it should be judged deductive. Similarly, when it claims that its premises only give evidence for its conclusion, or when it belongs to an inductive family, it should be judged inductive.

We feel that this criterion is satisfying on three grounds. First, it preserves the familiar inductive/deductive distinction along traditional lines. Not only is the distinction maintained, but arguments traditionally regarded as deductive will remain so, as will arguments traditionally regarded as inductive. Second, the criterion preserves and integrates certain insights of those working in the field, particularly Sam Fohr and David Hitchcock, about what should count in judging an argument deductive or inductive. In particular, it suggests a reconciliation of these two divergent views. Finally, the criterion is flexible. It can accommodate disagreements as to whether specific arguments are deductive or inductive. Just as different persons may weigh differently the same set of **prima facie** obligations and so come to different views as to what is the overriding obligation in a given situation, so different persons may weigh differently the various marks an argument presents and so judge differently whether the argument is deductive or inductive. But as the former case discredits neither the notion of **prima facie** duty nor of overriding duty, so such examples do not show that there are no **prima facie** marks to distinguish deductive from inductive arguments nor that the inductive/deductive distinction is not viable. Disagreements over cases or inability to decide a case are not the fault of the criterion, but of the cases. There may not be any clear **prima facie** marks or the marks may be so conflicting as to prevent reliable judgment. But even here, our criterion yields an explanation for the difficulty. We conclude then that we can maintain the distinction between deductive and inductive arguments along traditional lines. We can hold that there are at least these two categories of arguments.

What is the status of an argument, A, pray tell, which argues that a certain argument, B, is either deductive or inductive? Is A inductive or deductive? By taking account of various factors each of which is a relevant mark for the argument's being deductive or inductive, much of the reasoning

derives its conclusion from a variety of premises each of which has some independent relevance....Since what is characteristic of this sort of reasoning is the leading together of various considerations, it seems appropriate to label it "conduction."

((15, p. 52; quoted in (6), p. 12) So such an argument, or much of the reasoning in it, is conductive. Are conductive arguments a third type, over and above inductive and deductive arguments? Apparently we need to answer that to determine the status of A. But the analysis of conductive arguments is the subject of another paper.

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Professor James B. Freeman, Department of Philosophy,
Hunter College, 695 Park Avenue, New York, N.Y.
10021.

Piagetian Insights and Critical Thinking

A.J.A. Binker
and
Marla Charbonneau

I. Introduction

Richard Paul, in his recent paper, "Teaching Critical Thinking in the 'Strong Sense': A Focus on Self-Deception, World Views, and a Dialectical Mode of Analysis"¹ argues for a basic change in approach to the teaching of Critical Thinking. He feels his approach would avoid the common pitfalls of traditional approaches. These pitfalls, according to Paul, include "sophistry", "dismissal", and an unhelpful atomistic approach to and analysis of reasoning.

Paul's approach is particularly noteworthy for his