

# Do We Reason When We Think We Reason, or Do We Think?<sup>1</sup>

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*ABSTRACT* If the open society is a society that ‘sets free the critical powers of man’ (Popper, 1945, Introduction), then the subject of critical thinking, now widely taught in universities in North America and at the level of further education in the UK, might seem to be a welcome innovation. Caution is advised. By mistakenly supposing that thinking intelligently is identical with thinking logically, critical thinking textbooks almost invariably regard the purpose of argument to be a combination of justification and persuasion, authoritarian goals that critical rationalists, and other supporters of the open society, must shun. If students do not learn the proper place of reason, and its limitations, they will be disappointed when it fails, and like many irrationalists in the past, may be induced to reason their way out of reason altogether.

## INTRODUCTION

Man being a rational animal, it is customarily supposed that at least some of his distinctive activities must be rational activities. Science, the intelligent and deliberate search for reliable positive knowledge of the world, is orthodoxly regarded as the rational pursuit *par excellence*. Being a rational pursuit, it must surely be conducted according to rational and, at least in principle, well-articulated methods. ‘It is a truth universally acknowledged’, a past Director of the Royal Institution declared guilelessly in a recent address, ‘that science progresses by tenacious logical analysis’ (Meurig Thomas, 2001, p. 106). But even in our pre-scientific and commonsense activities we appear often to behave in a different way from most other animals: instead of merely responding instinctively to the problems that our surroundings pose for us, we make use of reason to direct us, to guide us forward. Brutes may think intelligently but humans think logically.

It would be foolish to deny that reasoning plays a crucial role in intelligent human thinking, and that our approach to problem solving is in some respects different from that of other intelligent animals. Yet I wish vigorously to deny (and also to refute) the core of this orthodox doctrine that

it is logical thinking or reasoning that drives intelligent thinking forward. It is one of the most insidious mistakes that can be made about human thinking.

The mistake takes a naturalistic form in the field of artificial intelligence (AI), many of whose programmes set out explicitly to formulate systems of rules of inference whose use simulates, and might even be the same as, intelligent human thought processes. Hence arises the doctrine that how we think (or how AI savants think that we think) is the arbiter of how we ought to think. (Commenting on this criticism, Peter Madden writes in a private communication: 'it is possibly unfair to state that because AI tends to limit itself to the logical arena, AI practitioners believe this is all there is to thinking. It is simply that those tasks outside the logical domain have proved, to date and not for want of trying, extremely difficult.' I unhesitatingly accept this qualification.) The mistake is constitutive too of the traditions of critical thinking and informal logic, where it is non-naturalistic and prescriptive. Informal logicians see arguments everywhere, many of them inadequate and unconvincing. In the critical thinking literature, critical thinking almost always means the exposure of poor arguments. A third area where the mistake in question has had a deadly influence is the theory of scientific method. It is indisputable that intelligent thinking is involved in science, which is accordingly seen to be replete with argumentation. Countless treatises offer expositions of 'scientific inference' or 'scientific reasoning' or 'scientific method', in the belief that an understanding of the reasoning processes is not only, as I admit, necessary to an understanding of how science works, but also sufficient.

My own view, following Karl Popper, is that although both informal everyday discussion and institutionalized scientific practice may have their argumentative sides, and to the extent that they employ argumentation merit the accolade of rationality, they are not exhausted by the reasoning they exemplify, and they cannot be understood properly if attention is paid only to their argumentative aspects. For reasoning is a processing procedure, not a productive one, and it requires material, something on which to reason. This something, I shall maintain, is only indirectly the product of reasoning, whose sole proper use is destructive rather than constructive. Science consists, as Popper put it so well, of conjectures and refutations; not only of refutations, I stress, but also (and rather importantly) of conjectures; that is, of blind (but not random) guesses. It is my thesis that most of those whose views I shall be attacking are strangely blind to the pervasiveness of blind guessing. In much of artificial intelligence, in the whole of informal logic, and in almost all discussions of the procedures of science, and of mathematics too, much that is not reasoning is paraded as reasoning, and regimented into whatever thought formations are thought to be appropriate to reasoning. That these formations go beyond those of classical deductive logic is the one point in which I agree with those with whom I disagree. But it must be protested loudly that this fascination with reasoning is excessive. It is excessive because much of our

thinking consists of exploratory problem solving that is not constrained by rules, and is not argumentative. Faced with a problem, we generate guesses in a more or less blind manner, hoping that one may offer some kind of solution, then use reasoning or calculation, again more or less blindly, to find out where our guesses break down. Genuine critical thinking is the exposure not of poor arguments but of poor guesses.

In this article I leave AI, and all other empirical matters, to one side. The unbridled development of systems of non-monotonic logic, and the wealth of papers on cognitive psychology that purport to investigate inductive reasoning (see the survey of Heit, 2000, or Chater, Heit and Oaksford, 2005), show that what I allege to be a great mistake continues to be taken for granted as an obvious truth. By drawing attention to an alternative interpretation of the phenomena, a logically more palatable one, I hope to indicate how unthinking the mistake is. The failure to recognize the true role that reasoning plays in intelligent thinking is responsible, both in logic and in scientific method, for a monstrously illogical theory of intelligent thinking.

### CRITICAL THINKING

The phenomenon of critical thinking and of informal logic is a remarkable one. Within a few years it seems to have embedded itself solidly into the university landscape in North America, and it is making a great impression in other countries at the level of further education. Yet for all its popularity, it seems to have been developed on the back of a dismally erroneous view of what can be achieved through reasoning, or through the use of logic, not to mention an extraordinary failure to be critical of its own assumptions. Whatever other merits the critical thinking movement may have, and I do not doubt its sincere attachment to the rational values of the open society, it is not critical. It fails to live up to the spirit, or even the letter, of the demand that '[c]ritical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends' (Glaser, 1941, p. 5, quoted by Thomson, 1996, p. 4). This means that the most important general lesson, the most important 'transferable skill' (if you care to call it that), that might be learnt from the study of reasoning is negated before the process gets under way. This lesson is the lesson, familiar to (though not always welcomed by) many of the leading logicians of the nineteenth century, that argument or reasoning cannot serve as a process of justification or proof. Yet if there is one thing that present-day textbooks of critical thinking impress on their readers at the outset, it is that the principal purpose of proposing an argument is to justify or to provide good reasons for the argument's conclusion. In many works (but not all) this logical thesis is silently merged with the psychological (or perhaps only pragmatic) thesis that the underlying purpose of an argument is the persuasion of others to the arguer's own views. Let me offer some illustrative quotations.

The first is from the popular text by Trudy Govier, now in its fifth edition (2001, p. 11):

Why all this fuss about arguments? The general answer is that unlike descriptions, jokes, stories, exclamations, questions, and explanations, arguments are attempts to prove or justify a claim. We use argument when we try rationally to persuade others of our beliefs and opinions. The processes of justification and rational persuasion are important both socially and personally, and for both practical and intellectual reasons. When we give arguments, we try to show reasons for believing what we do, and in doing so, we gain an opportunity to explore the strength of these reasons.

Next, two works published in the United Kingdom. Anne Thomson writes (*ibid.*, p. 6):

Sometimes we want to persuade others to accept the truth of a statement, and one way of doing this is to offer them reasons or evidence in support of this statement. This is the essence of argument. The simplest examples of arguments occur when someone, who believes some statement, will present reasons which aim at persuading others to adopt this same point of view.

Tracy Bowell and Gary Kemp write similarly (2002, pp. 1f.; the emphasis is in the original):

The focus of this book is written and spoken ways of persuading us to do things and to believe things. Every day we are bombarded with messages apparently telling us what to do or not to do, what to believe or not to believe .... Some messages we just ignore, some we unreflectively obey, and some we unreflectively reject. Other we might think about and question, asking ... ‘why should I believe that, or not believe it?’

When we ask the question ‘why?’ we’re asking for a *reason* for doing what we are being enjoined to do, or [believing] what we are being enjoined to believe. When we ask for a reason in this way we are asking for a *justification* for taking the action recommended or accepting the belief — not just a reason but a good reason ....

To attempt to persuade by giving good reason is to give an *argument*.

A rather more sophisticated book is Alec Fisher’s *The Logic of Real Arguments* (1988), but on these matters of justification and persuasion he has pretty much the same to say (p. 16):

Remember, reasoning or arguing a case consists in giving grounds or *reasons* for *conclusions*, and the reasons are put forward in order to *support, justify, establish, prove* or *demonstrate* the conclusion. (The author is trying to *convince* the audience by means of reasoning.)

The central move in Fisher's 'general method of argument analysis' is called the Assertibility Question (p. 22): 'What argument or evidence would justify me in asserting the conclusion C?' Engel (1986) goes so far as to tie the analysis of arguments to their supportive and suasive potentials (p. 6): 'To distinguish the premise from the conclusion in cases of this sort, ask yourself such questions as: what is being argued *for* and what is the person trying to *persuade us of*?' Toulmin, Rieke and Janik (1984, p. 5) similarly identify

*argumentative* uses of language ... [as] those utterances that succeed or fail only to the extent that they can be 'supported' by arguments, reasons, evidence, or the like and that are able to carry the reader or hearer along with them only because they have such a 'rational foundation.'

and subsequently analyse arguments into 'claims', 'grounds', 'warrants' and 'backing' (p. 25). In other works the twin prospects of proof and persuasion are taken as normal, rather than indispensable. Jones (1997, p. 3), for example, writes: 'Arguments are usually put forward to try to convince someone else to accept a particular statement or belief or point of view. Typically, they consist of a reason, or reasons, ... which support, or fail to support, ... a conclusion.' Damer (1980, pp. 1f.) says that his book offers 'strategies that ... assist faulty arguers in doing what they allegedly wish to do — to argue in convincing and nondeceptive ways towards the objective of establishing the truth of a claim or belief.'

Finally, a word from Shand (2000), a book that differs in two commendable ways from the others sampled. First, he respects the distinction between the logical question of whether an argument is a good one and the psychological question of whether it leads anyone to adopt any new belief (p. 3), and indeed stresses the danger of seductive rhetorical gambits. Secondly, he restricts good arguments to deductively valid arguments (pp. 8-11; see also his 2001/2002), holding that inductive arguments, if acceptable, are deductive enthymemes; that is, that they have hidden premises that make them deductively valid. (He actually demands that a good argument be sound; that it should be a valid deduction from true premises.) On the logical function of argument, however, he is in accord with everyone else (pp. 2f.):

The theoretical contention of the author is that the notion of good reasoning can be reduced to a certain basic idea ..., that of deductive soundness: (a) the premises must be *true* and (b) the argument *valid* so that the conclusion follows from the premises .... It is from (a) and (b) alone that an argument giving one a reason to accept a conclusion as true is ultimately derived. ...

In addition it is a theoretical contention of this book that the *only* thing that can give one a good reason for a belief or an action is that there is a sound argument for it.

These themes are repeated throughout chapters 1 and 2 of the book. That sound arguments always furnish justification for their conclusions is stated unequivocally thus (p. 22):

The value of arguments is that they are a way of finding out what it is rational to believe or think true. We know that if an argument is a good argument, the premises are true and the conclusion follows from the premises, then we are rationally justified in believing the conclusion of that argument or accepting it as true.

The converse is proclaimed in a ringing summary (p. 38; author's emphasis suppressed): 'Good reasoning consists of using only valid arguments and true premises, for only in this way does an argument give a reason for the conclusion being true.'

This selection of quotations is only a small sample from a huge population, and was dictated largely by which textbooks happened to come the author's way. The extent of the literature on critical thinking can be judged from Cassel and Congleton (1993), an annotated list of 930 books and papers drawn from the period 1980-1991. Earlier works might have been added; for example, Toulmin (1958), which maintains that 'the other functions which arguments have for us ... are ... parasitic upon th[e] primary justificatory use' (p. 12). A recent unambiguous statement of what are generally thought to be the aims of argument appears in the opening words of Blair's preface to Govier (1999):

Argument is a social practice, arguably part of the core of any culture. Not quarrelsome disputation or overbearing browbeating; but the finding of reasons to justify beliefs and the response to disagreement by rational persuasion.

To someone who had the good fortune to be exposed to Popper's philosophy early and often, the unanimous fascination with justification, reasons, and proof to be found in these passages makes uncomfortable reading indeed. Equally disturbing, I may add, is the nearly unanimous fascination with the persuasion of others, but I shall not pursue this complaint far here. How different such single-mindedness (even if described as 'rational persuasion') seems to the formulation of critical rationalism that Popper gave in *The Open Society and Its Enemies*, and later adopted almost as his motto: 'I may be wrong and you may be right, and by an effort, we may get nearer to the truth' (1945, chapter 24, § 1). Persuasion reeks of authority, of the attitude of the person who wants to teach rather than to learn. It is an unpalatable thought that these goals, justification and persuasion, are widely taught to embody 'the essence of argument', as Thomson puts it. A real fear for rationalists must be that if students do not learn the proper place of argument, and its limitations, they will be disappointed when it fails to live up to their hopes, and like many irrationalists in the past, may be induced to reason their

way out of reason altogether. ‘Fools give you reasons, wise men never try’ (Hammerstein, 1949).

### CRITICAL RATIONALISM

In *Logik der Forschung* (1934) Popper proposed the thesis that in natural science empirical justification, whether it be conclusive proof or only that pale simulacrum of proof promised by high probability, is an unattainable goal. If scientific theories merit our close attention, as they do, it is not because they are especially well established. The best that we can hope for, Popper explained, is that our theories are (uncertainly) falsified, or that, if they resist falsification, they are true. Some years later he developed this falsificationist philosophy into a more general *critical rationalism*, a rationalism that renounces the search for positive certainty or any surrogate for it and stresses instead the power of negative criticism (1945, *ibid.*). In a neglected passage dating from 1953, he wrote about the role of reasoning in science (1957; 1963, chapter 1, § VII):

The demand for rational proofs in science indicates a failure to keep distinct the broad realm of rationality and the narrow realm of rational certainty: it is an untenable, an unreasonable demand.

Nevertheless, the role of logical argument, of deductive logical reasoning, remains all-important for the critical approach; not because it allows us to prove our theories, or to infer them from observation statements, but only because by purely deductive reasoning is it possible for us to discover what our theories imply, and thus to criticize them effectively. Criticism ... is an attempt to find the weak spots in a theory, and these, as a rule, can be found only in the more remote logical consequences which can be derived from it. It is here that purely logical reasoning plays an important part in science.

Thinking rationally, according to Popper, just means being critical; not being critical of arguments, which is what proponents of critical thinking usually think of as criticism (Govier, 2001, pp. 81f.), but being critical of their conclusions (and so of their premises). This approach to criticism allows us to correct our premises rather than merely explore them. It is as far removed as it could be from the idea that ‘to think critically means that we are able to think in a logical fashion — in straight lines, as it were’ (Jones, *ibid.*, p. 2).

### PETITIO PRINCIPII

Even in the absence of the clear light that critical rationalism has shed for sixty years on the role that argument plays in inquiry, it should be almost obvious that ‘reasons are [not] put forward in order to *support, justify, establish, prove or demonstrate*’ conclusions, as Fisher puts it, simply because they are incapable of doing any such thing. It has long been known, perhaps since the time of Sextus Empiricus, but definitely since the early 19th century, and



certainly since Mill (1843, Book II, chapter III, § 1), that every deductively valid argument is question-begging in the sense that its conclusion is (implicitly or explicitly) included within its premises taken together. It is quite impossible therefore that a valid argument could justify its conclusion, unless indeed a proposition can justify itself. None of the authors cited fully admits this absurd outcome. Yet according to Shand, *ibid.*, p. 22, if an argument is sound, that is, if it is deductively valid and has true premises, then 'we are rationally justified in believing the conclusion'. If the proposition *A* is true, that is to say, we are rationally justified in believing *A* (since the argument from *A* to *A* is incontestably valid). This credo of Shand's looks like a straightforward misreading of 'We are rationally justified in believing that if the premises of a valid argument are true, then the conclusion is true' as 'If the premises of a valid argument are true (or at least we believe that they are true), then we are rationally justified in believing that the conclusion is true'; the ancient mistake of confounding *necessitas consequentiae* with *necessitas consequentis*. In any case the categories of truth and justified truth are effectively identified (*ibid.*, p. 16). This is a fairly unobjectionable identification as long as it is truth in the usual classical sense that is taken as the primitive idea, for then talk about justification is easily seen for what it is: distracting embroidery. But the identification of truth with justified truth is far from harmless if it is justification that is taken as primitive (as it is by verificationists) and we are placed in the position of having to deny truth to propositions that we cannot justify.

Given its devastating impact on their principal doctrines, the treatment given in critical thinking texts to circular argumentation, or begging the question, or the fallacy of *petitio principii*, is surprisingly meagre. Thomson and Shand seem nowhere to address the difficulty, and Fisher addresses it just once. Howell and Kemp grant it a couple of pages. Lambert and Ulrich (1980, p. 28) mention circular reasoning on half a page, and disarmingly conclude that 'no such argument is fallacious, but anyone who argued in this way would be making some sort of mistake'. Damer judges that '[s]uch arguments violate a rule of sound reasoning that one should employ as premises only those propositions that are self-evidently true or conclusions based upon other well-supported premises' (*ibid.*, p. 25), but appears not to notice what a crippling restriction this is. Engel (*ibid.*, p. 144) concedes that

All [deductive] arguments ... are in a sense circular. There are two respects, however, in which sound arguments differ from those that we condemn because of their circularity.

First, a sound argument contains premises that assert information not contained in the conclusion. That is, the premises provide evidence for the conclusion rather than simply restating assertions made in the conclusion, as circular arguments do. Second, a sound argument may contain obviously true premises rather than premises which are open to question.



I shall say no more about the second alleged attribute of sound arguments, which has no bearing on the issue of justification, but only on the question of obvious truth, and (as Engel admits on the next page) is of limited use in contrasting the persuasiveness of circular and sound arguments. If the first alleged attribute provides the benefit expected of it, then when *C* logically implies *A* without being identical with *A*, the argument from *C* to *A* may be less discredibly circular than is the argument from *A* to *A*, since *C* may furnish evidence for *A*. Yet *C* is identical with *A* & *C*, and therefore also restates *A*. Engel nowhere explains how a premise that asserts the conclusion, and more than the conclusion, can be any less question-begging than one that simply asserts the conclusion.

Govier *ibid.* is more thorough, but she too misjudges the gravity of the problem, and the seriousness with which it was discussed a century and more ago (by Mill, *ibid.*; earlier by Whately, 1827, chapter III, § 13; later by Keynes, 1906, Part III, chapter IX; and in between). Indeed, in her (1999) she records with evident satisfaction that although ‘as recently as 15 years ago, there had been relatively little systematic reflection by philosophers on philosophical and non-formal issues pertaining to argument ... [t]oday the study of argument is a burgeoning interdisciplinary field. But even so, within philosophy itself basic philosophical questions about the nature of argument and the power of argument to provide rational justification could be said to receive insufficient attention’ (p. 94). In her textbook she introduces in these words the problem of begging the question (2001, p. 85):

A surprisingly common mistake when offering arguments is to put forward premises that state or presuppose the conclusion. In such a case, the premises are logically too close to the conclusion to be able to support it.

Later, in the chapter ‘Premises: what to accept and why’, she elaborates (pp. 163-5):

An argument begs the question if one or more of its premises assert[s] the conclusion (usually in slightly different words) or presupposes that the conclusion is true. ... Anyone who disputed the conclusion in this case would also dispute the premise.

It may seem amazing that anyone would ever use or be fooled by a question-begging argument. ...

[Some] cases of begging the question are ... more difficult to spot than instances in which one premise by itself claims the conclusion. The circularity is more subtle and more disguised. But the problem is in essence the same: the premises are not acceptable unless we already accept the conclusion.

In these passages, which admit that circularity is not simply a matter of a superficial reformulation of the premises in the conclusion, I find no

recognition of the blunt truth that in all valid arguments the premises assume the truth of the conclusion; that is, that all valid arguments are question-begging. I do not accuse Govier (or any of the other authors cited) of deliberate deception, or even self-deception, but I am irresistibly reminded of a nature magazine called *Ranger Rick* that my elder son was sent some 25 years ago by friends in California. This magazine wished to implant in its young readers a respect for nature, a love of animals, and so on; it wished too to educate them by telling them how animals lived. Sex, rather than procreation, was of course ignored, for there was a much trickier dilemma to negotiate, namely food. Consummate skill had to be employed by the writers not to make it obvious that many animals in the wild kill and eat other animals.

#### WHAT ARGUMENTS ARE USED FOR

Justification is an impossible dream, unless one allows a proposition to be justified by itself, or by some non-linguistic entity such as a fact. Approaches of this kind, such as reliabilism, which understands the justification that a justified hypothesis enjoys to be underwritten by the method by which it was generated, characteristically treat justification as a descriptive rather than an evaluative dimension. They are hardly relevant to whether arguments ever justify their conclusions. It is plain that even the best arguments are not able to do this. A deductive argument can justify its conclusion only if the premises, which include the conclusion, are themselves justified.

Persuasion fares no better as a goal of argumentation than does justification, for if anything persuades the listener of the truth of the conclusion it is the truth of the premises (Miller, 2005, chapter 4, § 1). The argument itself is no more than a way of presenting in a new light some or all of the content conveyed by the premises. Only those who are impressed by style rather than by substance could be convinced by an argument, rather than by what it is that the premises assert. Govier *ibid.* gets this more or less right, but does not draw the right conclusion. For the same reason arguments, at least deductive arguments, cannot help us to make discoveries, or to advance our knowledge in any objective sense. To be sure, they can provide new subjective knowledge, in the way that mathematical proofs uncannily do. Arguments, it may be conceded, do have an exploratory function, even if what they explore is what is already known, or conjectured, about the world, and not the world itself. We do well to recognize nonetheless that genuine deductive reasoning is an inescapably trial-and-error process (Miller, *ibid.*, chapter 4, §3), and that the bulk of what we discover deductively in deductive disciplines is how propositions of interest cannot be proved. This is as true in the enterprise of mechanical theorem proving as it is in the mathematics of humans. If we later forget the countless wrong turnings taken on the road to victory, that does not mean that they were not made.

A word must be said about allegedly non-deductive or inductive inferences, if only to allay the suspicion that some power they possess to advance or to entrench our knowledge might atone for their pitiful incorrectness. Here I agree with Whately (*ibid.*, p. 209), provided that ‘syllogistic’ is liberally interpreted to encompass everything and anything deductive:

Induction, *therefore*, so far forth as it is an *argument*, may, of course, be stated Syllogistically: but so far forth as it is a *process of inquiry* with a view to obtain the Premises of that argument, it is, of course, out of the province of Logic.

and, provided that ‘plausible’ is understood as a purely descriptive adjective, with Bertrand Russell (1903, p. 11): ‘What is called induction appears to me to be either disguised deduction or a mere method of making plausible guesses.’ Into the category of disguised deductions go those non sequiturs that have recourse to identifiable, though perhaps hidden, inductive rules of inference or background assumptions. I am reluctant to concur with Musgrave (1999, chapter 14), Shand (2001/2002), and Govier (in such places as 1999, p. 87) that everything that has ever been advertised as an inductive inference can be so construed, if only because, even in the simplest cases, it is a subtle matter what should be taken as the suppressed premise (Miller, 1995b; for a suggestion, see Boyer, 1997). But for these deductive enthymemes the previous considerations apply with unremitting force. Inferences of the second kind, those that resist deductive reconstruction, are evidently indistinguishable from blind guesses, and it would be less tendentious if they were so described. In contrast to deductive inferences, they can indeed lead to an augmentation of knowledge (provided that knowledge is recognized, as it must be, to be conjectural through and through and through). But in no one’s estimation is guesswork a procedure of justification or proof, or even one of persuasion. What is more, even non-deductive inferences, if elucidated in terms of probabilistic support, beg the question to some degree (Miller 1994, chapter 3, § 3 and pp. 73f., note *b*). In short, non-deductive inferences are in the same leaky boat as their deductive mates.

As was indicated briefly on pp. 58 and 63, the primary role of arguments is not justification, not persuasion, not discovery, not even exploration, but criticism. Except perhaps in mathematics, we use arguments not to prove or to elaborate on our premises, but to probe them and to upset them. Of the texts mentioned above, Toulmin, Rieke and Janik (*ibid.*), who at one point describe reasoning as ‘a way of *testing and sifting ideas critically*’ (p. 10), get closest to this insight, but for them too criticism comes to mean the criticism of bad arguments rather than the criticism of false premises. Fogelin (1978) fairly describes as ‘one-sided’ the view that the only function of arguments is ‘to prove something or justify some claim’ (p. 95), but for him also criticism is directed more at arguments than at their premises. It is a rum business.

Given the profusion and intelligibility, not only in mathematics, of *reductio ad absurdum* arguments, it is a mystery that anyone can maintain that all good arguments have true premises, or that they prove their conclusions.

Do these considerations imply that deductive logic is no more than a psychological crutch, something that we could do without if we were logically omniscient? The answer has to be affirmative as far as deductive calculi are concerned, since a flawless command of deductive calculation would be one aspect of knowing all the laws of logic. (Grammar provides an example of a system in which many of us are more or less fluent, at least at the conscious level; and here there is only rarely a need to resort to the devices of a formal system.) As regards reasoning in a more general sense, the answer is less straightforward. In pure mathematics, to the extent that it aims only at the construction of proofs in (background) axiomatized systems, for example set theory, it is evident that an affirmative answer is once more unavoidable. If even some of us were boundlessly brainy (and the notorious physical limitations in some manner overcome) then pure mathematics would be complete, at least until the invention of new axioms. But as soon as a critical attitude is adopted, reasoning emerges with a usefulness that is more than prosthetic. Not only do we have to know what follows from what, we have to decide which conclusions to draw from which premises. Arguments, being transparent, become gratuitous, but inferences do not. If our desire is to know the truth, it is not enough to know the logical connections between all the propositions jostling for attention. The processes of testing and criticism indeed often require that we bring into existence new premises, and with them new conclusions.

The misconceptions about argumentation that I have criticized arise from a single source; from the thought that intelligent thinking means logical thinking. This is false. Most of the time, problem solvers that we are, we think creatively or speculatively or, if you like, intuitively. Although the exercise of reason is inevitably postponed in this way, it is not cancelled. Glaser (quoted above), and Dewey before him, though too sanguine about the power of evidence and positive argument, rightly insisted that the rational thinker should be ready to submit all guesses to remorseless criticism, and to reject the failures. It cannot be denied that a complex sequence of interlocked blind guesses and cruel rejections may look much like directed thought, just as Darwinian evolution simulates orthogenesis or design. But we must not be hoodwinked into thinking that it is reasoning, or anything else that we know, that drives us forward to what is unknown. What reasoning does is pull us back. Our guesses are not random, of course, but informed; which means only that they are guesses informed by earlier guesses. We who have noses follow our noses (and other organisms follow homologous organs), but we do not see beyond our noses. However richly our guesses are informed by what is known, they know not (are blind to) what is not known. Campbell (1974, p. 422) puts it well: 'In going beyond what is already known, one cannot but go blindly. If one can go wisely, this indicates already achieved wisdom of some general sort.'

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## NOTE

- 1 This article derives from a talk given to the Philosophy of Education Society of Great Britain (South East England Branch) at Canterbury Christ Church University College, on 10 February 2003, and later, more informally, to the Nottingham High School for Boys Philosophy Society on 2 March 2004, and at a gathering of the University of Warwick Alumni Association on 4 April 2004. Some of the material had been used in talks at Reason Park, the First International Summer School on Reasoning under Partial Knowledge, held at Foligno (Perugia) from 27 August to 6 September 2001, ([www.dipmat.unipg.it/reasonpark](http://www.dipmat.unipg.it/reasonpark)) and at the seminar *Induction: Fact or Fantasy?* held at King's College London on 9 January 2002. There are some loud echoes too of chapter 3 of my (1994), and of two papers (Miller, 1995a and 1997) that have yet to be published in English. A thoroughly revised version of (1997) will appear as chapter 3 of Miller (2005). I am indebted to Peter Milne for bringing Cassel and Congleton (1993) to my attention; to Stephen Read and to Deryck Horton for useful advice; to John Collins and Peter Madden for pressing me to state clearly that blind guesses may be informed guesses; and to Michelle Speidel for profitable discussions of the educational value of university courses in critical thinking. Responsibility for errors is reserved.

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