Information processing and the Spirit of Finesse

by Dr. Richard van de Lagemaat

> The real danger is not that computers will begin to think like men, but that men will begin to think like computers. [Sydney Harris]

Living as we do in the so-called "information age", it is perhaps not surprising that the dominant model in contemporary psychology identifies thinking with information processing or computation. According to this model, human thought is nothing more than a set of rule-governed operations on various bits of information, that could in principle be performed by a digital computer. The two main assumptions behind this model are: first, that the world consists of a collection of information that can be clearly defined - usually in mathematical terms; and, second, that knowledge is generated through the application of rules to this information. Advocates of the model argue that it can explain all forms of intelligent activity from deductive reasoning through common sense judgment to practical know-how. Thus good judgment, which was once considered the hallmark of the educated person, is now widely believed to have less value than technical competence. Indeed, with the development of so-called "expert systems" which simulate the reasoning processes of experts in various disciplines, some believe that we will eventually be able to replace fallible human judgment with the certainty of mechanical calculation.

The aim of this article is to cast doubt on the information processing model of thinking by reference to the ideas of the great seventeenth century French philosopher, Blaise Pascal (1623-1662). A genius of the first order, Pascal is credited, among other things, with inventing the first digital computer - a geared machine that could add and subtract numbers up to eight digits. But he would have had little sympathy with the widely held belief that the mind is nothing more than a sophisticated computer.

The basis for Pascal's rejection of the computer model of the mind can be found in a distinction he makes in his most famous work, the *Pensees*, between the spirit of geometry (*l'esprit de geometrie*) and the spirit of finesse (*l'esprit de finesse*). This distinction is designed to show that in addition to what we now call information processing, the mind also functions at a more intuitive level. To explain the difference between these two modes of thinking, we can say that while the spirit of geometry analyses phenomena into clearly definable parts and uses deductive reason to construct a system of knowledge based on rigorous proof, the spirit of finesse concerns ideas and perceptions which cannot be precisely defined or broken down into parts, and uses intuitive reason to make sense of the relevant phenomena as a whole. Furthermore, while the spirit of geometry results in conclusions that command universal assent, the spirit of finesse results in fallible judgments about which intelligent people may from time

to time disagree.

According to Pascal, while the geometrical mind is rigorous and exact, it is also "slow, rigid and inflexible". The intuitive mind, by contrast, "has a suppleness of thought which fastens at once upon the various pleasing qualities of what it loves." Such a mind is "accustomed to judge at a single glance", and it does so "tacitly, naturally, and without technical rules". However, in distinguishing between these two ways of thinking, Pascal makes its clear that both are important ingredients in a balanced intellectual outlook. The trouble arises if we focus too exclusively on the one or the other. Thus, while mathematicians who are only mathematicians "do not at all understand matters of feeling, seeking principles and being unable to see at a glance", "men of intuition who are only intuitive cannot have the patience to reach to first principles". While the ideal is a combination of the spirit of geometry and the spirit of finesse, the tendency of the Western intellectual tradition has been towards what might be called geometrical *imperialism* - that is, the extension of geometrical thinking into every area of intellectual life in the mistaken belief that it is the only possible approach to reality.

To counter geometrical imperialism, I wish briefly to draw attention to the important role played by intuitive thinking in three different subject areas: history, science, and mathematics.

History History is a good example of a subject area in which intuitive understanding rather than geometrical explanation is the appropriate intellectual mode. Since history trades in concepts that resist precise mathematical specification, it cannot be reduced to a measurable science. For example, an important factor in determining the outcome of a battle might be the "morale" of the troops; but "morale" is an inherently vague, qualitative term; and while you may be able to measure the troops' height or weight, you cannot measure their morale. Certainly, statistics have a role to play in history; but any attempt to reduce historical explanations to numbers can only result in absurdity, as the following example from the American historian Barbara Tuchman shows:

> In a quantification study of the origins of World War I which I have seen, the operators have divided all the diplomatic documents, messages, and utterances of the July crisis into categories labelled "hostility", "friendship", "frustration", "satisfaction" and so on, with each statement rated for intensity on a scale from one to nine, including fractions. But no pre-established categories could match all the private character traits and public pressures variously operating on the nervous monarchs and ministers who were involved. The massive effort that went into this study brought forth a mouse - the less than startling conclusion that the likelihood of war increases in proportion to the rise in hostility of the messages.

The absurdity of the above study is apparent from the fact that it reaches conclusions that would have been readily apparent to a historian of even average historical insight.

In any case, even it made sense to organise the relevant historical documents into categories and attach numbers to them, this would not obviate the need for judgment; for, as Tuchman observes, the problem would remain of the choice of categories - which are not "revealed doctrine". In other words, judgment is required to decide that the appropriate categories in terms of which to analyse the data are "hostility" and "friendship" rather than, say, "insecurity" and "envy".

The motivation behind such quantification studies is to find repeatable patterns in history; but this remains an empty dream. For history is by its very nature concerned, not with the abstract and general, but with the concrete and particular. Moreover, the meaning and significance of particular events cannot be understood in isolation, but only in the overall context in which they take place. Since historical events are unique and unrepeatable, the most for which we can hope when we inquire into, say, the cause of revolution or the consequences of neutrality, are similarities rather than identities, and tendencies rather than laws. Given that history is a matter of intuitive understanding and judgment rather than geometrical explanation and proof, it is not surprising that historians rarely achieve consensus. However, this does not vitiate history as a discipline, but simply reflects the nature of the subject matter with which it deals.

Science Despite the importance given to measurable quantities and law-like regularities in traditional accounts of the scientific method, intuitive understanding also plays a crucial role in scientific thinking. For, contrary to the traditional inductive view of science, scientific theories cannot be derived mechanically from the facts, but require a leap of creative insight. For example, despite the enormous difference between the principles of Newtonian mechanics and those of general relativity theory, they are, over a wide range, consistent with the same experimental facts. Einstein was not in possession of any facts that were not available to physicists working in the Newtonian paradigm when he developed relativity theory. He simply interpreted the existing facts differently (- and then went on to make testable predictions on the basis of them). This explains his comment - which could easily have been made by Pascal - that, "Laws are only reached by non-logical methods. To make a law one has to have an intellectual love of the subject."

What this suggests is that while scientific thinking within a paradigm, or over-arching theory, might be geometric in nature, the development of new paradigms is a matter of creative insight rather than geometrical proof. Moreover, what we take the facts to be itself depends on our pre-existing theories. Consider, for example, the statement: "Sulphur burns in air combining with oxygen". While this might appear to be an unambiguous fact, the history of science shows that it is actually a theory dependent observation. For prior to the modern theory of combustion as developed by Lavoisier (1743-1794) at the end of the 18th century, combustion was explained in terms of the giving off of a colourless, odorless and weightless substance called *phlogiston*. So before Lavoisier, the relevant statement would have read, "Sulphur burns in air releasing its phlogiston."

The above discussion implies that, contrary to the traditional account of the scientific method which says that theories are derived from neutral facts using geometrical reason, it would be more accurate to say that facts are theory dependent, and that the theories on which they depend are the result of various acts of creative insight. Reverting to Pacal's terminology, we might conclude that the spirit of finesse casts a deep shadow over the whole domain of science.

So why is the spirit of finesse not more readily apparent in the sciences, and why is it so widely believed that theories can be mechanically derived from the observable facts? Following the biologist, Peter Medawar, I think that the reason derives from the way in which science is written. For there is a sense in which the vast majority of science writing is *science fiction*. I do not mean by this that the results are false, but rather that the report on the way in which they were derived is false. Very often in science, the idea that grows into a testable hypothesis comes before the evidence, and the scientist then looks for the evidence to confirm her idea. However, when she comes to write up her work in a science paper, the actual process of thought is reversed, so that, rather than admitting that it was the idea that led to the selection of the data, she begins with the data and implies that it was the evidence alone that led her to the conclusion. What is wrong with this is that it covers up the tentative nature of science in which finesse plays a role, and leave us with the impression, not of an open-ended and fallible process of enquiry, but of a completed and timeless body of doctrine.

Mathematics While mathematics is, of course, the homeland of geometrical explanations, it turns out that intuitive understanding even has a role to play in this discipline. For as Pascal observes, while we may use deduction to reason from axioms to theorems, the axioms themselves are not subject to proof. All proof must end somewhere, and it ends with first principles that we can justify only on the basis of intuitive understanding. Furthermore, even when it comes to proving theorems, the French mathematician Henri Poincare (1854-1912) claimed that great mathematicians are guided as much by the intuition of beauty as by mechanical calculation:

> Mathematical work is not a simple mechanical work, and it could not be entrusted to any machine, whatever the degree of perfection we suppose it to have been brought to. It is not merely a question of applying certain rules, of manufacturing as many combinations as possible according to certain fixed laws. The combinations so obtained would be extremely numerous, useless and encumbering. The real work of the discoverer consists in choosing between these combinations with a view to eliminating those that are useless, or rather not giving himself the trouble of making them at all. The useful combinations are precisely the most beautiful, I mean those that can most charm that special sensibility that all mathematicians know, but of which laymen are so ignorant.

At a more esoteric level, Roger Penrose, in his book *The Emperor's New Mind*, contends that one of the implications of Godel's Incompleteness Theorem is that the

way in which we decide whether or not certain mathematical statements are true is intuitive rather than rule-governed. Be that as it may, we have all, at some level, had the "ah-ha" experience of suddenly being able to see how to solve a mathematical problem - and this is surely a faint echo of the higher level intuitions of the great mathematicians.

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These brief excursions into history, science and mathematics all suggest that Pascal's spirit of finesse, or what we have called intuitive understanding, has a crucial role to play in intellectual activity. If we further accept that intuitive understanding cannot be reduced to a rule-governed activity, then it follows that the information processing model of thinking is inadequate. Against this, it might be objected that when we learn a new skill, such as poetry analysis, or essay writing, or, indeed, playing a musical instrument, the activity in question is usually broken down into simple steps and we are then given guidelines in the form of simple rules on how to proceed. This is true enough; but once we acquire expertise in a particular area, we eventually go beyond the rules that we have been taught. Thus, when we begin learning how to write an essay, it is generally a good idea to follow some simple guidelines, but we cannot reduce the work of a great writer to a set of mechanical rules, and the oeuvre of a creative genius, such as Shakespeare, transcends any imaginable rules. As I understand it, this is the point Pascal is making in the following quotation:

> True eloquence makes light of eloquence, true morality makes light of morality; that is to say, the morality of the judgement, which has no rules, makes light of the morality of the intellect. To make light of philosophy is to be a true philosopher.

In its highest form, then, the spirit of finesse takes flight and achieves a naturalness that lies entirely beyond rules. With reference to the art of living, this is surely part of what we mean by wisdom.

Despite these comments, proponents of the information processing model might insist that at some level our minds must always be following rules and processing information even if we are not always aware of it. If intuition is "the feeling of what the end must be without consciously going through every step of the reasoning" (Isaac Asimov), then even when we are not *consciously* going through a sequential reasoning process, this must surely be happening at the unconscious level. For otherwise intuitive insight and judgment become entirely mysterious affairs. In response to this point, I would ask: But why must this be happening? Why *must* our minds at some level be processing information? Do we really want to claim that all areas of thoughtful activity, such as scientific insight, writing poetry, and intellectual conversation, could in principle be reduced to a set of rules that we are unconsciously following? Indeed, I wonder if it even makes sense to speak of following a rule *unconsciously*.

In the absence of empirical evidence, I think there are two reasons why many people are attracted by the information processing model. First, we can all too easily become bewitched by our own rhetoric into taking a metaphor - "The mind is a computer" - as a literal truth. This seems to be a particular danger when we are dealing with the human mind, which has frequently been understood in terms of the latest and most fashionable technology. While it is doubtless illuminating to look at similarities and differences between the mind and a computer, there is no particular reason to think that the mind *is* a computer. The second possible reason for our prejudice in favour the information processing model concerns the nature of explanation itself. Quite simply, we are so hooked into an atomistic and geometrical account of reality, that we have no other conception of what it is to explain something. Thus in the current AI debate, advocates of AI imply that the only alternative to the mind-is-a-computer thesis is out-and-out mysticism. This, however, is a false dichotomy. The way to steer a middle course between geometry and mysticism is to accept that the spirit of finesse is an irreducible mode of intellectual activity.

Perhaps the most fundamental weakness of the information processing model of thinking is that it takes the idea of facts or information for granted. Now, one would, of course, be a fool not to take note of the best available facts when seeking to build up a picture of the world, and we are likely to generate worthwhile ideas only if we have a good command of such facts. At the same time, however, we must remember that facts do not simply rain down from heaven. In his book, *The Cult of Information*, Theodore Roszak uses the word *idea* specifically to denote a master idea that informs an entire way of thinking in a particular area. Using this terminology, Roszak argues that that, "*the mind thinks with ideas, not with information*." Such ideas are not generated mechanically from the facts, but rather inform what things show up as the facts in the first place, and how these facts are interpreted. Indeed, as Roszak observes, the belief that the world is a collection of facts, and the belief that the mind is a computer are themselves ideas and not facts; and when we argue about ideas, it is a question not of geometric proof, but of judgment and finesse.

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What are the implications of the distinction between the spirit of geometry and the spirit of finesse for us as educators in general, and TOK teachers in particular? Let me mention three. First, we should have no truck with the view of education espoused by Mr Gradgrind in Charles Dickens' novel, *Hard Times*:

> Facts alone are wanted in life. Plant nothing else, and root out everything else. You can only form the minds of reasoning animals upon Facts; nothing else will ever be of any service to them.

Contrary to Mr. Gradgrind, facts are clearly *not* all that is wanted in life; for education is not simply about conveying information, but about teaching students how to reflect intelligently on information, make meaningful connections, and come up with creative

ideas. In the current, sometimes mindless, rush to hook every classroom up to the information super-highway, this is something that we would do well to remember.

Second, since intuition, judgment and creativity cannot be reduced to a set of rules, we must accept the fact that there can be no quick route to their acquisition short of immersing oneself in the subject-matter in question, and considering the relevant "facts" from a variety of different perspectives. For the spirit of finesse is the product not of a superficial survey and rote learning, but of wide reading and personal reflection.

Third, while the information processing model implies that every problem has a definite and clearly specifiable solution, I would argue that not all thinking can be equated with problem-solving. While such an equation may be appropriate in some areas, many important questions that confront us - , "What is the relationship between science and religion?", "Do animals have rights?", "How should I live?" etc - do not have definite answers. With such questions we should think in terms, not of problems that have a clearly specifiable solution, but of difficulties that require thoughtful illumination.

In conclusion, I think that in an increasingly computer dominated and information-driven world, there is, as the opening quotation suggested, a danger that people begin to think like computers, and that they come to value technical competence over wisdom, and mechanical calculation over sound judgment. If we wish to avoid this danger and remain true to the traditional ideal of the well-educated person, then, following Pascal, we must seek to encourage in our students, not only the spirit of geometry, but also the more elusive, yet equally valuable, spirit of finesse.