THE LEFT-HANDED COMPUTER — *alternative images of classroom computing*

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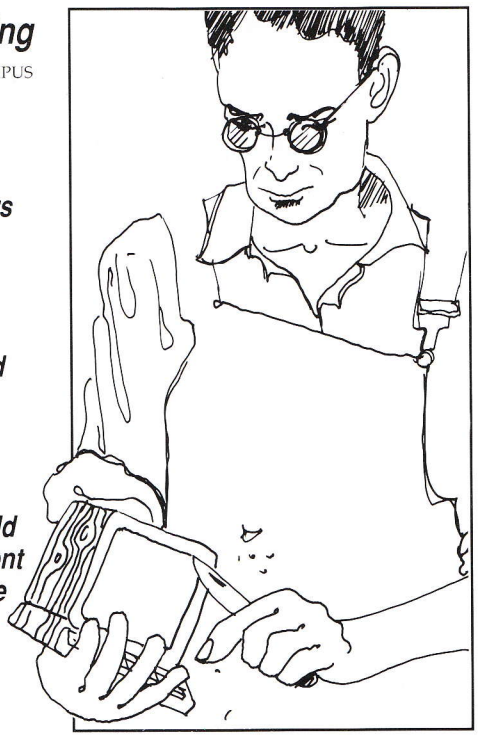

In recent years considerable concern has been voiced by educators in regard to the models of thinking, learning and decision-making endorsed and amplified by the majority of computer-based activities. While some possibilities for the encouragement of the type of open-ended activity commonly described as 'creative' do exist, the most prevalent mode of use is related to the achievement of a predetermined product, through the application of step-by-step logic to a perceived 'problem'. In such circumstances, attributes such as accuracy, speed, efficiency and predictability are valued above such qualities as vagueness or uncertainty of outcome.

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In recent years considerable concern has been voiced by educators in regard to the models of thinking, learning and decision-making endorsed and amplified by the majority of computer-based activities (Bowers 1988, 1991, 1992). The computer is an artefact which is highly consonant with a particular subset of cultural goals and aspirations within our society. As portrayed in the popular media it is most commonly associated with the corporate image of men in suits moving rapidly (generally in upwardly moving elevators) from one decision-making situation to another. It is rare to find the computer associated publicly with the more exploratory or contemplative modes of life.

Such a characterisation of the computer as a 'tool' for the efficient achievement of clearly defined and instrumentally constrained ends may appear to be in conflict with much of the rhetoric of educators concerning this particular model of classroom computing, where the notion of a tool is closely associated with ideas of the empowerment of the individual in the service of personally formulated goals (Taylor 1980). While it can be argued (Bowers 1988, 1992) that such a conception is itself in some conflict both with a number of philosophical positions and with aspects of contemporary educational theory such as that concerning the social construction of knowledge, this may be of less concem than might be feared, since it contrasts significantly with the uses to which the computer is most often put.

In practice, the majority of computing activities in the classroom are curriculum driven and relate to externally imposed goals. The computer is in most cases used by the student to achieve ends largely defined by the teacher. Rarely are children given the opportunity to construct and explore their own subject domains. As I have written elsewhere, 'The computer is a tool for the carpenter rather than the sculptor' (Dowling 1990). While some possibilities for the encouragement of the type of open-ended activity commonly described as 'creative' do exist, the most prevalent mode of use is related to the achievement of a predetermined product through the application of step-by-step logic to a perceived 'problem'. In such circumstances, attributes such as accuracy, speed and predictability are valued above such qualities as vagueness or uncertainty of outcome.

Education is most commonly seen, particularly by those outside it, as concerned for the most part with the imposition of order, logic and discipline upon the chaos of the unschooled mind and upon the undesirable irregularities of life as we experience it. Some time ago I attended a school council meeting at which a number of members were most vocal concerning the point that raffles were a threat to the fundamental ethos of the school. The school was described by one speaker as being 'about order and structure', while raffles were perceived as being antithetical to such values. At around the same time a letter appeared in the local paper deploring the use of choose-your-own-adventure books in school, on the grounds that they appeared to 'endorse a model of decision making ... where decisions are made on the throw of a dice.' The letter continues:

In an increasingly complex society, it is

> surely the role of educators to encourage the young to seek knowledge, acquire understanding, explore options and make decisions based on reason and morality. The model endorsed by (the book in question) represents at best an opting out of responsible decision-making, at worst a retreat into chaos and unreason. Our young people deserve better (Simpson 1989).

Such perceptions of education fit comfortably with most images of computer use, not simply as practised in the commercial world, but equally as reflected in many of the better known projects in the area of artificial intelligence, along with obvious resonances concerning models of the workings of the human mind (Papert 1991). But if the computer has, as is sometimes suggested, a special role to play as a tool *for* the mind, is it necessary and inevitable that it should so conspicuously support one 'side' as it were, of the mind's activity, to the effective exclusion of the other, or others? (Dowling 1986,1990) This is an important issue, since it is increasingly common in contemporary thinking for particular types of activity to be not simply supported but validated by the involvement of computing technology, to the detriment of other modes of thought and action.

The development of alternative models of thinking within the fields of artificial intelligence and cognitive science, particularly in connection with neural networks and emergent behaviour, supports the suggestion that other quite different styles of computer use may be possible, especially in areas where the digital processing and the Cartesian mode of logical thought most commonly associated with computers are not particularly helpful (Papert 1991).

We recognise that not all human endeavour is directed towards the achievement of preconceived goals, and that new ideas, understandings and creations do not necessarily arise from the application of a series of clearly defined logical steps to a piece of existing knowledge. In many instances, in fact, it is from the disordering of customary perceptions and of accepted modes of thought and action that the most prized expressions of ourselves and of our culture stem. A large part of our conscious and perhaps our unconscious existence is devoted not to linear problem solving, but to mental, physical and emotional 'puddling about' — the 'primal ooze', if you like— from which much of what we applaud as creative achievement arises. As Fielden puts it, summarising the views of several writers, 'creativity involves a relaxing of controls and a letting go of rational thought processes.' She contrasts such an approach with traditional concerns of technical education, in particular that concemed with the use of computers, which 'is about refining and perfecting rational thinking' (Fielden 1992).

In discussing some of the implications of what he characterises as the 'new' AI, Papert questions the desirability of limiting our conceptions of thinking and learning to the linear Cartesian model concerned with the step-by-step development of concepts, at a time when, as he puts it, the very concept of a concept is under significant threat. 'Get it right. Be consistent. Be logical. Or ... are these things really restrictions? Do they cramp the spirit of the working of the mind? Do they impede leaming?' (Papert 1991)

If altemative modes of thinking are not afforded the value we would hope for in the classroom, we should recognise the part played by the computer in offering support to an ethos which is largely contrary to such types of activity. Perhaps the most effective means of counteracting this emphasis on the virtues of the immediately instrumental, the logical, the digital in our thinking is to enlist the computer itself as member of our team. Is this possible, and to what extent?

One might argue that the extensive use of graphics and word processing packages and to a growing extent hyper- and multimedia software in the classroom points to a well established base of open-ended, creative uses of computers. While clearly this is so in some cases, I would suggest that the details of how these programs are used most commonly reveal a number of restrictive practices. In the case of word processing, for example, even in cases where the computer is used as a tool for composition rather than as an up-market typewriter, the act of writing is set about with regulations pertaining to choice of topic, the number and manner of drafts undertaken, the format and language which is acceptable within particular established genres, the degree of 'complexity' of sentences deemed to be desirable, and so on. The teaching of writing as facilitated by the computer results all too often in a lively and individual piece of expression being transfommed into blandly acceptable prose whose dreary unifomity is reflected in the over-conventionalised appearance of the hard copy.

What else could we be doing with computers? In his introduction to Silverman's *The Phantom Fishtank* (1987), a series of provocative 'game of life' programs designed for educational use, Papert writes: '... a whole software industry is committed to the idea that programmers will make computers do what they are told — no more and no less. But there are times when the thrill comes from the computer doing something that one did not anticipate and perhaps could not have imagined even if one has tried. The excitement is not what was specified but in what emerges' (Papert 1987). As mentioned earlier, this is a theme upon which he has expanded more recently in connection with the new images of thinking, learning and computing associated with changing emphases in artificial intelligence research.

Potential classroom applications of such an approach are exemplified by the work of Resnick in creating and exploring computing environments for children based on a decentralised model of computation and of behaviour (Resnick 1991). Here we recognise some of the ways of thinking which characterise the work of chaos theorists, and which are familiar to many computer-using teachers and to a number of students within this context. The relation of randomness to order, the significance of small changes to the configuration of the whole, the degree of complexity which can emerge from a few simple rules and, very importantly,

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an acceptance of the principle of unpredictability in any sense that we currently understand it, are some of the elements of this way of looking at the world.

In his writing Resnick is careful to point out that what he terms a 'decentralized mindset' is not to be regarded as appropriate or desirable in all situations, but it is certainly encouraging to see such altemative modes of thinking and of computing set against those assumptions which have until now gone largely unchallenged, regarding the 'proper' uses of the mind and of computers.

On more familiar ground, in Australia as elsewhere there is a well established tradition of Logo being used in an open-ended, exploratory way, in contrast to the teaching of programming in the interests of more traditional forms of problem solving. Such an approach is reflected in Wills' phrase, 'Doodle, Design, Debug' (1985). A similar emphasis permeates Nevile and Dowling's *Let's Talk Apple Turtle* and succeeding books, in which a string of Logo commands typed without initial regard to details of the outcome forms the starting point for all activities.

The work of Idit Harel (Harel & Papert 1991) conceming chidren as software designers, an account of which was presented at WCCE '90 in Sydney, is of particular interest in relation to the emphasis placed on the degree of choice given to the students in developing and articulating their own goals, and the means by which they achieve them. While the emphasis on design within the context of theories of constructionism as espoused by those connected with the MIT Media Laboratory (Harel & Papert 1991) resonates in many respects with current popularity of the term within Australian educational circles, particularly in relation to technology education, there are interesting differences, particularly in regard to the requirement which often seems to be assumed, that design activity be judged in terms of practical outcomes.

While the requirement that a product have meaning in terms of its cultural context is often cited as one of the criteria for a 'creative' act to be accepted as such, it is by no means the case that perceived utility and functionality are necessary pre-requisites for such an acknowledgement. Such a bias is evident within classroom computing when the philosophy of 'debugging' is put at the service of getting programs, however mundane, to 'work', rather than encouraging exploratory modifications which might possibly lead to new and quite unexpected insights and outcomes. Deplanning, or flexibility of goals is frequently discussed as though it reflects a disability on the part of the learner, rather than being a positive attribute which can often lead to more original, complex, even more appropriate results than those suggested by the initial goal or concept. The element of surprise is too rarely extolled in educational circles for its capacity to provoke deep and sustained thought and creative enterprise.

The computer as a cultural icon of considerable power has the capacity, through its tacit validation of selected models of perception, and thought, to set our minds in concrete. It can be the supreme vehicle for the consolidation and preservation of a particular set of attitudes and values, perhaps most notably in relation to what might be termed instrumentalist modes of interaction with the world. It is therefore important that we devote serious attention to the possibility of encouraging altemative types of computing, particularly in the classroom, since we might reasonably expect that the image of the computer which children encounter during their years of schooling is likely to strongly influence the use they make of the technology in later life. Left-handed computing might be a minority activity, but it may well turn out to be significant in maintaining a balance within our culture between alternative ways of thinking and doing.

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