he question of software portability, assumptions about how thinking is based on data, and claims about the emergent Information Age which make computers appear as essential to survival, all relate to how we understand the nature of language and its relationship to the process of thinking. The special issue on educational software portability, published by the Journal of research on computing in education (Winter, 1991), suggests that some of the leading thinkers in the field are beginning to take seriously an observation made by Seymour Papert that 'the educator must be an anthropologist'. The authors in this issue of JRCE touch on issues ranging from how cognitive style varies among cultural groups to the differences between oral and written discourse. One author, M. A. Murray-Lasso, even goes so far as to claim, rightly from my point of view, that 'the personal computer reflects the individualistic values of the United States, which developed it, and the dominance of personally oriented, interactive software confirms it'. (1990, p. 260) His statement would be more correct if he had identified Cartesian thinking (which is the dominant orientation in a number of countries who share this European epistemological tradition) as the source of individualistic values and thinking. Aside from the problem of getting the genealogy correct, Murray-Lasso and the other authors addressing the problem of software portability, including Marilyn Fleer (who wrote a fascinating article on 'Reflecting indigenous culture in educational software' (1989) are on the right track. 

The thinking that will continue to obscure fundamental questions relating to the language (culture) – thought connection is reflected in Papert's argument that 'learning consists of building up a set of materials and tools that one can handle and manipulate', and that 'when knowledge can be broken into “mind-size bites”, it is more communicable, more assimilable, and simply constructable.' (1980, p. 171, p. 173) This view of thinking as an individualistic activity, facilitated by the ready availability of data (information) still dominates textbooks and journal articles within the field of educational computing. Witness the statement by Lynne Anderson-Imman in a recent issue of The computing teacher: 'Information organisers are tools for helping students manipulate what they are learning into a structure that is personally meaningful.' Computer-based information, she goes on to claim, provides the ‘skill for the Information Age.' (1991, p. 41)

Because it appears the field of educational computing is still largely concerned with technical questions relating to classroom implementation, and takes for granted the Cartesian view of the culturally-autonomous individual who uses data as the basis for constructing ideas, it is necessary to challenge more directly the assumptions that computers are neutral tools manipulated by individuals, that thought is individualistic and based upon data, and that language is a neutral conduit that allows data to be communicated via computers between individuals. As we obtain a better understanding of why these assumptions are incorrect, the issues that must be addressed by both developers of educational software and classroom teachers who oversee the use of computers in the cultural-transmission process will come more fully into view.

As I explain in The cultural dimensions of educational computing, a technology is not a neutral device that individuals manipulate entirely for their own purposes. As can be seen in the case of a stick that allows a person's reach to be extended yet eliminates the physical sense of touch; technologies mediate the intersubjective experience of the individual. That is, the characteristics of the technology select certain aspects of experience for amplification, while reducing others. The telephone, for example, amplifies human voice over distance, but eliminates from the communication process many of the contextual cues like the use of space and body language that are essential aspects of face-to-face communication.

To take a third example, the automobile amplifies our ability to move rapidly through space while reducing the more complex sensory forms of awareness that are part of the experience of walking.

The amplification and reduction characteristics of technology must also be understood in terms of the assumptions and values that are part of the natural attitude of the cultural group.

When we begin to consider the amplification characteristics of educational computing, the complexity of the mediation process quickly becomes apparent. In some areas of the learning process the computer may strengthen attributes of students by providing for storage, accurate recovery, and efficient manipulation of data in a manner that exceeds their natural capacity. Use of the computer to simulate certain phenomena, like the forming of continents and a chemical reaction, may be visually speeded up

transmission process in another way that deserves mention. Although most of the student's cultural knowledge is contextual, tacit, and serves as the analogues for making sense of and acting in new situations (like the patterns of non-verbal communication, writing from left to right, using conceptual categories that organise experience into shared cultural patterns, and so forth) computers amplify those forms of knowledge that can be made explicit. Tacit knowledge, and the historical aspects of explicit knowledge (what appears on the student's monitor) are not acknowledged, and thus are relegated to the realm of the unimportant. Yet, a case can be made that students need to be aware that many traditions of their cultural group are learned and experienced at this tacit, taken-for-granted level — and that this form of knowledge can be both a source of community and personal empowerment, and also the underlying cause of many of our social and environmental problems.

The second problematic aspect of how the use of the computer mediates which personal and cultural aspects of experience come to-gether as an individual life relates more directly to the language—thought connection -- particularly how the student is socialised to understand this connection. In addition to identifying how educational computing amplifies the Cartesian orientation of Western cultures, the computer must also be understood, in terms of its present state of technological development, as amplifying a 'conduit' view of language. Briefly, a conduit view of language is assumed when people make reference to getting their ideas across to others, to putting more meaning or information into statements, and (perhaps most importantly) to the factual nature of statements — which suggests that words stand for or represent real events and objects in the world. Although this view of language can more accurately be traced back to John Locke than to Rene Descartes, it is still an essential aspect of the Cartesian mind-set that computers amplify.

The implications of understanding both language and thought as essentially metaphorical were also dealt with.)

The metaphorical images encoded at the deepest level of a cultural group's symbolic world (embodied in stories of origins, evocative-culture forming experiences like our fascination with machines, etc.) and frame the process of analogic thinking. For example, a cultural group whose master metaphor represents life as organic and interdependent would not likely use a mechanistically-based schema of understanding in the process of analogic thinking, as is reflected in our tendency to think of organic processes in terms of 'functions', 'systems' and 'efficiency' — which reflect the master metaphor of a mechanistic universe that still influences thinking in the West.
Out of the process of analogic thinking emerge, over time, the taken-for-granted images or schema of understanding. To put it another way, words and phrases like 'individualism', 'technology', 'intelligence testing', 'natural resources', and so forth, are iconic metaphors that encode the thought process of an earlier and successful stage of analogic thinking; that is, the earlier process of analogic thinking (like working out how to 'measure' intelligence) provides the basis for a taken-for-granted way of understanding. Later, it may be challenged as inadequate for understanding more recent cultural developments, and the process of analogic thinking will eventually lead to a new image or schema being encoded in the iconic metaphor. We can see this re-encoding process in how the word 'individual', as a metaphor, has been associated at different times in Western history with being a subject, a citizen, self-expression, and now complete autonomy.

The problem with the conduit view of language amplified through the use of educational software programs is that it reinforces a false sense of literalness. When words are understood as representing an unmediated reality—like the example of the software program that represents European immigrants making their way along the Oregon trail as 'pioneers', and the people attacking them as 'bandits',—students will be more susceptible to indoctrination. Whose pattern of thinking and political interests are encoded in the metaphors 'pioneer' and 'bandit' or to take an entirely different example, whose thought patterns are encoded in the phrases 'Far East' and 'Down Under'? Most students will not understand how the mental/cultural processes encoded in the language influences their thinking. Nor are they likely to be aware that language encodes the epistemic patterns of a cultural group. As an example of this is the observation of Jamake Highwater, whose roots are in culture of the Blackfeet Indians, that speakers of English use words to construct a view of reality very different from that of Native Americans. Whereas the Native American wants to spell 'Earth' with a capital 'E' to communicate its spiritual significance, the two English synonyms for their way of understanding Earth are 'soil' and 'dirt' which are used to describe uncleanness (1981, p. 5).

There is another consequence of using a language desensitising technology in educational settings that relates directly to the ecological crisis. To put the problem in its most succinct form, the schemata of understanding constituted through the process of being socialised to the metaphorical thinking of a cultural group influences how critical relationships (such as how humans relate to the rest of the biotic community) are understood. Stated somewhat differently, language and the individual's lifeworld (which includes both culture and bioregion) can be understood, in Gregory Bateson's terms, as a relationship between map and territory. Language, like a map, may not always take account of the most important features of the territory, and it may become outdated and even jeopardise the safety of unwary people who rely upon it as a guide.

If educational computing simply reinforces the cultural myths surrounding a conduit view of language, which includes the current hype about computers saving us from the potential chaos of the 'Information Age', then it may actually be strengthening an aspect of culture that is part of the ecological problem.

As we begin to recognize how English encodes the thought patterns of earlier times when the environment was viewed as a threat to survival (and thus to be subdued and conquered) and more recently, as a natural resource to be exploited (and now 'managed' on a sustainable basis), we can see that one of the most formidable and important educational challenges is to help sensitise students to how language influences the thought patterns that relate most directly to the ecological crises: how we think about individualism (Is it understood as dependent upon the information and energy webs that make up the natural systems that sustain life?); technology (Is it viewed somewhat paradoxically as a neutral tool that serves human purposes and as a basis of progress?); progress (Is progress as we understand it compatible with degrading the habitat?) and so forth. As language has to do with conceptual maps, the most critical question facing educators (including the advocates of using computers for educational purposes) is whether students are being encouraged to understand the connection between their own language, the cultural history it encodes, and the ecological crisis. If educational computing simply reinforces the cultural myths surrounding a conduit view of language, which includes the current hype about computers saving us from the potential chaos of the 'Information Age', then it may actually be strengthening an aspect of culture that is part of the ecological problem.

The third major problem relates to how computers amplify the cultural myth of the autonomous individual. The other amplification characteristics of computer technology (the epistemological orientation of knower as spectator and manipulator of the external world, the view of technology as neutral tool that serves the purpose of the individual, and the sender-receiver view of language) help to reinforce the student's self-image as an autonomous individual. There is also a vast literature dealing with the classroom uses of the computer that helps to frame how teachers and software developers view the thought processes of the student. This literature, as we have seen in the statements by Anderson-Anman and Papert, represents the student as an individual who utilizes data as the basis of making rational (that is, culturally autonomous) judgments.

This view of the individual fits nicely with the liberal myth that fuses rational self-direction with social progress. But it is a myth that is increasingly difficult to defend. The earlier discussion of the tacit nature of most of our cultural knowledge, as well as the argument that language encodes the metaphorical thinking of past generations that helps to provide the current schemata for understanding (that is, language thinks us as we think within the language), represents a fundamental challenge to those who want to associate thought with the internal mental processes of the 'individual'. A stronger case, as well as a more politically relevant one, can be made that the student gives individualized expression to shared cultural (and linguistic) patterns. This also applies to the person who writes the software program, and reproduces (as is the case in the Carmen San Diego program) a specific cultural orientation toward working 'efficiently', viewing 'time as valuable', and relying upon data as the basis of decision making.

The implications of a cultural view of the 'individual' for software
portability are enormous and complex. But even the image of the 'individual' as a cultural being may be inadequate, primarily because within the context of Eurocentric cultures it retains the myth of the anthropocentric universe. That is, it retains the way of understanding that represents humans as rationally superior, and thus as separate from the rest of the biotic community.

Within the tradition of Western thinkers, Gregory Bateson (1904–80) provides a way of shifting attention from the individual as the basic unit of mental activity to the larger ecology of which the individual is an interactive member (and whose fate is bound together with that of the larger ecology). Bateson separates himself from the Cartesian epistemology that characterises the field of educational computing by suggesting that in the relationships and patterns of living systems can be found the information exchanges that collectively characterise the mental ecology of the entire system. Instead of the Cartesian view, which represents the individual as thinking about the external world, acting upon it, or observing it as a source of information, Bateson focuses upon what happens within the interactions that collectively constitute the dynamics (or life) of the entire system. This emphasis on the information exchanges that occur in relationships points to the individual and the other (which may be anything that creates a 'difference that makes a difference') acting together as the source of mental activity. The following statement may help clarify how Bateson views the individual as always part of a larger ecology. Bateson writes:

'The total self-corrective unit which processes information, or as I say, 'thinks' and 'acts' and 'decides', is a system whose boundaries do not at all coincide either with the body or of what is popularly called the 'self' or 'consciousness...' (1972, p. 319)

The clearest examples of this process of knowing as an ongoing transaction within a system of relationships is his account of a person felling a tree with an axe (it is also a good example of how the non-human aspects of a system may be understood as part of a mental process). The following is Bateson's way of understanding of how humans participate in the information pathways that operate as cybernetic circuits: 'Each stroke of the axe is modified or corrected, according to the shape of the cut face of the tree left by the previous stroke. This self-corrective (i.e. mental) process is brought about by a total system, tree-eyes-brain-muscles-axe-stroke-tree; and it is this total system that has the characteristics of immanent mind. More correctly, we should spell the matter out as: (differences in tree) — (differences in retina) — (differences in brain) — (differences in muscles) — (differences in movement of axe). What is transmitted around the circuit is transforms of differences. And as noted above, a difference which makes a difference is an idea or unit of information.' (1972, pp. 317–8)

Bateson's distinction between map and territory, and his arguments that our conceptual maps are largely metaphorical constructions of the culture, are critical to recognizing that humans make sense of the 'difference that makes a difference' in a very different way than other elements an ecology. How Bateson's ideas relate to understanding the classroom as an ecology of cultural and linguistic patterns has been worked out in the book, Responsive teaching (which I co-authored with David Flinders). Bateson's writings contain numerous warnings about the danger of metaphorically-based maps causing us to misunderstand the nature of the territory (i.e. our impact on the environment). By bringing humans and the environment together in the sense that 'the mental characteristics of the system are immanent, not in some part, but in the system as a whole' (p. 316), Bateson is challenging us to recognise the survival of humans is impossible without the survival of the larger eco-system upon which they are dependent.

The shift away from the anthropocentric/Cartesian mind set will require fundamental cultural changes — including changes in the educational/cultural transmission process. Instead of reinforcing the old cultural episteme of objective data, de-contextualised thinking, a technicist orientation to problem solving (all cultural characteristics reinforced through educational computing) we will have to shift to new (actually, ancient) master metaphors that represent humans as interdependent with the rest of the biotic community. This will have implications for re-connecting a sense of moral responsibility to our forms of knowledge, particularly our technological knowledge. We will also need to incorporate in the educational process a different way of understanding place (the bioregion), including a knowledge of its past, essential relationships and condition, and future possibilities. Another change we will have to consider is shifting from valuing highly experimental and individualistic forms of knowledge to preserving ways of knowing, technological skills, and relationships that are ecologically sustainable over the long term. If we take an honest look at the diverging trendlines, where cultural demands and population growth are shooting upward while trendlines relating to the viability of natural systems are in sharp decline, we will have to face up to the fact that the content of educational software is not helping students understand the deep cultural dimensions of the crisis, and that the cultural orientation reinforced by the amplification characteristics of the technology (including the software) are part of the Cartesian mind set that is deepening the crisis.

While the need to bring about fundamental changes in the cultural/educational practices seems compelling, given the scale of environmental disruption we are now witnessing, I am not arguing for the elimination of computers from the classroom. Rather the challenge is to bring about basic changes in educational software, and to educate teachers to their responsibilities for helping students recognise the cultural amplification/reduction characteristics of the technology.

References


