Playing With the Planet: Environmental Education and Entertainment Software

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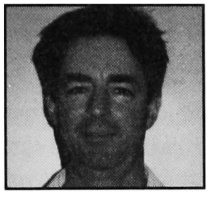

A B S T R A C T

A genre of computer software with which users simulate designing and managing natural resources and ecosystems deserves critical attention from environmental educators. Such software encourages users to develop their understanding of theoretical and applied ecology by manipulating virtual environmental forces in imaginative ways. This paper refers readers to a directory of software titles in this genre. It argues that there is significant social and educational momentum toward increased use of such resources for teaching and learning about the environment. It presents some reservations about the nature and purpose of this genre of software, and outlines ethical, economic and experiential questions about it which have implications for the future direction of environmental education.

From Animal Quest to Zurk's Rainforest Lab, many interactive software products are now available for users from pre-school to professional, products whose common aim is to stimulate creative thinking about the environment by providing engaging ways to study ecological processes. Their producers may be commercial organisations, educational projects, or individual enthusiasts. The experiences they offer are described variously as educational or entertaining or both, and the software interfaces they employ range from utilitarian graphical displays to multimedia fantasy worlds. All characteristically offer options—to compete against the forces of nature, assume and play out roles, or invent and unleash scenarios—which invite users to experiment in a virtual biosphere.

A descriptive listing of such software titles, called Ecosim, has now been compiled on the World Wide Web. This directory is intended to draw the attention of educators and students to the range of software currently available, to indicate the variety of approaches being used in designing environmental simulations using interactive multimedia, and to provide a basis for reflection on movements toward 'cyberstudy' in environmental education. Details and some images of approximately 100 software titles including those mentioned in this paper, can be found at this Web site.

Does the emergence of this genre of software advance environmental education? An ironic and intriguing definition of 'advancement' is suggested by Whitaker (1995):

> *What were once boring stretches of 'nature' can be repackaged to bring out their full recreation potential. Mixed media presentations featuring high-definition films and wraparound dioramas with multitrack audio accompaniment,...[and] scientific sound bites backed by appropriate bars of music, will prime the public to experience biodiversity to the fullest... Most people will get a lot more education out of the 'bio-world experience' than they ever did out of nature in the raw.*

Such a vision implies that this genre of software has the potential to improve our understanding, behaviour and enjoyment in relation to the natural environment. Indeed, developments in society, in education systems and in the practice of environmental education itself have created a climate congenial toward the possibilities of increasing use of such software; these developments are discussed in the next part of this paper. At the same time, the rate at which new software titles are being created and sampled has outstripped critical reflection about the educational effects of heightened reliance on computer-simulated experiences; the subsequent section of this paper outlines some germane observations about media and multimedia. Environmental education may lead in various possible directions in the future, depending upon how educational theory comes to shape the new educational media, and vice versa; this paper concludes with some questions for future research raised by two very dissimilar visions of the educational potential of simulation software.

Social and educational momentum

Computer technology now offers many citizens in consumer societies new forms of entertainment in which

https://doi.org/10.1017/S0814062600004158 Published online by Cambridge University Press

are embedded skill-based and conceptual learning experiences. The integration of multimedia and networking technologies with educational theory and practice in the past decade has led to the emergence of innovative learning situations, which require compatible learning resources. In the field of environmental education, certain elements in the established repertoire of teaching and learning may have found their logical extension in the emergence of a genre of software for playing with the planet.

Social change

It is increasingly likely that citizens will be somewhere between occasional recreational computer users and addicted ones. Recent information industry data for Australia (Slattery 1995) indicate that:

> *Today, about 40 percent of Australian households own personal computers, while 9 percent own a CD-ROM and 7 percent are on the Internet...The numbers are rising fast, with computers expected in 47 percent of homes by next year. At this rate they will be near[ly] universal here within five years. Of the 40 percent of households with computers, however, the latest Keig Report on New Media and Technology found that 60 percent use them for games. Asked what were the main uses of the home computer, 46 percent listed entertainment.*

This kind of leisure activity may be creating a citizenry with a new common denominator of general abilities: among the characteristics cultivated in games afficionados are strategic thinking, extensive knowledge of the subject domain of choice, and sophisticated information retrieval skills, as illustrated in this excerpt from a players' manual for the game Millennium: Return to Earth (1991):

> *On the right side of the screen—under the category 'Kg/Day'—are the minerals that can be mined on the specific planet or moon. The numbers under this category represent amounts of the specific minerals, in kilograms, that can be mined in one day. The numbers that appear under the Stock category represent the amount of specific minerals—in kilograms—that are stockpiled on the planet or moon. You must establish colonies on other planets and moons in order to mine all of the minerals you need to progress through the game. Minerals are used to construct every item or piece of equipment you require. You may also acquire minerals by mining asteroids.*

At the same time, many people are becoming accustomed to more and more elaborate computer-mediated recreational experiences, as new electronic playgrounds open up beyond the bounds of the personal computer or the games arcade in the mall. Computer networks now enable players to interact with each other in long-running events such as the World Game, originally devised by Buckminster Fuller, or in unfolding scenarios such as the Rainforest MUD (multi-user dungeon). Within the electronic entertainment industry, products which fuse the narrative of films, the networking of telephones and the fuzzy logic of artificial intelligence claim to offer "entire worlds of linked experiences that unroll in intervals of personal discovery and connection, virtual Plato's Caves for exploration, engagement and reflection" (Leary 1996).

Educational change

The social trend toward such activities has influenced educational approaches to the media, methods and modes of teaching and learning. Conventional educational media—'chalk and talk', textbooks, videos, laboratory manuals and field notes, for instance—are being complemented or replaced by interactive multimedia learning activities, such as this one offered in the Shareware Software Catalogue (1995) description of the edutainment product Animal Quest:

> *A game that lets you step into the wonderful world of nature and experience wildlife through very different eyes. Select what animal you [would] like to become and then discover your prey, be challenged by your predators and outsmart your competitors as you try to cross the Forest, collecting Energy tokens.*

Underlying the development of these educational resources, too, are new theories of education which challenge traditional classroom methods—as illustrated in Louden and Wallace's (1994) case study of a teacher grappling with what they term the "constructivist paradox", trying to collaborate with students in the exploration of knowledge, and to create situations where students could have opportunities to frame their own questions and build their own understanding. Interactive multimedia simulations may facilitate these new classroom dynamics; for example, the producers of the software Investigating Lake Iluka explicitly addressed the task of designing a constructivist learning environment for biology (Harper et al. 1992). An even more open-ended version of simulation software, based on playing with Logo-programmable Lego bricks which allow students' metacognitive skills to emerge from learning-by-simulated-doing; students using this system could design and observe artificial life forms, as a way of gaining insight into the behaviour of complex ecosystems (Levy 1992).

Moreover in the era of the 'information firehose', the 'electronic superhighway' and the 'virtual university', the educational tradition of convening groups at dedicated sites according to fixed timetables in order to progress sequentially through a curriculum is predicted to become obsolete or at least less commonplace than new modes of education. Even now routine collaborators may be geographically dispersed, databases and competency specifications can be accessed on demand, and providers of educational resources and certification compete for

https://doi.org/10.1017/S0814062600004158 Published online by Cambridge University Press

customers in an international marketplace; respective examples are the Kidlink Gopher linking schoolchildren in a global dialogue about the future of the planet, the US National Institute for the Environment's major reference collection on-line and Carnegie Mellon University's global promotion of its Green Engineering and Management program for business people.

The practice of environmental education

As distinct from broad social and educational momentum, there are also particular features of environmental education that have given impetus to the emergence of the genre of software under consideration, including the nature of its curricula, the methodology of its foundation disciplines, and pre-existing methods and media of teaching and learning.

Environmental education has been formally recognised only since the 1970s, and sets out as its principal objective to develop not only knowledge and skills, but also personal commitment and social action (Hunter & Keyt 1995). The discipline of ecology on which it is in part founded has broadened in scope since its origins just over a century ago from a minor branch of biology into an integrative discipline linking biological, physical and social sciences (Bramwell 1989, Odum 1975).

These factors have given rise to relatively new and ambitious curricula compared to some other subject areas which may be especially compatible with the similarly new and ambitious educational experiences offered by interactive multimedia. This view is substantiated in a recent review of technology in tertiary education which considered the use of complex computer-based simulations to be essential in fields from modern meteorology to the study of emergent behaviour in complex systems (Tinkler et al. 1994).

Furthermore, using simulations in the foundation discipline of ecology is an established methodology; Hall and Day (1977) reviewed the general principles which have guided such activity, and described many models conceived in a more rudimentary computing environment than today's to assist the understanding natural systems, assess environmental impacts, and design optimal human-environment interactions. Kingsland (1995) summarised the view that advances in computing technology have enabled progress in the methodology of ecological simulation:

> *because we could build better machines, in the form of more powerful and sophisticated computers, scientists were now in a position to appreciate nature "as it really is" and construct, via the machine, a more realistic, less deterministic, and more historically sensitive account.*

James Lovelock's Gaia hypothesis, which seeks to explain the planet as a single system regulated by its life forms, is perhaps the most familiar example of a theoretical model which has been translated into computer simulations not only for ecological research, but also for education and entertainment, in the form of the SimEarth software (Bremer 1993).

Precursors to the genre of software in question may be found in environmental education's methods and media, as well. First, playing games is not new in the methodology of environmental education; participation in non-computerised simulations is widely regarded as an effective way to develop higher order thinking skills. A general discussion of how role playing as an educational method meshes with environmental education theory is found in Errington (1991). One long standing example of this method is the *Commons Game*, based on Garrett Hardin's description of the commons dilemma, which has been used to teach students how unowned resources such as the atmosphere or the oceans may be overexploited (Powers 1985). Second, environmental educators rely substantially on audiovisual resources, and credit film and television media with the ability to activate environmental change (Gellhorn 1991). Natural history documentary videos, such as Attenborough's *Trials of Life*, Parer and Parer's *Nature of Australia* and Suzuki's *A Planet for the Taking*, epitomise the educational resources commonly used to present conservation issues (Hooks 1995).

Reservations about media and multimedia

From the preceding observations about developments in society, education in general and environmental education in particular it might seem desirable and inevitable that the software for playing with the planet will be increasingly used for education and entertainment. However other more reserved attitudes to this phenomenon are discernible in the ideas of several commentators on media technologies.

Digital imagery

Misgivings about understanding the natural environment through audiovisual mass media are associated in part with a broad discussion about truth in contemporary science imagery. In this discussion, enthusiasm about the power and sophistication of computerised design tools is tempered by critical judgements about matters of substance, such as context, narration, sound, authority and viewpoint of presentation, editing, and the reliability and amount of underlying data (Kallick 1994). For instance, the editorial ethics of using digitally altered images to illustrate scientific reports about wildlife conservation have been the subject of recent comment in this vein (Borland 1996).

Television

Commentators on the social impacts of television have also contributed pertinent observations. Mander (1991), for example, discussed the subjugation of environmental realities to televisual ones throughout the modern world. There is concern that society is coming to regard the media industry's planetary flow of electronic data as a substitute for ecological energy flows, resulting in a false sense of

assurance that all's right with the world. This is the view of McKibben (1993):

> *It worries me because it alters perception. TV, and the culture it anchors, masks and drowns out the subtle and vital information that contact with the real world once provided. There are lessons—small lessons, enormous lessons, lessons that may be crucial to the planet's persistence as a green and diverse place and also the happiness of its inhabitants—that nature teaches and TV can't. Subversive ideas, about how much you need, or what comfort is, or beauty, or time, that you can learn from the one great logoless channel and not the hundred noisy ones or even the pay-per-view.*

More specifically the television nature show has been criticised for its anthropomorphic representation of non-human life which may have the effect of confusing genuine sensibility (Siebert 1993):

> *I'm thinking in particular of my walks in the woods, how they begin with such a deep sense of disappointment not so much in, but from, my surroundings. It's a disappointment rooted in the disparity between the ways in which we now represent nature to ourselves and the way it actually is; between that flitting, omniscient, nature-show overview delivering me from one available arcane wonder to the next, and the plodding, myopic bulk of me within such a mute and long-lived presence.*

The Voyage of the Mimi project offers an example that connects such mass media criticisms with considerations of interactive multimedia simulations. This software is directly descended from a mid-1980s educational television-cum-computing concept of the same name, which Postman (1985) concluded "was conceived by someone's asking the question 'What is television good for?', not 'What is education good for?' ". This genre of software has been used also to illustrate the phenomenon of popular consciousness shifting focus from existing mass media into cyberspace where the possibilities of playing with the planet are characterised by Slouka (1995) as an assault on identity, place, community and reality.

Future directions for environmental education

The commentators just presented claim that mainstream media portrayals manipulate nature and succumb to the imperative to use it as fodder for entertainment. They imply at least that the current state of the art of capturing ecological processes in multimedia has not quite got it right, and possibly that the application of our finest multimedia design arts may never advance higher order thinking about ecology. They further suggest that there may be some fundamental incompatibility between the desire to simulate the natural world and the intention to negotiate a sustainable life within it, and that engagement with virtual ecosystems can be only escapist, not enlightening.

Such reservations about this genre of software pose a counterfoil to more optimistic ideas about what it may have to offer environmental education. The latter are outlined here, and used to indicate some of the research that is required to develop a framework for understanding how this software, increasingly available and increasingly used, may debase, enhance, or otherwise change environmental education in future.

The promise of simulation technology

The technological direction of simulation design is toward virtual learning systems, which promise learning that engages different types of intelligence, heightened realism in a wealth of otherwise impossible learning experiences, and an environment which is secure and motivating, as summarised, for example, in McLellan (1994). Many educators believe that interactive multimedia simulations accord well with new educational theories; they regard them as a catalyst to creative thinking and a way of replacing instructivist approaches with constructivist ones. (Rieber 1992) exemplifies educators who have used environmental simulations in support of this argument. Environmental educators Rohwedder and Alm (1994) assert that "environmental multimedia offers the potential for true 'whole systems learning'—mirroring the whole systems of mind and planet".

Questions for research

Many research questions of relevance to the genre of software under discussion may be raised by critical assessment, of the kind offered by Senese (1995), of the design and use of simulations in society, science and education generally. Further, many research questions related to this genre may arise out of close consideration, such as that given by Robottom and Hart (1993), to diverse epistemological and ideological orientations within environmental education as a whole. Such research questions are beyond the scope of this paper. However, from three problems flagged by Rohwedder and Alm (1994) concerning the use of interactive multimedia and on-line learning—equity, economics and experience—it is possible to map some general directions for research. Related research is now underway in connection with the Ecosim project described earlier.

One research question centres on equity. Despite predictions that everyone everywhere inevitably will be a member of a virtual community, it is naive to dismiss socio-political counter-tendencies which may reinforce existing inequities of access to learning resources, electronic or otherwise. Environmental educators must consider how the sort of decision-making invited by educational software produced for an elite group can accommodate the ecological vantage points of dissident or disadvantaged groups, such as environmental refugees or indigenous peoples.

The second research question is an economic one. The

development of high-quality simulation software has an opportunity cost. It requires the investment of talent, time and money that might otherwise be directed to managing real-world environmental resources by other highly educative methods. Environmental educators need to clarify the costs and benefits of cyberstudy, especially considering that real-world environmental remediation and conservation are chronically under-funded. Only a thorough understanding of those educational outcomes which can be achieved through such a medium will be able to refute the criticism that it is an expensive misapplication of technology.

The third research question concerns experience. Experience at a computer workstation is essentially different from field experience, even allowing for convergence of the two as portable laptop machines 'go bush'. Environmental educators must investigate how the interaction embedded in software versions of nature equips learners to 'read', respond to and reflect upon the real thing, and indeed to what extent experience of the technology is an end in itself.

Two scenarios

These research questions are begged in two contrasting scenarios, illustrating how this genre of software and environmental education may coevolve to create very different futures, which conclude this paper. The first is taken from the literature extolling the electronic revolution; the second is paraphrased from remarks overheard at a recent educational technology exhibition.

It is tantalising to think that the genre of software examined in this paper may be a precursor to the ideal digital society promised by visionaries in the multimedia industry (Negroponte 1995):

> *Tomorrow, people of all ages will find a more harmonious continuum in their lives, because, increasingly, the tools to work with and the toys to play with will be the same. There will be a more common palette for love and duty, for self-expression and group work.*

Such a future seems to dovetail with the aims of environmental educators who are trying to shift a generation of students away from the dominant social paradigm toward the values of a conserver society—the two visions share the underlying concept of a gracefully self-regulating holism.

On the other hand, it is dismaying to reflect that enthusiastic support for the genre, which is now emerging from some administrative and funding bodies, may be based on an ideal much less in harmony with the aims of environmental education:

> *When we take our children and grandchildren to science museums and nature study centres, they will enjoy visiting the virtual environment installations to hear the different croaks made by various frog species, to see their camouflage colours, to learn about their diet and so on, even if the frogs themselves are dead and gone.*

This view of the future may galvanise environmental educators to engage much more deeply with the phenomenon of playing with the planet.

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