THE INTERNET IS NOT A PANACEA

TOM CONLON

SYNOPSIS
Technology enthusiasts and politicians have portrayed the Internet in unrealistic and misleading ways which give an inflated impression of its suitability for school education. This paper seeks to redress the balance. It argues that the Internet is not a library, nor a ‘community’, nor a panacea for difficult problems of teaching and learning. To determine the benefits and pitfalls for education will require extensive research and evaluation in which not only the Internet but also its alternatives should be explored. Until this is done, the option of saying no to the Internet is a legitimate one for schools.

INTRODUCTION
The growth of the Internet — and especially of its multimedia arm, the World Wide Web — has been truly phenomenal. In June 1993 the Internet connected approximately 1.3 million computers across the globe and Web sites numbered around 130. By July 1996 the corresponding figures were 12.9 million and 230,000; by January 1997 the Web had grown to 650,000 sites (Scientific American, 1997). In the space of a few years, the Internet which previously had been the province mainly of scientists and engineers has been massively transformed.

Undoubtedly the Internet brings opportunities to education, including (the focus of this paper) school education; but it also presents a new set of problems. Unfortunately, neither the opportunities nor the problems are yet well understood. For example, the National Council for Educational Technology (NCET) points out that: ‘There is no quantitative evidence of the impact and benefits of the Internet on UK education to date.’ (NCET, 1997)

Neither is there much evidence that is qualitative. According to the NCET, less than 1% of all teachers have personal Internet subscriptions and no more than 4% of primary schools have an Internet connection (NCET, 1996b). About 80% of secondary schools have connections but this may mean no more than a single computer (perhaps used for administration) with a modem link. Very few schools currently have the dedicated broadband network connections that are necessary for significant levels of classroom use.

Given this context, the best way forward surely lies through research and carefully planned trials. Unfortunately schools are under pressure to move quickly. Telephone and cable companies, Internet service providers, and hardware and software vendors all regard education as a potentially lucrative source of revenue. Technology enthusiasts and politicians add to the clamour. Schools are vulnerable to such pressure, especially since the creation of an educational ‘marketplace’ has set school against school in a competition to win the support of parents.

In his book ‘Silicon Snake Oil’, Clifford Stoll has provided a sharp critique of the exaggerated claims and distortions that have been made for the Internet in the USA (Stoll, 1995). Unfortunately in the UK critical debate seems hardly yet to have begun whilst the pressure groups have gained enormous momentum. Doubtless a critical and reflective literature will emerge eventually, as has happened in previous phases of technology development in education (e.g. Robins & Webster, 1989; Solomonides & Levidow, 1985; Conlon & Cope, 1989). However, the rate of change in this field is such that if critical analysis is to be able to influence policy, it must begin sooner rather than later.
The aim of this paper is to stimulate such timely critical analysis. I do so by offering a critique of claims that have been made by UK politicians and technology enthusiasts. Specifically, I argue that:

- Politicians and technology enthusiasts have often presented unrealistic images of the Internet.
- In particular, the Internet is not a library.
- Neither is the Internet a ‘community’.
- Neither is the Internet a panacea for problems of teaching and learning.

It hardly needs to be said that although this paper takes a critical line, it does not therefore amount to an argument that the Internet is good for nothing. The scope of this paper is quite limited: it mostly relates to the World Wide Web, and to the published comments of a few individuals. The author’s view in summary is that the Internet is actually quite promising as a resource for teachers but there are good reasons to question its suitability as a resource for children. More importantly, the paper represents a plea for balanced and rigorous evaluation, a process that is not helped by a commitment in advance to simplistic positions.

**IMAGES OF THE INTERNET**

How is the Internet portrayed at present? The NCET begins its account ‘What is the Internet?’ with the following quotation, which it offers without comment:

> The Net is possibly the largest store of information on this planet. Everybody can be part of it; it is one of the few places where race, creed, colour, gender, sexual preference do not prejudice people against others. All this through the magic of modern technology. Communication is the key. People talking to people. The Net isn’t computers. That’s just the way we access it. The Net is people helping each other in a world-wide community. (NCET, 1995)

This is the *Internet-as-utopia*: a virtual paradise in which human imperfections vanish under the benign influence of technology. Sadly, the image of utopia is only too easily dispelled. Racist, violent, and pornographic material is commonplace on the Internet. An investigation by Harold Thimbleby, Professor of Computing Research at Middlesex University, indicated that 47% of the 11,000 most often repeated searches on the World Wide Web were pornographic. Thimbleby concluded: ‘The Internet has been called a global electronic village. If so, most of it is a heavily-used red light district.’ (Thimbleby, 1995)

Other images of the Internet come from politicians. In November 1996 Raymond Robertson, the Scottish Education Minister, announced the creation of a new Superhighways Task Force. Robertson said:

> Make no mistake. New technology is coming fast and it is improving even faster. Its effects are inescapable... we need to monitor the beneficial changes it has so that we can spread good practice throughout our schools. In this way we can begin to shape the classroom of tomorrow. (Robertson, 1996)

Here the images are more mixed. The promise of a better future is combined with a threat: join the bandwagon or be crushed by it. The Internet is equated with educational progress. Acceptance of the technology is to be unconditional and uncritical.

Robertson was speaking at the Scottish Council for Educational Technology (SCET) conference ‘Lifelong Learning in a Wired World’. At the same conference, SCET’s Chief Executive Nigel Paine promised that his organisation would assist
Scotland to become ‘100% wired’ to the Internet during 1997.’ Paine said:

... the best service we can do our young people is to help them leave education at whatever age, not just skilled in a particular subject area, but confident and competent in a technological world. The best thing we can do for our adults is to help them on the first steps towards coping and competing in that world. The point is, we either wake up to what is happening around us, we equip our people to survive in that world or we die, not fast, but slowly the sad economic death of obsolescence. (Paine, 1996)

What images are we offered here? The language is tough, perhaps even Thatcherite. The Internet is presented as the nation’s chance of gaining a competitive edge in the grim struggle that is the global economy. So dire would be the consequences of failure that the very purpose of education must be redefined (inevitably, in technological terms) to ensure our salvation. Paine’s rhetoric is evangelistic, even messianic, as befits one who believes that he holds the key to a life and death struggle.

Of course, these few short extracts can only give a brief flavour of public pronouncements about the Internet. Yet, having read many such statements I believe that they accurately convey some of the recurring images advanced by the UK Internet pressure groups. The Internet is presented as:

• An idealised community;
• The path to educational progress and to ‘the classroom of tomorrow’;
• An unstoppable force: schools have no choice but to accommodate it;
• The key to our future economic prosperity.

I believe that such images are unbalanced and misleading. In the next few sections, I argue against three specific misrepresentations.

THE INTERNET IS NOT A LIBRARY

In their descriptions of the Internet, technology enthusiasts are fond of the metaphor of the Internet-as-library. For example, Nigel Paine tells the Times Educational Supplement: ‘It is like a library with all its books scattered on the floor.’ (TES, 1997)

The metaphor is appealing since libraries are universally respected. However, it is also deeply misleading. The Internet is not a library, not only because of its chaotic organisation but also because it lacks the most essential attribute of a library: books. With exceptions such as the Bible, the Internet has very few books on-line. One reason is financial: the Internet provides no satisfactory method of paying publishers for their work. Another is practical: reading a book from a computer screen is not very pleasant.

What then does the Internet contain? Since the information is given away free, the content leans heavily on advertisers and sales-people of various kinds. Recent figures suggest that around two-thirds of Web sites are commercial (Scientific American, 1997). Also, because anyone with a computer can publish on the Internet, the mad, the sad and the bad are all there. The Web is now the favoured recruitment medium for cults, such as the Heaven’s Gate cult which recently committed mass suicide in the belief that a spaceship hidden behind the Hale-Bopp comet would transport their bodies to paradise (Scotland on Sunday, 1997). Internet users are never more than a dozen keystrokes away from illegal material and the case of three Berwick schoolboys shows that some of this material will find its way to curious youngsters. The boys downloaded details of how to make Molotov cocktails and hallucinogenic drugs, steal by credit card fraud, and use one-handed killing techniques. They tried out the credit card fraud and ended up in court (Scotsman, 1994).
Fortunately, such desperate material is uncommon: a high proportion of Web pages are merely trivial. Michael Fry nicely characterises these pages as:

... rather like teenagers’ bedrooms, a whole mixture of daft things: collages stuck on the wall, naughty things under the bed, No Entry Signs nailed to the door, odd collections that express individuality and the desire to shock and break out. (quoted in Net, 1997)

On the Internet, absence of regulation means (among other things) lack of any form of quality control: a document need not by seen by anyone, other than its author, prior to publication. In contrast, publishers, editors, reviewers, the paying public, and library boards all exercise an influence in determining whether a book will appear on a library shelf. Although the system is not perfect, these mediating influences do ensure that libraries are largely free of illegal, trivial and commercial material.

The Internet does contain high-quality material. The problem is how to find it among the millions of on-line documents. Libraries index their collections according to standard classification schemes, such as the Dewey Decimal system: no such scheme is enforced on the Internet. On the World Wide Web, information can be pursued by ‘surfing’ (the hopeful practice of following links from page to page) or by entering keywords into a search program. Keyword searching is often confounded by the sheer size of the Internet, and by the unreliability of its content: a typical search may produce hundreds or thousands of ‘hits’, without any guarantees about the quality or authenticity of the documents uncovered.

So is the Internet ‘like a library’? Yes, if a library can be imagined which has no librarians and hardly any books; which has an abundance of material that is blatantly deviant, commercial, untruthful, or trivial; where nobody accepts responsibility for what is on the shelves; and without any method of classifying the collection. That’s some library.

THE INTERNET IS NOT A COMMUNITY

The notion (mentioned earlier) of the Internet as ‘people helping each other in a world-wide community’ is not only romantically simplistic, it also misleads in an important sense. The Internet is not a community. At any rate, it is not a community in the meaningful sense described, for example, by Sergiovanni:

...communities are collections of individuals who are bonded together by natural will and who are together bound to a shared set of ideas and ideals. This binding and bonding is tight enough to transform them from a collection of ‘I’s into a collective ‘we’. As a ‘we’ members are part of a tightly knit web of meaningful relationships. (Sergiovanni, 1994)

What are the shared ideas of the Internet’s 100 million users? A common set of electronic communication protocols hardly constitutes a meaningful relationship. One might equally well speak of a ‘national grid community’ or a ‘radio wave community’ as a community of the Internet.

Yet, although the Internet is patently not a community, communities do use it. This is where some interesting questions lie. When a community — say a fishing club, an environmental group, a school — adopts the Internet, do the bonds of that community become stronger or weaker as a result? Would a locally controlled computer network help with community relationships more than a global one, like the Internet? Who influences the community in choosing its technology, and with what motives?

Unfortunately, there seem to be no studies of school communities which can answer such questions in the context of education. However, studies of the
introduction of new technology into Scottish industry reveal that the management objectives behind change are the product of complex strategic choice, but issues related to power and control are often to the fore (McLoughlin & Clark, 1995). It would be naive not to expect such issues to arise also in education, and indeed they are already discernible in the speeches of ministers and policy makers, as the following quotations show:

But not just business can benefit from the Information Age. Far from it. Education is a very important area too. The Superhighways for Education Initiative has been launched, and my own department is running Schools on-line, a pilot project involving 60 schools and over 150 teachers with 18 sponsoring companies. This project is exploring how to use the resources of the Internet to deliver the National Curriculum. (Taylor, 1996)

In schools in the longer term we may see an overall decline in the numbers of teachers to pupils in favour of more adults with different skills, such as network technicians for instance or resource managers/librarians. The trend could be towards fewer, but more highly IT qualified teachers managing the work of other skilled adults involved in the learning process. (NCET, 1996a)

Thus, behind choices that may seem to be merely technological there lie visions — contestable, ideologically inspired visions — of how schools should change, and under whose power and control. The Internet is not inevitably an empowering force. It will hardly be perceived as such by teachers if, having already learned to be wary of a centrally controlled curriculum, they are now told to give up their jobs in order that ‘network technicians’ can deliver it more efficiently.

Relationships between males and females may also be affected by the Internet. Dale Spender, a feminist writer who has conducted a study of this subject, reports that females on-line are outnumbered twenty to one by males. Furthermore, the Internet provides an anonymity which seems to encourage abusive and coercive sexist behaviour. Spender writes:

The studies that have been done on communication on the net make it clear that it’s more a male monologue than a mixed-sex conversation. The discourse is male; the style is adversarial. The premises are winning or losing. Despite the enormous potential of the net to be a network — to promote egalitarian, cooperative communication exchanges — the virtual reality is one where aggression, intimidation and macho-mode prevail. As some perceptive researchers have noted, the behaviour is not so different from that of aggressive men behind the wheel of the car on the road. (Spender, 1995)

Spender quotes numerous examples of sexual harassment — and worse — on the Internet. She recommends that women adopt a gender neutral name, or a male pseudonym, ‘…simply to avoid some of the hassle… any blatant feminine names that are out there (such as ‘Marilyn’) probably belong to men in drag’. (Ibid, p. 245)

It is of course sad that such a tactic should be thought necessary; clearly it underlines the need for caution in proposals for children’s use of the Internet. Yet there is no echo of this in, for example, the recent recommendation of Tony Blair’s IT inquiry group that all children aged nine and above should be given personal electronic mail accounts on the Internet (Stevenson, 1997).

Can any characterisation of the Internet be wider from the mark than ‘world-wide community’? Unfortunately, yes. A new Scottish course on the Internet aimed at 16–18 year olds tells teachers: ‘It is important to emphasise the democratic, de-centralised nature of the Internet.’ (Higher Still Development Unit, 1997)
De-centralised, certainly; but the notion of the Internet as democratic is astounding. A more accurate label may be anarchistic, although that label sits uneasily alongside the powerful forces that drive IT in the world today – for example Gates and Murdoch, the telephone and cable companies, and the communications moguls.

THE INTERNET IS NOT A PANACEA

In his (previously mentioned) speech at the ‘Lifelong Learning in a Wired World’ conference, Nigel Paine related a tale of a Glasgow teacher who asked a pupil to name two types of fish:

…the pupil replied Single and Special. What do you do with a pupil like that? How do you balance the very narrow view of the world that can’t see further than the fish and chip shop? You could do it by lecturing at them, not very successful; you could do it by giving them a book which they probably will not be interested in reading; you can send them to the library to do research, or you can let them loose on the Internet. In half an hour that pupil could visit aquaria around the world. She could learn about hundreds of different species of fish, learn about their physical characteristics, the way they see, the way they hear and could come back entranced, perhaps excited and perhaps motivated to learn more. In that one single instant she could break out of the cycle of narrow focus and lack of interest in knowing more than she already does and seeing no further than the end of her street. (Paine, 1996)

This is the Internet-as-panacea: pictures of fish on a computer screen provide a miraculous cure for a woefully impoverished knowledge of the environment. Of course, one suspects that the pupil’s original remark was actually intended as ironic. But even accepting the situation at face value, why should we believe that the Internet scenario gives the best possible outcome? The tale could have ended quite differently. For example, each of these alternative endings seems at least plausible:

- The teacher takes the class on a day out to Marine World. They see, touch and feed real fish, talk with the keepers, and take home sea shells.
- The teacher provides a lesson (not a ‘lecture’) which is actually highly effective: it is skillfully pitched towards the pupil’s existing knowledge and interests, involves group discussion, and makes good use of audiovisual materials.
- The pupil tries the Internet but can’t find any pictures of fish. She looks at lots of pages of information from the Web: they take an age to load and mostly turn out to be articles from academic journals, none of which she understands.
- The pupil successfully uses the Internet but finds her way to extreme pornographic material. Her parents subsequently complain to the School Board.
- The pupil finds some very nice pictures of fish which the teacher later incorporates into a teaching package. The school is sued for breach of copyright.

The beauty of telling a tale is that the narrator gets to choose the ending.

Technology evangelists have been forecasting the demise of the teacher and the school for a long time. Nearly thirty years ago Ivan Illich recommended the use of ‘liberating technologies’ — he meant the postal service and the telephone — to create an educational web (Illich, 1971). More recently, the teacher’s role has been variously challenged by developments in Resource-Based Learning, Interactive Video, and Intelligent Tutoring Systems. Although these ideas all have merit, it is
fair to say that their impact has been generally less than their proponents predicted. Why? One explanation is that schooling is necessarily a social experience — one in which a child’s live interaction with his or her peers and teachers plays an essential part. Another is that technologists exaggerate the effectiveness of new methods. They underestimate the skills of a good teacher and undervalue the teacher’s role.

This isn’t to deny that Paine’s scenario is possible — the child ‘let loose on the Internet’ may indeed learn and be motivated. However, there are good reasons why we should regard this as optimistic, including the following:

- The child may not be able to find relevant, high-quality information that is pitched at an appropriate level.
- Even if she looks in exactly the right place, the network may not be able to deliver the required information. The Web is inherently unreliable: there is no guarantee that an address reached yesterday will be contactable today. Long waits which end with messages saying ‘The site cannot be accessed’ are common and not very motivating. They may however be expensive.
- Even if the required information is obtained, it may not much help the child to learn. Research into the effectiveness of hypertext and hypermedia (i.e. electronically linked structures of information, like the Web) indicates that it is not particularly good for novices initially attempting to learn about a topic (Charney, 1994). McKendree, Reader and Hammond report that:

> There is no reason to believe that hypertext is any more easily assimilated with what the reader already knows than a linear text. A linear text is an exquisitely connected structure... Assimilation requires actively comparing, contrasting, questioning, and applying what is being read and what has been previously learned. If a hypertext can encourage learners to actively engage in this manner, it will be effective. But there is no reason to think that simply because it is done in hypertext form it will be more likely to invoke such strategies than a good book. (McKendree, Reader & Hammond, 1995)

This does not mean that good on-line learning resources are impossible. But enough is known about the technology to make safe a prediction that their development will require a lot of work, and to expect that existing Web pages — even millions of them, with lots of pictures — will save us the trouble is asking too much. McKendree et al counsel software developers against superficial approaches. They recommend that:

> ...building in a combination of relevant work and a supportive environment is more effective for learners than giving them a whizzy, fact-filled ‘multimedia experience’.

As with much of IT, on the Internet appearance threatens to triumph over substance. Teachers should not be misled. For instance, learners working with the Web may well produce colourful project reports. But cutting and pasting is not the same as learning: it may simply be plagiarism.

CONCLUSION

Contrary to the impressions which may have been given by some UK politicians and technology enthusiasts, the Internet is neither a library, nor a community, nor a panacea for difficult problems of teaching and learning. These are simplistic notions which, given the pressure upon schools to look good in the ‘education marketplace’, could be dangerously misleading.

At this early stage, any appraisal of the Internet’s potential role in schools should
be tentative. Perhaps however we can usefully distinguish the Internet’s prospects as a tool for teachers from its prospects as a tool for children. As a tool for teachers, the Internet’s negative features — its chaotic organisation, its absence of quality control, its unreliability — might be outweighed by its benefits as a powerful medium for research and communication. In higher education, the Internet has been effective when strategically used by skilled and knowledgeable adults. Teachers who have Internet links in their homes and staff bases may likewise find them to be of value.

But as a tool for children, the negative features loom large and the benefits are much less clear. To determine the balance of advantage will require extensive research. As a minimum, schools will require assurances that children are safe from the violent, pornographic, racist, cult-oriented, and other unsuitable material that contaminates the Internet. Software screening systems such as Cyber Patrol (Microsystems Ltd.) may provide part of the answer, but computer security systems are never foolproof or without disadvantage and careful evaluation will be necessary. Until this research and evaluation is done, schools that would not dream of allowing strangers to walk unchallenged into their buildings will be justified in taking a similarly cautious line towards the ‘virtual visitors’ who may arrive through the Internet. The option of saying no to the Internet is legitimate.

There are alternatives to the Internet which might bring some of the same kinds of benefit with less risk: for example, internal school networks (Intranets), reference materials on CD-ROM, and subscription-based conferencing systems. More radically, a computer network could be created exclusively for education. Obviously this would require a major public service investment, but there are precedents. In the USA, the Clinton administration has announced that a new computer network, separate from the Internet, is to be developed so that scientists and engineers who now find the Internet hopelessly choked with data traffic can get back to work (Scientific American, 1997). In the UK finance houses and banks have decided similarly to develop their own private networks, recognising that to piggy-back for free on the unregulated Internet is not a good long-term strategy.

The history of IT in education suggests that technology evangelism is unhelpful. By misrepresenting complex issues as clear-cut, the evangelists short-circuit or polarise debate. The danger is that alternatives are overlooked and the role of research and evaluation is marginalised. Furthermore, evangelism inflates expectations to unrealistic levels and hence makes subsequent disillusionment almost inevitable. A slogan such as ‘100% wired by 1997’ may have momentary appeal but schools concerned to plan for the future will want to look beyond mere soundbites: the technology choices and their implications for teachers, learners and communities could be far-reaching.

NOTES
1 SCET itself had less than two years of Internet connection experience at the time of Paine’s speech.
2 Costs to schools of Internet connections depend partly on the connection type. A report by McKinsey and Company (The Future of Information Technology in UK Schools, 1997) recommends that schools obtain dedicated leased line connections. These avoid tariff arrangements but are expensive at commercial rates (between £7,200 and £33,000 per school per year according to the capacity of the connection). Recently UK cable companies have announced a variety of special arrangements which appear to offer schools much lower costs, but as always, caveat emptor is the rule.
3 It is unwise to place too much reliance on Internet research sources. For example, how likely is it that the World Wide Web references given at the end of this paper will still be accessible in five years’ time?
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REFERENCES
Charney, D. (1994), The Impact of Hypertext on processes of reading and writing. In Sef, C. & Hilligoss, S. (Eds), Literacy and Computers: the complications of teaching and learning with technology. New York: Modern Language Association.
Conlon, T. & Cope, P. (Eds), (1989), Computing in Scottish Education: the First Decade and Beyond. Edinburgh: Edinburgh University Press.
Higher Still Development Unit (1997), Support Notes of ‘The Internet’, a module proposed for an Intermediate 2 level course in Information Systems, p.6.
Illich, I. (1971), Deschooling Society. Harper and Row.
McKendree, J., Reader, W., and Hammond, J. (1995) The ‘homeopathic fallacy’ in learning from hypertext. In: Interactions, ACM Press, 23, 7, 4–82.
McLoughlin, I. & Clark, J. (1995) Technological Change at Work. In: Heap, N., Thomas, R., Einon, G, Mason, R. & Mackay, H. (Eds) Information Technology and Society. Open University: Sage Publications, 1995.
Microsystems Software Ltd., Cyber Patrol, Silwood Park, Ascot, UK SL5 7PW. Tel: 01344 874111.
NCET (1995), Highways for Learning — The Internet for schools and colleges: What is the Internet? http://www.ncet.org.uk/publications/highways/full.html
NCET (1996a) NCET Response to House of Lords Committee on Science and Technology Sub-Committee Information Superhighway: Applications in Society, March. http://www.ncet.org.uk/temps/ish.html
NCET (1996b), Internet Bulletin. How many UK schools are on the Internet? 12 November. http://www.ncet.org.uk/gen-sheets/intbull.html
NCET (1997), Highways for Learning — The Internet for schools and colleges: Towards an Evaluation. http://www.ncet.org.uk/publications/highways/full.html
Net Magazine (1997) March, p.118.
Paine, N. (1996), speech to SCET conference ‘Lifelong Learning In a Wired World’, November. http://www.scet.org.uk/liveconf/NPKey.htm
Robins, R. & Webster, F. (1989), The Technical Fix: Education, Computers and Industry. Macmillan.
Robertson, R. MP (1996), speech to SCET conference ‘Lifelong Learning In a Wired World’, November 96. http://www.scet.org.uk/liveconf/sment.htm
Scientific American, (1997) March, pp.42–45.
Scotland on Sunday, (1997) 30 March, pp.20–21.
Scotsman, (1994) 8 October.
Sergiovanni, T.J. (1994), Building Community in Schools. San Francisco, Jossey Bass. Quoted in Fielding, M. Beyond Collaboration: On the Importance of Community, appearing in: Bridges, D. & Husbands, C. (Eds) (1996) Consorting and Collaborating in the Education Marketplace. Falmer.
Solomonides, T. & Levidow, L. (Eds). (1985). Compulsive Technology: Computers as Culture. Free Association Books.
Spender, D. (1995), Nattering on the Women: Power and Cyberspace. North Melbourne: Spinifex Press. p.198.
Stoll, C. (1995), Silicon Snake Oil. Pan Books.
Stevenson, D. (1997), Information and Communications Technology in UK Schools: An Independent Inquiry. 78–90 St. John Street, London EC1M 4HR.
Taylor, I. MBE MP (Minister for Science & Technology) (1996)) Highway Codes on the Information Superhighway, speech to the ‘Seize the Moment’ Conference, 21 March. http://www.dti.gov.uk/minspeech/ishighco.htm
TES (1997), Computers Update, 3.1.97 p. 5.
Thimbleby, H. (1995), Problems In the Global Village. Talk given 12 September 1995, Newcastle, UK, to the British Association. http://www.cs.mdx.ac.uk/research/village.html