1.   Information, Knowledge and Learning: Some Issues Facing Epistemology and Education in a Digital Age

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INTRODUCTION

Philosophers of education have always been interested in epistemological issues. In their efforts to help inform educational theory and practice they have dealt extensively with concepts like knowledge, teaching, learning, thinking, understanding, belief, justification, theory, the disciplines, rationality and the like. Their inquiries have addressed issues about what kinds of knowledge are most important and worthwhile, and how knowledge and information might best be organised as curricular activity. They have also investigated the relationships between teaching and learning, belief and opinion, knowledge and belief, and data and information. For some a key issue has been how students can become autonomous knowers. This issue has often been bound up with questions about what count as appropriate standards for reasonableness or rationality, and the conditions under which we can properly regard understanding as having occurred. During the past decade renewed interest has been shown in what is involved in becoming an authority, expert or competent performer in a given area of knowledge, as well as in how we evaluate and critique different or competing beliefs, theories, points of view or paradigms.

Until recently, such activity was conducted under relatively stable conditions. We could assume that the printed word/book comprised the paradigm medium for knowledge production and transmission; that propositional knowledge and denotation comprised the principal mode and space of knowledge work; that educational activity was underwritten by ideals of progress, liberal enlightenment, and personal and collective enhancement made possible through knowledge; and that scientific pursuit of knowledge was based on secure foundations.

We are presently living through a period in which such assumptions have been undermined to the point where they are no longer tenable. The circumstances, conditions and the very *status* of knowledge, learning, teaching and researching are currently in a state of profound

upheaval under the double impact of rapid and far-reaching technological change and the massive assault on longstanding narratives of foundation and legitimation.

In this context new work in epistemology for education assumes great urgency, and should be given very high priority by philosophers of education. Indeed, many of the very questions about knowledge that in the past have been fundamental to epistemological work no longer seem relevant. In an age which *fetishises* information (Poster, 1993), knowledge may seem either to be passé or in need of a serious reframing. What follows is an attempt to identify some areas and concerns we believe need close attention in the context of the burgeoning use of new communications and information technologies, including their rapid incorporation into school-based teaching and learning. One important dimension of this, although by no means the only one, is the exponential growth of public and professional participation in the Internet.

LIFE ONLINE: SOCIAL EPISTEMOLOGY AND PRACTICES IN SPACES ON THE INTERNET

One of the most difficult challenges facing attempts to think about epistemology in relation to 'the Internet' has to do with what we might call the Internet's spatial 'ontology'.

For some people the Internet can seemingly be understood as an elaborate infrastructure for transmitting, receiving and manipulating information. As such it may be thought of in terms of a number of more or less discrete but linkable 'technologies' including email, pre-print archives, and the World Wide Web. From this perspective, Paul Thagard (1997) talks of such Internet technologies as now being 'ubiquitous parts of scientific practice'. He describes a range of these technologies and then offers what he calls 'an epistemological appraisal of their contributions to scientific research'. This involves working from the assumption that 'science aims at and sometimes achieves truth understood as correspondence between beliefs and the external world'. Scientists increasingly use Internet technologies in their efforts to achieve 'truth', and Thagard provides typical everyday examples of such uses. He then takes Alvin Goldman's (1986, 1992) five 'epistemic criteria'—reliability, power, fecundity, speed and efficiency—and uses them as a framework for evaluating 'the largely positive impact of Internet technologies on the development of scientific knowledge'. So, for example, the criterion of power is treated in terms of measured ability to help people find true answers to their chosen questions. Thagard looks at various ways in which the World Wide Web (WWW) is 'powerful in helping scientists find answers to the questions that interest them'. He identifies the availability of video simulations, the hypertextual organisation of material, the availability of digital databases and their capacity 'to be searched quickly and thoroughly', the use of email and news groups 'to solicit answers to interesting questions', the ready availability of software on the Web which scientists

can use 'to generate answers to statistical or other questions that would be unanswerable otherwise', the availability of electronic pre-print archives as sources of answers to questions and the fact that scientists with common interests can find each other and work collaboratively on the Internet. Thagard then works through the remaining criteria in the same way, typically beginning his accounts by showing how the printing press previously helped scientists in their pursuit of truth, and how the Internet now builds on and amplifies the power, fecundity, speed, efficiency and reliability enabled by print.

For Thagard the Internet seems to be just another facility for conducting business as usual. Scientists continue to practise the pursuit of truth much as they always have, but now they have new technologies to help them in their efforts. Thagard calls this 'Internet epistemology', understood as the contributions of new information technologies to scientific research (which he understands in scientific realist and objectivist terms).

In many ways Thagard's conception of the Internet illustrates what Weston (1994) refers to as 'Phase II of the old boys' operation . . . [of] remodelling the modern apparatus'—an operation codenamed the 'Information Superhighway'. Following a well-established line of argument within the analysis and critique of mass media, Weston claims that 'all social institutions have their relative certainties made possible by the centralizing power of the technologies of mass communication'. In other words, the operating logic of public media throughout history and exemplified in the broadcast mass media of late modernity has followed a familiar pattern, in which:

> successive public communication technologies either began as, or very quickly were made to conform to, the extreme send:receive imbalances that, somewhere along the line, we started calling the mass media, or simply the media . . . Public access to these media is simply not problematical. On the one hand, there are the media and, on the other, there are their audiences, consumers, constituents, and publics. (Weston, 1994)

Weston notes that the development of what is now known as the Internet was intended by those with the power to oversee such things to follow the same media operating logic. He says that by 'the information revolution' they only meant 'to digitize the modern industrial state'. The so-called 'information superhighway' was 'supposed to be about a five hundred, not a one hundred million channel universe'. And it was certainly *not* 'supposed to be about a technological adventure that would reconfigure social relations [of communication and media] or blur the well-constructed boundaries between the public and the private ground'. The intended 'model' would fit well with the picture of state and corporate scientific endeavour made more efficient by Internet technologies painted by Thagard.

However, as is now obvious, the Internet has to date evolved rather differently. It has so far defied centralisation and the restriction of

channels that are controlled by a few. It is a truly distributed public medium. It is certainly inadequate to view 'it' (simply) in terms of an information infrastructure involving multiple discrete but connectable 'technologies'. Neither is it appropriate to think of the Internet in terms solely of information and data except, perhaps, in some trivial sense in which *anything* that is communicated can sooner or later be called data or information. Instead, we can envisage the Internet as a range of technologically-mediated spaces of communicative practice that are amazingly diverse—a multiplicity of language games that are by no means confined to informing, and that are not best understood solely in terms of content.

Weston notes that the exponential growth in participation within diverse spaces of practice on the Internet has occurred *despite* a range of well-known constraints—initially including difficulty of access, frustratingly narrow bandwidth, and continuing observations that much of what is to be found there is banal or otherwise offensive, and often disorganised. For perhaps a majority of people who actively participate in online activities the Internet, unlike conventional mass media, is 'less about information or content, and more about relations'. Weston argues that practices in the Internet are mainly about 'people finding their voice' and about 'speaking for themselves in a public way'. From this perspective the matter of the content carrying this new relationship 'is of separate, even secondary, importance'. It remains important, however, because people usually want to '[re]present themselves as well as they can' (Weston, 1994). Hence, if we are to understand the Internet in more than merely infrastructural and technicist terms, or as a massive conduit for information transmission, retrieval and manipulation—which we must—we need to understand the ways in which the relational aspects of the diverse kinds of practices and purposes played out there 'qualify and define what gets transmitted as content'.

At the same time, if we are seriously to address issues of epistemology in relation to the development of the Internet we need to sort out how the complex range of practices engaged in on the Internet relate to epistemology—what, if any, the epistemological implications of particular practices are; and within this field of possible epistemological implications we have to work out which ones are (most) educationally relevant (which will involve difficult questions about the extent to which education should be about preparing people for lives and futures that will seemingly be increasingly lived out in cyberspace). This means at least three things. First, we have to recognise that the way academics understand and approach the Internet is only one way, and that it may differ greatly from the way non-academic publics understand and use the spaces and technologies in question. Second, to make plausible judgements about social practices on the Internet we need to know a lot more about what people actually do there than we know at present, and we need to look for patterns of practice and purpose and 'production' that go far beyond our current knowledge. Third, we must problematise our limited and often mystified understandings of the Internet which, to

use an analogy from Chris Bigum (in personal communication), may be more like a chameleon than an elephant. If, to continue the analogy, we are like blind persons trying to discover the nature of the beast by fumbling for parts of it, the fact is that it will be even more difficult to do this if the beast is a chameleon than if it is an elephant! And this makes epistemological work especially difficult.

Nonetheless, as educationists we neglect investigating the possible epistemological significance and implications of practices involving new Information and Communications Technologies (ICTs) at our peril. This would be to hand the game over completely to the 'visions' of neo-liberal policymakers, techno-scientists and corporations who stand to gain from technologising educational provision in the image of computing hardware and software. What follows is a tentative preliminary exercise in considering some 'patterns', features and issues of social practices that have been associated with the rapid growth of electronic ICTs generally and Internet-based practices more specifically, and how these might call for rethinking epistemology in a digital age. This rethinking might conceive of epistemology in social terms as practices of knowing that reflect a range of strategies for 'assembling', 'editing', 'processing', 'receiving', 'sending', and 'working on' information and data to transform 'data' into 'knowledge'. We might think here of Ludwig Wittgenstein's (1953) 'performative' epistemology, an epistemology of performance—'Now I know how to go on!' (Wittgenstein, 1953, p. 105)—that conceives knowing as making, doing and acting. This account is based on the relation of knowing to the 'mastery of a technique'. Such a view of performance epistemology might be usefully applied to a range of emergent practices. These include 'bricolage', understood as assemblage of elements, and 'collage', understood as the practice of transferring materials from one context to another. They also include 'montage', construed as the practice of disseminating borrowings in a new setting (Ulmer, 1985b).

PATTERNS AND PRACTICES OF THE NEW COMMUNICATIONS AND INFORMATION TECHNOLOGIES

Knowledge in the postmodern condition

In *The Postmodern Condition* Jean-François Lyotard (1984) advances what has proved to be a highly prescient and compelling account of scientific (as distinct from narrative) knowledge in so-called 'advanced' societies (Peters, 1995). His analysis resonates powerfully with the experiences of knowledge workers in modern neo-liberal states over the past 10–15 years. Lyotard's working hypothesis is that:

> the status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age. (Lyotard, 1984, p. 3)

Lyotard's analysis of the postmodern condition is a report on the status of knowledge under the impact of technological transformation within the context of the crisis of narratives—especially Enlightenment meta-narratives concerning meaning, truth and emancipation which have been used to legitimate both the rules of knowledge in the sciences and the foundations of modern institutions. His concept of the postmodern condition describes the state of knowledge and the problem of its legitimation in the most 'highly developed' countries, in the wake of 'transformations which, since the end of the nineteenth century, have altered the game rules for science, literature and the arts' (*ibid.*, p. 3).

By 'transformations' Lyotard means particularly the effects of new technologies since the 1940s and their combined impact on the two main *functions* of knowledge: namely, research and the transmission of acquired learning. He argues that the leading sciences and technologies are all grounded in *language-based* developments—in theories of linguistics, cybernetics, informatics, computer languages, telematics, theories of algebra—and on principles of miniaturisation and commercialisation. This is a context in which:

> knowledge is and will be produced in order to be sold, and it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange. (*ibid.*, p. 4)

Knowledge, in other words, 'ceases to become an end in itself'; it loses its use value and becomes, to all intents and purposes, an exchange value alone. The changed status of knowledge comprises at least the following additional aspects.

- Availability of knowledge as an international commodity becomes the basis for national and commercial advantage within the emerging global economy.
- Computerised uses of knowledge become the basis for enhanced state security and international monitoring.
- Anything in the constituted body of knowledge that is not translatable into quantities of information will be abandoned.
- Knowledge is exteriorised with respect to the knower, and the status of the learner and the teacher is transformed into a commodity relationship of 'supplier' and 'user'.

Lyotard sees some important implications and corollaries associated with this changed status of knowledge. In particular:

- As the principal force in economic production, knowledge 'effects' include radically changing the composition of the workforce.
- Mercantilisation of knowledge widens the gap between 'developed' and 'developing' countries.
- Commercialisation of knowledge and emerging new forms of media circulation—including, par excellence, the Internet—raise new

ethico-legal issues including intellectual property rights, the state's role in promoting and providing learning, issues of decency, offence and censorship and issues concerning the relationship between the state and information-rich multinationals.

Lyotard's critique frames the central question of legitimation of scientific knowledge in terms of its functions of research and transmission of learning within computerised societies where meta-narratives meet with 'incredulity' (*ibid.*, p. xxiv). In his critique of capitalism Lyotard argues that the state and company/corporation have found their only credible goal in power. Science (research) and education (transmission of acquired learning) as institutionalised activities of state and corporation are/become legitimated, in de facto terms, through the principle of *performativity*: of optimising the overall performance of social institutions according to the criterion of efficiency or, as Lyotard puts it, 'the endless optimization of the cost/benefit (input/output) ratio' (Lyotard, 1993, p. 25). They are legitimated by their contribution to maximising the system's performance, a logic which becomes self-legitimating—that is, enhanced measurable and demonstrable performance as its own end.

The implications for the education function of knowledge are especially pertinent here. In terms of status, education—until recently regarded as a universal welfare right under a social democratic model—has been reconstituted in instrumental and commodified terms as a leading contributor to and sub-sector of the economy: indeed, one of the main *enterprises* of the post-industrial economy. The focus of educational work and provision is no longer based on questions of educational aims and ideals in the old sense that drew on language games involving values, aspirations, conceptions of and beliefs about humanity, potential, personal worth and autonomy, emancipation and dignity and the like. Rather, attention has moved from aims, values and ideals to a new focus on 'means and techniques for obtaining [optimally] efficient outcomes' (Marshall, 1998a, p. 8). That is to say, the education language game has been forced into commensurability with the varieties of technicist language games, and is required to play—to perform—according to the technological criterion of efficiency. The problem of legitimation, which is ever a problem of rationalising *power*, is addressed by making efficiency the basis of legitimation and then extending this logic across *all* the language games of the public–social institutional domain.

At the level of daily practice, performativity in education at all levels calls for our schools and universities to make 'the optimal contribution . . . to the best performativity of the social system' (Lyotard, 1984, p. 48). This involves creating the sorts of *skills* among learners that are indispensable to maximum efficiency of the social system. For societies like our own, this is a system of increasing diversity and is seen as being composed of players competing in the marketplace of global capitalism. Accordingly, two kinds of skills predominate: first, skills 'specifically

designed to tackle world [economic] competition', which will vary 'according to which ''specialities'' the nation-states or educational institutions can sell on the world market', and second, skills which fulfil the society's 'own needs'. These have to do with maintaining the society's 'internal cohesion'. Under postmodern conditions, says Lyotard, these cohesion skills displace the old educational concern for *ideals*. Education is now about supplying 'the system with players capable of acceptably filling their roles at the pragmatic posts required by its institutions' (see Lyotard, 1984, p. 48).

As Marshall notes:

> educational institutions . . . will be used to change people away from the former liberal humanist *ideals* (of knowledge as good in itself, of emancipation, of social progress) to people who through an organized stock of professional knowledge will pursue performativity through increasingly technological devices and scientific managerial theories. (Marshall, 1998, p. 12)

What are the implications for the content and processes of education so far as knowledge is concerned? Lyotard identifies several with specific reference to higher education, although these implications can readily be extrapolated downwards to elementary and secondary school levels. We will look at five of these implications which are especially relevant to our topic.

First, transmitting the 'organised stock of established knowledge' required for professional training may increasingly be left to new technologies. That is:

> to the extent that learning is translatable into computer language and the traditional teacher is replaceable by memory banks, didactics can be entrusted to machines linking traditional memory banks (libraries, etc.) and computer data banks to intelligent terminals placed at the students' disposal. (Lyotard, 1984, p. 50)

Second, from a pedagogical perspective, didactic instruction by teachers would be directed to teaching students 'how to use the terminals'. Lyotard identifies two aspects here: (a) teaching new languages (e.g., informatics, telematics), and (b) developing refined abilities to handle 'the language game of interrogation'—particularly, to what information source should the question be addressed, and how should the question be framed in order to get the required information most efficiently?

A third implication noted by Lyotard is of particular concern here. He suggests that a primary concern of professionally-oriented students, the state and education institutions will be with whether the learning of information is of any use—typically in the sense of 'Is it saleable?' or 'Is it efficient?'—not with whether it is *true*.

A fourth implication that runs parallel to the third is that competence according to criteria like true/false, just/unjust has been displaced by competence according to the criterion of high performativity.

Finally, under conditions of less than perfect information the learner–student–graduate–expert who has knowledge (can use the terminals effectively in terms of computing language competence and interrogation) and can access information has an advantage. However, the more closely conditions approximate to conditions of perfect information (where data are in principle accessible to any expert), the greater the advantage that accrues to the ability to arrange data 'in a new way'. This involves using imagination to connect together 'series of data that were previously held to be independent' (Lyotard, 1984, p. 52). That is, in the final analysis, imagination becomes the basis of extra performativity.

We need to emphasise two important points here with respect to Lyotard's analysis. First, his working hypothesis and the exploration based on it were not intended to have predictive value but, instead, strategic value in relation to the question of the status of knowledge in advanced societies. Nonetheless, Lyotard's account is very close to what has emerged in developed neo-liberal states. Second, we do not see Lyotard as advocating or endorsing the values and orientation emerging from his analysis. Instead, we see him as reporting the direction in which exploration of his hypothesis points.

Our own view is that Lyotard's investigation of his working hypothesis has, in the event, proved to be disturbingly accurate. His account of the changed status of knowledge corresponds closely to the lived experience of many teachers and researchers working in reconstituted and increasingly professionalised universities. Moreover, with the current strong push to technologise school classrooms we can already see at least the second, third and fourth of the implications described above applying increasingly to school learning contexts (cf. Lankshear, Bigum *et al*., 1997; Lankshear and Snyder, 2000).

We would argue that Lyotard's investigation of the implications for the status of knowledge of computerisation occurring under conditions of incredulity toward meta-narratives is massively important. At the same time, it is at most a part of a much larger story so far as epistemology and education in a digital age are concerned. Lyotard's work predated the dramatic developments in and uptake of new ICTs during the 1990s. Practices involving new ICTs—and, notably, the Internet—occurring within non-formal and non-educational sites have crucial significance for how we think about knowledge and truth, and about their relationship to educational work. It is high time that educationists tried to 'tell the larger story as it is', and to face square on its implications for established epistemological positions, and for educational practices and emphases predicated on these. At the same time, it is important in the context of what are confused and confusing times not to give too much away too easily so far as epistemological principles are concerned. The rapid and far-reaching changes in which we are embroiled may have thrown into serious doubt some substantive

epistemological theories, and various educational priorities, values, assumptions and practices associated with them. This, however, is *not* to argue against the importance of trying to get clear about the nature of knowledge, the significance of truth and the distinctions between and relationships among knowledge, truth, belief, information and the like, under changed and changing conditions. Our argument is not so much with the principles and concerns of conventional epistemologies as with some substantive theories that have been dominant throughout modernity.

It seems to us very likely that the relationship between education and knowledge needs to be rethought in profound ways within the mode of information (Poster, 1993). There are at least two important aspects to this inquiry. One will involve considering the extent to which education will henceforth be concerned with knowledge under foreseeable conditions. The other will involve asking the question: 'to the extent that education will still be concerned with knowledge, what kind or kinds of knowledge will be most important for schools to address, and what substantive changes in educational emphasis will this entail?'

We are aware that in much of what we have to say it may appear we believe that there is no longer any truth or any knowledge beyond what circulates as information. This is *not* our position. Rather, we think three things here. One is that new conditions require us to look again and, perhaps, in different ways from those we are used to, at what counts as knowledge and truth. The second is that we need carefully to consider the extent to which everyday practices—including many on the Internet—simply are not concerned with knowledge and truth as we have often understood them, but instead 'play' on quite different terrain. Third, we need to consider the extent to which education must help prepare learners for successful participation in such practices.

The superabundance of information

The Internet marks the current high point of what Mark Poster (1995) calls the second media age, or the second age of mass communications to emerge in the twentieth century. The first age, comprising film, radio and television, was based on the logic of broadcast. Here 'a small number of producers sent information to a large number of consumers', transcending earlier constraints of time and space by initially electrifying analogue information and, later, by digitising it. The integration of satellite technology with telephone, television and computer media has brought the emergence of a many-to-many logic of communication, which is Poster's second media age. This is a logic in which boundaries between producers, distributors and consumers of information break down, and where social relations of communication are radically reconfigured under conditions of infinitely greater scope for interactive communication than in the broadcast model (Poster, 1995, p. 3).

There is more to matters here than simply an analytic distinction between operating logics: one-to-one versus many-to-many. In addition,

there are important contingencies associated with the development of the Internet that are relevant to our purposes. Three in particular are worth noting briefly here. These will already be familiar to readers and are rehearsed here for subsequent analytic purposes.

First, there is the now notorious issue of the sheer volume of available information. While the phenomenon known as info-glut (Postman, 1993; Gilster 1997, p. 6) or data smog (Shenk, 1998) is by no means confined to the Internet, it certainly reaches an apex here. In part the superabundance of information can be seen simply in gross quantitative terms. There is a mountain of the stuff in the ether, so to speak, which presents serious challenges to negotiating this mass to find what one wants or needs. In addition, however, the information resources of the Internet are readily *customisable*. Services and software are available that enable users to have gigabytes of data on identified topics 'dumped' direct onto their hard drives on an ongoing basis. Once the parameters of interest have been set the data dumping operation is automatic (until one decides to end it).

Second, the Net is a radically 'democratic' inclusive medium where information is to a large extent unfiltered. Paul Gilster (1997, pp. 38–39) notes that even with the introduction of cable television, conventional mass media are nonetheless exclusive. Certain categories of content are excluded through the filtering decisions and actions of programming executives and the like. While many information sources on the Internet (especially on the WWW) filter and otherwise moderate content in accordance with their perceived interests and purposes, this is in no way the norm.

Third, a great deal of information on the Internet is *presented*. Two aspects must suffice here. First, Gilster (1997, pp. 2–3) notes that with the tools of electronic publication being dispersed practically on a global scale, 'the Net is a study in the myriad uses of rhetoric'. In this context, says Gilster, the ability to distinguish between content and presentation in order to achieve a balanced assessment is crucial. The importance of presentation and the incentives to present information in maximally compelling ways should not be underestimated in the context of what Goldhaber (1997) calls 'the attention economy' (see below). Second, on the WWW much information is hyperlinked in ways that reflect conceptions of interrelatedness, relevance, emphasis, significance and values of the presenters. The information texts available on the Web are intensely mediated/interpreted, and this is further iterated through the operating logics and assumptions of search engines. As Standish observes:

> the links we encounter are ready made. As such they are the products of the author or designer of the hypertext and so reflect in some degree that person's biases and preoccupations. The facility one easily acquires in clicking on icons enhances the appearance of naturalness that the links so quickly come to have and so covers over the more or less idiosyncratic nature of the connections they supply. (Standish, 2000; see also Burbules, 1998.)

Of course, we find similarities in other media—for instance, author choices of key sources and references in print texts. But on the Internet the hypertextual, hypermediated nature of information sources is more complex and profound than in other media. This is largely a function of the ease of creating hyperlinks and the speed and facility with which linkable resources can be mobilised online. It is also partly a function of the logic of the attention economy and the desires of Web publishers to create (potential) associations with other presences on the Web. Other matters related to image and identity also operate to generate information presentation effects that are much more complex and ambiguous than typically occur in, say, print texts.

Writers have identified numerous issues associated with the potential constraints to sound information retrieval and processing practices resulting from the logic of many-to-many communication and contingencies like those we have raised here. One such issue is that of *credibility in cyberspace*. Nicholas Burbules and Thomas Callister (1997), for example, address the issue of how Internet users can assess the credibility of particular items of information and of information providers, and how they can acquire credibility in their own right as informers. They argue that the Internet poses important challenges to our more traditional ideas of how to assess and gain credibility in relation to information and knowledge. Traditionally, they say, our criteria for credibility have emphasised qualifications and characteristics of identifiable knowledge and information agents (and for all the fallibility this may entail). On the Internet, however, it may be impossible to identify original sources of information—seemingly much more so than in the more finite world of print-based information. In such cases we (may) have to rely on a range of commonplace proxies. Judgements must rely on such indicators as 'the avenues though which that information was gained'—drawing on the idea of the Internet and, particularly, the WWW as 'a vast network of credibility relations' within which 'the people who establish active links to reliable information, and whose information or viewpoints are in turn identified as and recommended by others, gain credibility as both users of information and providers'; the links that 'others who are better known' have made to the information; how frequently the information has been accessed (e.g. page visitor counters) and so on.

Burbules and Callister emphasise that these are indirect and imperfect measures of credibility, yet they may be all that Internet users can draw on to evaluate information that is beyond their experience and expertise in a field. Clearly, traditional epistemological concepts, criteria and practices—particularly, those adhered to by knowledge 'professionals' like academics—are put under considerable strain here.

A second issue concerns *the quest for perspective and balance*. Paul Gilster (1997, Chapter 7) describes a practice he calls 'knowledge assembly' which he sees as a necessary new literacy in and for the information age. He asks how one builds knowledge out of online searching and catching, and how specific items of information are to be

evaluated. He seeks open, non-prejudiced inquiry, which strives for balance, goes where the evidence leads, and aims to get at the heart of the themes or issues in question. For Gilster, knowledge assembly is 'all about building perspective'. It proceeds by way of 'the accretion of unexpected insights' (*ibid.*, pp. 195, 219). When it is used properly, says Gilster:

> [n]etworked information possesses unique advantages. It is searchable, so that a given issue can be dissected with a scalpel's precision, laid open to reveal its inner workings. It can be customized to reflect our particular needs. Moreover, its hypertextual nature connects with other information sources, allowing us to listen to opposing points of view, and make informed decisions about their validity. (*ibid.*, p. 196)

Knowledge assembly is about targeting issues and stories using customised newsfeeds and evaluating the outcomes. It is the:

> ability to collect and evaluate both fact and opinion, ideally without bias. Knowledge assembly draws evidence from multiple sources, not just the World Wide Web; it mixes and distinguishes between hard journalism, editorial opinion, and personal viewpoints. [It] accepts the assumption that the Internet will become one of the major players in news delivery . . . but it also recognizes the continuing power of the traditional media. (*ibid.*, p. 199)

Gilster describes the tools and procedures of knowledge assembly using the Internet in terms of a five-step process. The first step involves developing a customised, personalised electronic news service—a personal newsfeed. Subscribing to an online news service and entering keywords that define the topics or issues you want to receive breaking stories about does this. The service—often fee-charging, depending on the range of information sources it culls—then sends you by email or via a Web page which can be tailored for personal use stories on topics of interest as they break. (For more detailed descriptions of the kinds of services available, see Gilster, 1997, pp. 201–208.)

The second step augments the first (which draws on formal 'published' information or 'hard news'). In the second step one subscribes to online newsgroups and mailing lists that deal with the subject(s) of interest. These offer the personal viewpoints and opinions of participants on the issues in question, providing access to what (other) netizens make of the topic. Some newsgroups make their own newsfeeds available, which helps with focused searching by sub-topics and the like among the myriad postings that occur across a range of lists on daily and even hourly bases.

In Gilster's third step one searches the Internet for background information—e.g. by going to the archives of online newspapers to get a history of the build-up of the story or issue thus far. Gilster also mentions using search engines to find Internet links to sites covering key players in the story or issue. These may provide related stories or other

information that helps contextualise the issue or topic, providing additional breadth, variables and angles.

The fourth step involves drawing together other helpful Internet news sources, such as radio archives accessed by software like RealAudio, interactive chat sessions, video archives and so on. Although the facility should not be abused, direct email links might also be used to verify or disconfirm information.

The final step in the assembly process takes us beyond Internet sources of information and involves relating the information obtained from networked sources to non-networked sources such as television, conventional newspapers, library resources and so on. This is indispensable to seeking balance and perspective, since it puts the issue or story being worked on into a wider context of news and information—including prioritised contexts (e.g. where newspapers consistently run the story on page 1, or on page 12).

These steps toward 'filling the information cache' entail diverse understandings, skills and procedures—many of which are only acquired through regular use and 'practice'. For example, learning to find one's way around the innumerable mailing lists, news groups and discussion lists; identifying the 'predilections' of different search engines, and which one to use (and with which other ones) for particular areas or topics; how to narrow searches down by refining keyword checks; how to use Boolean logic, and which search engines employ which Boolean commands and protocols, and so on. Gilster also mentions specific 'tools' of content evaluation that one uses along the way to filling one's information cache, item by item: for instance, the credentials of the sources, the probable audience a source pitches at, the likely reliability of the source, distinctions such as those between 'filtered, edited news', personal opinion and propaganda (*ibid.*, p. 217).

Constitutive effects of how we interrogate the world

In a chapter called 'Logic and intuition', Michael Heim (1993a) explores some constraining influences on how we interrogate the world of information—and, indeed, the world itself—that can be seen as associated with normalised practices of a digital regime. He focuses on Boolean search logic, since nowadays to a large and growing extent we 'interrogate the world through the computer interface' and 'most computer searches use Boolean logic' (*ibid.*, pp. 14–15).

Heim's underlying point is that to live within the digital regime means that using Boolean search logic and similar computing strategies rapidly becomes 'second nature'—something we take for granted (Heim, 1993a, p. 14). He is interested in how this will 'affect our thought processes and mental life and, to that extent, how we will be constituted as searchers, thinkers, and knowers'. He builds on two key ideas: the types of questions we ask shape the possible answers we get, and the ways we search limit what we find in our searching.

For reasons of space we must bypass here many interesting details in Heim's account of the shift from traditional Aristotelian logic based on direct statements/propositions to abstract, system-oriented symbolic logic based on algebra, originating with Boole and Venn and associated more recently with philosophers like Quine. And we must bypass details of the implications of this shift Heim identifies for ontology, worldview and relations of knower to known. Three fragments may suffice, however, to evoke the flavour of his argument:

> With modern logic:
> systemic consistency became more important than the direct reference to things addressed in our experience.
>
> When system precedes relevance, the way becomes clear for the primacy of information [since]...For it to become manipulable and transmissible as information, knowledge must first be reduced to homogenized units.
>
> In its intrinsic remoteness from direct human experience, Boolean search logic [facilitates] a gain in power at the price of our direct involvement with things...Placing us at a new remove from subject matter, by directing us away from the texture of what we are exploring. (*ibid.*, pp. 178–18)

This part of Heim's argument concerns objects of knowledge and the relationship between knower and world in addressing the world. By easy extension, we can see how the way contemporary modes of system-based relationship to the world can make it possible for policy-makers, corporate chiefs and other powerful shapers of destinies to frame and enact policies and measures that impact so dramatically (and painfully) on the material lives and experiences of (other) people. When materiality is dissolved away, real effects may be a small (since invisible) price to pay for enacting the elegance of a logic, so that matters of epistemology, ethics and politics are profoundly imbricated.

Returning more directly to Heim's account of the relationships between question types and answers, and between search modes and what our searches turn up, we arrive at the operating mode of the search engine. On the surface it may appear that search engines have already moved beyond using Boole's tools: the use of AND, NOT, OR, NEAR and so on, in conjunction with 'key words, buzz words and thought bits to scan the vast store of knowledge' (*ibid.*, p. 22). Some search engines now invite us simply to ask them a question or enter a few words. (The 'initiated', of course, still prefer to work with key words and Boole.) But beneath the surface of our natural language questions or phrases the software is still operating on largely Boolean lines. The point is that *all* such searching makes use of logics that presume pre-set, channelled, tunnelled searching: *pointed* rather than *open* searching. Invitations from the machine to refine our search (as when too many data sources are identified) are invitations to further sharpen/focus 'an already determined will to find something definite'; to 'construct a narrower and

more efficient thought tunnel; to create still finer funnels to sift and channel ''the onrush of data'' (*ibid.*, pp. 22–23).

Heim contrasts this kind of information scan with what he calls 'meditative perusal'. He distinguishes his notion of meditative work from that recommended by numerous advocates of online searching. For the latter, 'meditating' means no more than engaging in reflective efforts to find sharper and more discriminating key words. From this perspective, information scanning is pre-conceived, focused, highly goal-directed and treats texts as data. The key values of information scanning are speed, functionality, efficiency and control. The answers we get from scanning are bounded and defined, comprising data which falls within overlapping circles in Venn diagrams. We can then use what we get in accordance with our knowledge purposes.

In contrast to this, Heim describes 'meditative perusal' as the kind of 'contemplative, meditative meander along a line of thinking' that we might engage in by slowly reading a book and keeping 'the peripheral vision of the mind's eye' open. Here the reader is open to unexpected connections, meaning and interpretation, options that were taken and others that were not, authorial hunches, tensions and contradictions and so on. This is an approach to knowledge/getting to know (about) something which privileges intuition, the unexpected, openness to 'discoveries that overturn the questions we originally came to ask' and to 'turning up something more important than the discovery we had originally hoped to make' (*ibid.*, pp. 25–26). Insofar as spaces on the Internet can, like books, be browsed in this mode, doing so will require us to resist the wider web of values and purposes to which search logics are recruited or, at the very least, to be and remain aware of wider options that may exist.

Economies of information and attention

The superabundance of information has been linked to the hypothesis of an emerging attention economy in ways that have important epistemological implications. The fact that information is in over-saturated supply is seen as fatal to the coherence of the idea of an information economy, since 'economics are governed by what is scarce' (Goldhaber, 1997). Yet, if people in post-industrial societies will increasingly live their lives in the spaces of the Internet, these lives will fall more and more under economic laws organic to this new space. Numerous writers (e.g. Lanham, 1994; Thorngate, 1988, 1990) have argued that the basis of the coming new economy will be attention and *not* information. Attention, unlike information, is inherently scarce. But like information it moves through the Net.

The idea of an attention economy is premised on the fact that the human capacity to produce material things outstrips the Net capacity to consume the things that are produced—such are the irrational contingencies of distribution. In this context, 'material needs at the level of creature comfort are fairly well satisfied for those in a position to

demand them' (Goldhaber, 1997)—the great *minority*, it should noted, of people at present. Nonetheless, for this powerful minority, the need for attention becomes increasingly important, and increasingly the focus of their productive activity. Hence, the attention economy:

> [T]he energies set free by the successes of . . . the money-industrial economy go more and more in the direction of obtaining attention. And that leads to growing competition for what is increasingly scarce, which is of course attention. It sets up an unending scramble, a scramble that also increases the demands on each of us to pay what scarce attention we can. (Goldhaber, 1997)

Within an attention economy, individuals seek stages—performing spaces—from which they can perform for the widest/largest possible audiences. Goldhaber observes that the various spaces of the Internet lend themselves perfectly to this model. He makes two points of particular relevance to our concerns here. First, gaining attention is indexical to originality. It is difficult, says Goldhaber, to get new attention 'by repeating exactly what you or someone else has done before'. Consequently, the attention economy is based on 'endless originality, or at least attempts at originality'.

Second, Goldhaber argues that in a full-fledged attention economy the goal is simply to get enough attention or to get as much as possible. (In part this argument is predicated on the idea that having someone's full attention is a means for having them meet one's material needs and desires.) This becomes the primary motivation for and criterion of successful performance in cyberspace. Generating information will principally be concerned either with gaining attention directly, or with paying what Goldhaber calls 'illusory attention' to others in order to maintain the degree of interest in the exchange on their part necessary for gaining their attention.

Multimodal truth

Since the invention of the printing press the printed word has been the main carrier of (what is presented as) truth. Mass schooling has evolved under the regime of print, and print has more generally 'facilitated the literate foundation of culture' (Heim, 1999). Of course various kinds of images or graphics have been used in printed texts to help carry truth (such as tables, charts, graphs, photographic plates, illustrations). However, Web technology merges pictures and print (not to mention sound) much more intricately and easily than has ever been possible before. As Heim puts it

> The word now shares Web space with the image, and text appears inextricably tied to pictures. The pictures are dynamic, animated, and continually updated. The unprecedented speed and ease of digital production mounts photographs, movies, and video on the Web.

Cyberspace becomes visualized data, and meaning arrives in spatial as well as in verbal expressions.

This situation now confronts the primary focus within classroom-based education on the linguistic–verbal–textual resources of reading, writing and talk. Teaching and learning have been seen throughout the history of mass education as principally linguistic accomplishments (Gunther Kress, personal communication). Recently, however, teachers and educationists have become increasingly interested in the role of visual representations in relation to teaching and learning. 'The importance of images as an educational medium is beginning to be realised, as text books, CD ROM, and other educational resources become increasingly reliant on visual communication as a medium for dealing with large amounts of complex information' (*ibid.*).

SOME IMPLICATIONS FOR EPISTEMOLOGY AND EDUCATION

The patterns, features and issues associated with social practices involving new ICTs sketched here are by no means the only ones we could address. They are, however, quite diverse and well-subscribed, and they provide a reasonably broad-based 'catalyst' for considering how much and in what ways we may need to rethink epistemological matters in relation to educational theory and practice. This final section will identify some of the issues and challenges we believe should be taken up as priorities by educational philosophers (among others).

We can begin by identifying in a broad sweep some of the key elements of the epistemological model that has underpinned education throughout the modern-industrial era. We can then go on to consider how far these elements may be under question in a digital age where more and more of our time, purposes and energies are invested in activities involving new communications and information technologies.

Throughout the modern-industrial era of print, learning has been based on curriculum *subjects* organised as bodies of content which are in turn based on work done in the disciplines (history, mathematics, natural science and so on). The primary object of learning was the content of subjects. This was based on the premise that what we need to know about the world in order to function effectively in it, and that is to be taught in formal education, is discovered through (natural and social) scientific inquiry. Even the very 'practical' or 'manual' subjects (such as cooking, woodwork) contained a considerable 'theory' component.

School learning has also been based on the idea that by participating in curriculum subjects derived from the disciplines learners could come to see how this content gets discovered and justified by experts, in addition to learning (about) the content itself. To use a once-common formulation from Anglo-American educational philosophy, knowledge has both its literatures (content) and its languages (disciplined procedures), and successful learning initiates learners into both (cf. Hirst, 1974). Of course, it is another matter as to how far this ever

actually occurred in practice within schools. The fact remains, however, that for educational philosophers as otherwise different as John Dewey, Israel Scheffler, Maxine Greene, Paul Hirst and Kevin Harris, the epistemological ideal for education has always been to promote the development of *knowers* as well as to transmit *knowledge*.

The broad epistemological model which has dominated school education since its inception has been the standard view of knowledge which has dominated Western thought since the time of Plato. This is widely known as the 'justified true belief' model. According to this epistemology, for A (a person, knower) to know that *p* (a proposition) A must *believe* that *p*, *p* must be *true*, and A must be *justified* in believing that *p* (see, for example, Scheffler, 1965).

This general model allowed for many variations, for instance in theories of truth (correspondence, coherence, pragmatist), in theories of reality (realism, idealism) and so on. But beneath all such variations, justified true belief has been the epistemological standard for two millennia, and has been applied (in a more or less particular way) to school curricular learning. The ideas canvassed in the body of this chapter pose a range of issues for this epistemology and for established educational practices based on it. We will identify and comment briefly on five points here, aware that what we have to say is at most a tenuous beginning to a pressing area of inquiry.

First, the standard epistemology constructs knowledge as something that is carried linguistically and expressed in sentences/propositions and theories. This is hardly surprising considering that for two millennia the modes for producing and expressing knowledge have been oral language and static print. To the extent that images and graphics of various kinds have been employed in texts their role has been, literally, to illustrate, summarise or convey propositional content.

The multimedia realm of digital ICTs makes possible—indeed, makes *normal*—the radical convergence of text, image and sound in ways that break down the primacy of propositional linguistic forms of 'truth bearing'. While many images and sounds that are transmitted and received digitally still stand in for propositional information (cf. Kress' notion of images carrying complex information mentioned above), many do not. They can behave in epistemologically very different ways from talk and text—for example, evoking, attacking us sensually, shifting and evolving constantly, and so on. Meaning and truth arrive in spatial as well as textual expressions (Heim, 1999), and the rhetorical and normative modes displace the scientific-propositional on a major scale.

Michael Heim (1999) offers an interesting perspective on this in his account of what he calls 'the new mode of truth' that will be realised in the twenty-first century. He claims that as new digital media displace older forms of typed and printed word, questions about how truth is 'made present' through processes that are closer to rituals and iconographies than propositions and text re-emerge in similar forms to those discussed by theologians since medieval times. Heim argues that incarnate truth as the sacred Word is transmitted through a complex of

rituals and images integrated with text-words. In the case of the Catholic church, for instance:

> communal art is deemed essential to the transmission of the Word as conceived primarily through spoken and written scriptures. The word on the page is passed along in a vessel of images, fragrances, songs, and kinesthetic pressed flesh. Elements like water, salt, and wine contribute to the communication. Truth is transmitted not only through spoken and written words but also through a participatory community that re-enacts its truths through ritual. (Heim, 1999)

The issue of how truth is made present in and through the rituals of the community of believers/practitioners has been an abiding concern of theologians for centuries. Is the presence of incarnate truth granted to the community through ritualised enactment of the sacred word real, or should it be seen as symbolic or, perhaps, as a kind of virtual presence? (*ibid.*). Heim suggests that this and similar questions take on new significance with the full flowering of digital media. If truth 'becomes finite and accessible to humans primarily through the word', he asks, 'what implications do the new media hold for the living word as it shifts into spatial imagery?' (ibid.).

Heim casts his larger discussion of these issues in the context of avatar worlds being constructed by online users of virtual reality (VR) software to express their visions of virtual reality as a form of enacted truth. (Avatars are graphic images or icons adopted by users to represent themselves in three dimensional worlds which are inhabited and co-constructed by other participants represented by avatars. As such, avatars are graphic extensions of the textual descriptors for online identities adopted by participants in earlier text-based MOOs, MUDs and MUSHs.) Heim speaks of participants realising and transmitting their 'visions' of virtual reality—the worlds they construct online—through what he calls the 'new mode of truth'.

A second challenge facing much established epistemological thinking concerns the fact that knowing has generally been seen as an act we carry out on, and truth has been seen as pertaining to, something that already exists. In various ways, however, the kind of knowing involved in social practices within the diverse spaces of new ICTs is very different from this. More than propositional knowledge of what already exists, much of the knowing that is involved in the new spaces might better be understood in terms of a performance epistemology—knowing as an ability to perform.

At one level we can understand this in terms of procedures like knowing how to make and follow links when creating and reading Web documents. At another level it is reflected in Lyotard's observation that under conditions of the changed status of knowledge the kinds of knowledge most needed by knowledge workers include procedural knowledge of languages like telematics and informatics, and knowledge of how to interrogate information sources. Of particular importance to

'higher order work' and other forms of performance under current and foreseeable conditions—including performances that gain attention—is knowledge of how to make new moves in a game and how to change the very rules of the game. This directly confronts some dominant assumptions in conventional epistemological thought, such as those concretised in normal science which presuppose stability in the rules of the game as the norm and paradigm shifts as the exception. While the sorts of shifts involved in changing game rules cannot all be on the scale of paradigm shifts, they nonetheless subvert stability as the norm.

Once again, it is important to note here that Lyotard does not endorse the state of affairs he describes any more than we endorse the features and patterns of practice described earlier. Rather, the operating logic is: 'if this is how things are, this is what follows from them'. Accepting the way things are and accommodating to them educationally and epistemologically is one option. Problematising them, however, is a different option. And it is the option we favour. But in order to problematise them they need first to be *named*. Lyotard names some of them and we have tried to name others—as a basis for problematising them and working toward developing considered epistemological and educational responses.

Third, practices involving new media help to identify weaknesses in traditional individualistic epistemologies which, following Descartes, have always existed. Problems with the notion that knowing, thinking, believing, being justified and so on are located within the individual person (the 'cogitating' subject) have become readily apparent in postmodernity. Theories of distributed cognition, for example, have grown in conjunction with the emergence of 'fast capitalism' and networked technologies (Castells, 1998; Gee, Hull and Lankshear, 1997). A further aspect is apparent in the role and significance of multi-disciplinary teams in 'imaging new moves or new games' in the quest for extra performance. The model of multi-disciplinary teams supersedes that of the expert individual as the efficient means to making new moves (Lyotard, 1984). In addition, we have seen that in the information-abundant world of the Internet and other searchable data sources it is often impossible for individuals to manage their own information needs, maintain an eye to the credibility of information items and so on. Practices of information gathering and organising are often highly customised and dispersed, with 'the individual' depending on roles being played by various services and technologies. Hence, a particular 'assemblage' of knowledge that is brought together—however momentarily—in the product of an individual may more properly be understood as a *collective* assemblage involving many minds (and machines).

Fourth, it is important to recognise that the role and significance of knowledge in the social conditions of postmodernity have changed in ways that should not be ignored by epistemologists and educationists. For a start, none of the three logical conditions of justified true belief is necessary for information. All that is required for information is that data be sent from sender to receivers, or that data be received by

receivers who are not even necessarily targeted by senders. Information is used and acted on. Belief *may* follow from using information, although it may not, and belief certainly need not precede the use of information or acting on it.

Furthermore, the 'new status' knowledge of the postmodern condition as described by Lyotard—knowledge that is produced to be sold or valorised in a new production—does not necessarily require that the conditions of justified true belief be met. This follows from the shift in the status of knowledge from being a use value to becoming an exchange value. For example, in the new game of 'hired gun' research where deadlines are often 'the day before yesterday' and the 'answer' to the problem may already be presupposed in the larger policies and performativity needs of the funders, the efficacy of the knowledge produced may begin and end with cashing the cheque (in the case of the producer) and in being able to file a report on time (in the case of the consumer). Belief, justification and truth need not come near the entire operation.

Even Gilster's account of assembling knowledge from news feeds stops short of truth, for all his emphasis on critical thinking, seeking to avoid bias, distinguishing hard and soft journalism and so on. The objectives are perspective and balance, and the knowledge assembly process as described by Gilster is much more obviously a matter of a production performance than some unveiling of what already exists. We assemble a point of view, a perspective, an angle on an issue or story. This takes the form of a *further* production, not a capturing or mirroring of some original state of affairs.

Once again, we are not endorsing, advocating or passively accepting the direction of these changes. We are identifying them as matters educationists have not to date taken sufficiently seriously. They prompt many questions. For example, if the accounts of features, patterns and growing significance of social practices involving new ICTs provided here are reasonably accurate, how are we to interpret and enact epistemological principles like commitment to truth, knowledge as a use value, the importance of following arguments and evidence where they lead and so on? What place is left for such principles in educational practices and everyday life, and do we need to shore up space for them? How should educationists respond to the fact that many teachers currently have no clear idea of what to do with the information new ICTs make available to learners? To what extent and in what ways should schools be seeking different operating conceptions of knowledge from those inherent in subject-based learning, and how do we decide what these are? What kind of mix and balance should we be seeking among propositional kinds of knowledge, procedural and performance knowledge, and how can curricula take account of this? What is the proper relationship between how learning is organised in school and 'insider' versions of social practices involving new ICTs occurring in the world beyond school?

Finally, so far as performances and productions within the spaces of the Internet are concerned, it is questionable how far 'knowledge' and

'information' are even the right metaphors for characterising much of what we find there. In many spaces where users are seeking some kind of critical assent to what they produce, it seems likely that constructs and metaphors from traditional rhetoric or literary theory—for example, composition—may serve better than traditional approaches to knowledge and information.

CONCLUSION

The digital age is throwing many of our educational practices and emphases and their underlying epistemological assumptions, beliefs, concepts and substantive theories into doubt. The relationship between what students learn in school and the ways in which they learn it and what people actually do and how they do it in the world beyond school in contexts increasingly mediated by new ICTs has become increasingly tenuous. There are many aspects of this which we have barely taken up here, including the extent to which mindsets associated with physical-industrial space and those associated with cyber-information space may be inherently different and, indeed, incompatible (Tunbridge, 1995; Bigum and Lankshear, 1998). Those aspects we have addressed here suggest that our capacity to understand what will be involved in making informed and principled responses to the conditions of postmodern life in computerised societies will depend greatly on our willingness to problematise and rethink *both* the role and significance of knowledge and truth within existing and emerging social practices and social relations *and* some of our longstanding epistemological investments. We need to rethink these each in relation to the other, and in relation to postmodern means of producing and enacting power. If this chapter does no more than encourage us to explore these claims further, it will have done its job.