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BUILDING CYBERSPACE

Information, Place and Policy

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Abstract. Information and place have always been linked. From prehistoric forest and hydraulic empire to canal network and the networked knowledge economy, the space of flows gives rise to the way human beings perceive the world as well as to the objects they perceive. The historical relationship between information and place is important in understanding Cyberspace as a space of information that reshapes our engagement with the physical world.

Information and Place

The purpose of this paper is to explore the ways that information and place interact. We will consider the ways in which information and place influence each other in the world today. On one level, this involves the way that the new information technologies affect our sense of place and space, and how they influence the policies we create to shape our environment. On another, and deeper level, this involves the ways in which the sense of place affects our way of understanding information. To understand this last, we must consider the ways in which place and space have shaped the way in which human beings know the world and themselves.

Indebted to Darwin

A creature swings through the branches of a tree. This creature has no sense of self. It might be male or female, but it doesn't think of itself that way. It hardly thinks of itself at all. What little thinking it does would not be recognizable to us as thought. Even so, this character is having a good day. The sun is up, food is plentiful and life is cheerful.

Here, in the branches of a leafy forest, light is a dull, rich green. The creature's eyes do well in this light. It sees everything going on around it, and it has reasonably good peripheral vision. Any flicker of motion at the edge of its peripheral range will bring a swift response to check on changes in the environment. Our friend will refocus swiftly to see what kind of threat or opportunity is about to enter its world. Thousands of sounds reach the creature's ears. These sounds help it to orient itself in time and space. They tell it what is going on in the world about. Sounds that have today's tone tell our friend that all is well.

The creature spies a tasty looking piece of fruit a couple of branches away. It skitters out to the end of a limb and leaps. Well equipped with stereoscopic eyes and depth perception, it orients itself properly in space, grabs the proper branch and gets the fruit it wants. If it remembers anything - which it may, in some rudimentary sense, be able to do - it might recall a cousin whose eyesight wasn't so good. That cousin didn't last long after leaving home. It reached for a branch one day, missed by a few centimeters and fell within reach of a hungry predator prowling the jungle floor. Our friend was terrified that day, climbing high and fast to get away from the commotion below.

The issue of depth perception never crossed its mind. Neither did any concept of its rich multiple sensory apparatus, senses that provided smell, taste, touch, balance and all the rest, along with sight and sound. This creature's sensory continuum was, in fact, one of the world's first attempts at multimedia. With a rich array of sensory tools fitted to the environment, the creature managed to survive and thrive. It passed these characteristics on to its offspring, and in that way shaped the ways in which its descendants would see and sense the world for millions of years to come.

This creature's ways of seeing and sensing eventually came together with a thousand and one further adaptations, some physical, some conceptual, and some in the final extensions of body and mind that we began to call tools when we developed language. Long before we invented tools and named them, however, these adaptations shaped a way of being and laid the basis for a way thinking. Many successful tricks of behavior and habits of mind came about by chance. Others were adopted by observation and analogy. Still others emerged through imitation in monkey-see, monkey-do fashion. One and another, these developments developed a creature that shaped itself and came eventually to shape the world around it.

I can't pretend to know that creature's name. If it had a name, it wasn't a name we'd recognize like we recognize Uncle Oliver or Aunt Eleanor. Even so, I know who that creature was. That creature was a distant relative of yours and mine.

The late avant-garde composer Nicholas Slonimsky told the story in one of his many almost-hit tunes titled: 'I owe a debt to Darwin. He made a monkey's uncle out of me.'

Our simian progenitor, whatever its name, was the genius of its genus. Everything we do from hearing tones to playing the piano to reading Slonimsky's sheet music is rooted in the physical adaptation to place that gave shape to our remote ancestor. So are our habits of mind, everything from the way we read these words and think them through to our ability to plan the environments we build. The characteristics our nameless ancestor developed in the course of its responsive adaptation to the environment made everything we do possible. In that sense, space and place shaped a great deal of human nature and in so doing, shaped the social world.

The Power of Place

Place - physical, environmental and context - have always been intimately connected with information. The very how and why of human knowing were influenced by place and space in the development of the human information and knowledge apparatus. The environment forms the context within which initially random adaptations create successful species. Success, in the sense of evolutionary development, is not purposeful. It simply means that a species is selected for survival by the environment on the basis of its physical and behavioural characteristics. Prior to human conscious adaptation, these characteristics generally developed through random genetic mutation. When a mutation proved well suited to the environment, the species survived and what had once been new genetic matter was inherited by descendants whose characteristics it defined. The human species and its predecessor species emerged in and adapted to a specific physical world. The physical world to which we adapted defined us.

Complexity theory (Aida et al., 1985; Casti, 1995; Waldrop, 1992) offers a rich series of explanations of how adaptation takes place. One of the salient paradigms of complexity theory is the notion of the way that complex adaptive systems shape their behaviour within what is known as a 'fitness landscape'. As complex adaptive systems fit themselves to the landscape, the context itself takes on different shapes and meanings. Complex adaptive systems include all biological creatures: plants, animals, individual humans. They also include the communities or societies that these creatures create. Their evolutionary paths move through time and history. Some vanish, others appear. Either way, there is no going back.

At some point in the relatively recent past, we developed the modern brain. The physical potential of this brain gave rise to our current habits of mind, the

habits that support our mental world. The forces that give rise to the modern mind go back over two and a half million years to the unknown moment when homo habilis manufactured the first tools. Four hundred thousand years ago, we manufactured spears. Forty thousand years ago, we moved up to specialized tools. It wasn't many thousand years before we were playing flutes, making art and manufacturing needles to sew the garments of the earliest fashion designers (Friedman, 1997, pp. 54-55; Ochoa and Corey, 1995, pp. 1-8).

We created the first external documentation and information systems some 20,000 years ago (Burke and Ornstein, 1997, pp. 29-30). Urban design and architecture came along some ten thousand years ago in Mesopotamia. Interior architecture and furniture design probably emerged with them. It was almost five thousand years more before graphic design and typography got their start in Sumeria with the development of cuneiform. Since then, it's been one innovation after another.

The externalized representation of knowledge through documentation and information created a new kind of human being. Even in the rudimentary form of what archeologists call the baton, a carved bone or antler, information tools began to 'reshape the way we think' (Burke and Ornstein, 1997, pp. 29-31). This was 'the first deliberate use of a device which would serve to extend the memory, because with it, knowledge could be held in recorded form outside the brain or the sequence of a ritual.' The relationship between these tools and the human mind is significant, in that 'the cognitive facilities needed to make the batons required a brain capable of a complex series of visual and temporal concepts, demanding both recall and recognition. These are exactly the same mental abilities which are involved in modern reading and writing.'

Defining the Terms of Discourse

One of the difficulties we typically encounter in the emergence of a discipline or a new conceptual framework is the use of terms. This is a particularly subtle problem since many terms in natural language are built on their relations one to the other in a recursive cycle of interdependent meanings.

To understand the way that information and knowledge influence shifting social patterns in an era variously called 'the information age' and 'the knowledge economy', it is helpful to conceptualize the several levels of data, information, and knowledge. Here, I will set forth some of the basic definitions of the words we will encounter in any discourse of information, place and policy. To make them manageable, I will attempt to structure a delimited meaning of the terms as I will use them, creating a hierarchy of meanings that rise from (1) the phenomenal world through (2) specific perceived facts taken from the physical world in the raw form known as data, through (3) data

structured and organized into information, which are, in turn, imbued with meaning to create (4) knowledge. Finally, I will raise the issue of a level of effective knowledge generally known as (5) wisdom.

It should be noted that the fuzziness of these terms makes it possible for other scholars to use the same words in somewhat different ways while attempting to articulate significant similar concepts. I will hold to the structure I present here, supported by a reasonable series of definitions.

On the first level, we find the world of phenomena, perceived and unperceived. The world of unperceived phenomena lies outside our consideration.

The perceived world generates data. Data can be described as facts used for reasoning, discussion, or calculation. It is also the information output of any sensing device or organ, and it may be useful or irrelevant, even redundant. Data also includes numerical information that can be digitally transmitted or processed. The salient feature of data is that it is raw information, unprocessed and therefore devoid of meaning (cf: Merriam-Webster, 1993, p. 293).

Data must be processed to be meaningful. Raw data are processed by the biological or mechanical apparatus. This translation gives them shape or form. Data, thus formed and given structure, become information.

Merriam-Webster defines information as:

> … 1: the communication or reception of knowledge or intelligence 2 a (1): knowledge obtained from investigation, study, or instruction (2): intelligence, news (3): facts, data b: the attribute inherent in and communicated by one of two or more alternative sequences or arrangements of something (as nucleotides in DNA or binary digits in a computer program) that produce specific effects c (1): a signal or character as in a communication system or computer) representing data (2): something (as a message, experimental data, or a picture) which justifies change in a construct (as a plan or theory) that represents physical or mental experience or another construct d: a quantitative measure of the content of information; specifically. : a numerical quantity that measures the uncertainty in the outcome of an experiment to be performed ... (Merriam-Webster, 1993, p. 599)

Closely linked to these definitions, we find a concept that has been linked with information throughout human history. The concept is knowledge. Information is formed, but it has not yet been endowed with meaning. Given form, data become information that, in turn, becomes a basis for knowledge.

The difference between information and knowledge is not always clear, but there are ways to divide them for the purposes of this study. Knowledge involves knowing something through experience or association and it is an acquaintance with or an understanding of any science, art, or technique. Knowledge involves being aware of something, and it describes the range or the limit of one’s awareness or understanding. Knowledge is also the total of what

is known, the comprehensive stock of truth, information, and principles of the human species. It involves facts or ideas acquired by study, investigation and research, and it can be acquired by observation or through experience (cf: Merriam-Webster, 1993, p. 647).

Gregory Bateson defines information in a way reminiscent of physical potential. His definition can almost be considered in the same way we consider the energy potential of an engine or a hydropower installation: ‘information is any difference that makes a difference’ (Bateson, 1984, p. 41).

Information is the potential to make a difference. The realized potential of that power is the difference between information and knowledge. This is so in the same way that water behind a dam represents the potential energy available for work while energy released as the water goes through the turbines is power. Frances Bacon, the sixteenth-century scholar and a founder of the scientific method, noted this difference in his Religious Meditations, Of Heresies, where he wrote that, ‘knowledge itself is power’ (in Mackay, 1991, p. 21).

Peter Drucker respects that difference, too, and describes the transformation of information into knowledge: ‘Knowledge is information that changes something or somebody - either by becoming grounds for action, or by making an individual (or an institution) capable of different and more effective action’ (Drucker, 1990, p. 242).

Choices establish the grounds for action. Choices are therefore the key to effective action. Here lies a difficult problem. We can’t always choose until we know; we can’t always know until we find ourselves in the appropriate situation that requires our knowledge; we can’t always orchestrate the proper situation until we’ve chosen. Johan Olaisen (1996) effectively describes this situation in his analysis of the philosophy of science applied to information science. Olaisen’s analysis outlines the challenges that every thinking person repeatedly confronts in the course of assembling the knowledge of daily life.

Olaisen states that one must navigate sensitively through four domains. The first is the domain of what we know that we know. The second is the domain of what we know that we don’t know. Navigating the third domain is more problematic, since it requires us to work with what we don’t know that we know. Navigating the fourth is the even more difficult, the domain of what we don’t know that we don’t know (Olaisen, 1996).

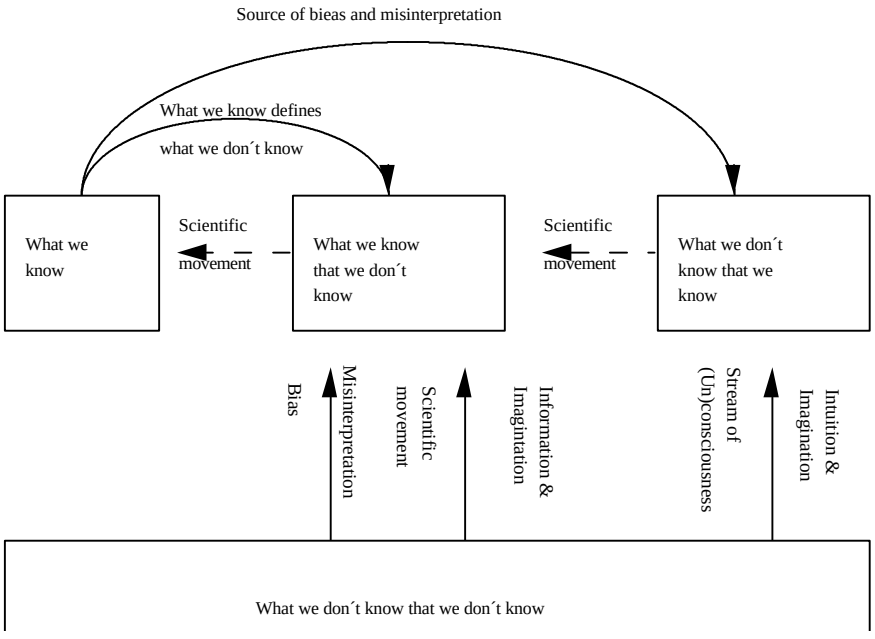

Figure 1. The scientific extension of human knowledge (source: Olaisen, 1996, p. 282)

Knowledge for effective action - including knowing when not to act - is wisdom. Wisdom has generally been a respected word in philosophy and theology. Scientific literature has shied away from it. Perhaps this is so because wisdom is located in the subjective mental processes of the human organism, either in the individual mind located in a single physical body or in the social mind located in a sociocultural body such as a tradition, a society or a community. The problem for many scientists is that these bodies of wisdom resist quantitative investigation.

Further, wisdom can be intensely personal, located at the boundaries of such existential and culture-bound concepts as authenticity, personal truth, or integrity. Even so, wisdom is the subject of a growing body of contemporary literature. It began in fields such as philosophy and psychology (Jourard, 1964; Maslow, 1962; Moustakas, 1967; Watts, 1951). It has extended to information science, informatics or social informatics (Johannesen, 1996; Olaisen, 1996).The concept has also become the subject for scholars in organization and management studies, those branches of scholarship most concerned with the consequences of effective decision making, and scholars in these fields are examining the question of wisdom.

Some scholars focus on knowledge management (Alvesson, 1995; Davenport and Prusak, 1997; McGregor, 1991; Myers, 1996; Nonaka and Takeuchi, 1995). Others study hybrid capital, the multiple and sometimes ambiguous forms of capital that include liquid capital, capital assets, human capital and the various forms of capital represented by processes, ideas, values and relationships (Hedlin, 1996; Polesie and Johansson, 1992). Intellectual capital is the frame of an increasing body of current literature (Brooking, 1996; Edvinsson, 1997; Fruin, 1997; Klein, 1997; Stewart, 1997; Sveiby, 1997). Some scholars even address the specific issue of managerial wisdom (Malan and Kriger, 1998).

Wisdom is knowledge made effective through integrated learning, values and action. It requires the ability to discern the qualities and relationships among things known and it demands insight. Wisdom is characterized by good sense and good judgment (cf: Merriam-Webster, 1993, p. 1358).

Place as Carrier of Information Traces

Space and place have always been linked with information. At first, place and space told us about themselves and served as their own maps. These

internalized maps were rooted in the landscape as the tangible factors that built our cognitive apparatus. Bruce Chatwin's Songlines (1987, p. 269) offers an example that reveals the way in which place shaped knowledge:

> The 'dry heart' of Australia ... was a jigsaw of microclimates, of different minerals in the soil and different plants and animals. A man raised in one part of the desert would know its flora and fauna backwards. He knew which plant attracted game. He knew his water. He knew where there were tubers underground. In other words, by naming all the things in his territory, he could always count on survival …

Issues of place affect more than the first peoples. They have affected the flow of civilization itself. We will return later to the questions implied by naming, that is, the question of mapping and representation. Here, we will consider the social structures and behavioural patterns that influence and arise from place in terms of their relationship to information.

Cities - like all human organizations - can be seen as information processing systems. The first cities emerged some ten thousand years ago. They began as villages and small conglomerations of people living near a cluster of farms. These conglomerations often became the focus of specialized skills and services, where the work of a specialist might be too much to supply any single farm but the specialist workers and craftsmen as a group together could well supply skills and services to a number of farms or communities around. They grew into towns and then into cities as societies grew larger and more complex, as social and cultural needs demanded more and more service, as the number and kinds of jobs began to proliferate requiring other and further kinds of services and workers to support them.

Cities were invented by a new kind of human being. This human being shifted from a hunter gatherer life or a nomad herding life to a life in one place as a result of the first agricultural revolution. The villages, towns and cities this revolution brought about created new societies and new behavioural patterns as a result of the systemic adaptive opportunities and demands that arose in response to a new kind of social complexity. These were the earliest traces of what has become modern information society. The new opportunities offered by the city enabled the management of large-scale agriculture, defence, commerce, communication, and transport.

Place also affected the way that human society moved, and many of those early traces remain as influential today as they were millennia ago. Consider, for example, the way in which the shape of the land so often affects boundaries, transport and the forms of human commerce that flow across and use them:

> Large rivers, highland barriers, dense forests form 'natural frontiers' with which, over time, political boundaries tend to coincide; the gaps between them are avenues along which armies on the march are drawn. Once through such gaps,

> however, armies rarely find themselves free to maneuver at will, even if no obstacle stands in their way. A more subtle geography comes into play, reinforced by climate and the season, and adapted by the road-maker and the bridge-builder, even if not by the fortification engineer. Thus the German Blitzkrieg into France in 1940, apparently an unconfined romp across open country once the tanks that led it had broken the barrier of the Ardennes forests and the River Meuse, turns out to have followed very closely the Route nationale 43, which for most of its length is the Roman road laid out soon after Caesar's conquest of Gaul in the first century BC. Neither the Romans nor those who built on their work made a point of quarreling with geography; we may infer, therefore, that the German tank commanders, whatever their illusion of pursuing a free trajectory, were in fact obeying topographical dictates as old as the last reshaping of the earth's surface in northern France, laid down at the retreat of the glaciers 10,000 years earlier. (Keegan, 1993, p. 71)

Space and place establish behavioural constraints. In one way, these constraints can be considered information. The well-known phenomenon of an incomprehensible bottleneck in a traffic flow is a perfect example. This often takes place at a site where an accident occurred or another obstacle recently took shape. Traffic slows down at the point of the accident or obstacle. Even after the damaged vehicles are pushed aside or the obstacle has been removed, traffic flow slows down at the point of the accident or obstacle, a behavioural constraint imposed by the flow of information that was once useful. The traces of this information remain in the system long after its uses are gone, sometimes causing distorted traffic patterns for hours after the wreckage has been cleared. This invisible behaviour becomes visible behaviour when we find ourselves slowing down at some point in the road that seems no different from the points before or after, nothing - to us - but a momentary and apparently meaningless jam in the traffic.

We see it, too, in the unplanned paths that emerge on every college campus and every major city park. Some of these patterns have existed for millennia where goats and sheep once went to ford a long-vanished stream. Others emerge when impatient students and faculty establish their own short-cut between two much-travelled points on a campus, breaching the tidy green of a well kept lawn. This behaviour irritates gardeners and gives birth to the annual memoranda on the subject of using sidewalks that all members of a college cheerfully ignore. Nothing less draconian than the Code of Hammurabi would prevent the development of unplanned paths, and few deans or park directors are permitted the use of capital punishment. One thing seems as likely a universal fact as can be found: if the eight-century university at Salerno had a quadrangle, it also had an unplanned path between the Department of Norman Studies and the Alchemy Lab.

Place gives shape and form to our behaviour, and it gives shape and form to our ways of thinking. This in-forming of thought through behavioural pattern in

the physical world was the first form in which pre-humans obtained information. The in-forming of thought in the physical world is still central to the relationship between our mental constructs and our behaviour, between our mental constructs and the physical worlds from which they arise, between our mental constructs and worlds of idea and experience they represent.

Habits of Mind

The Greek poet Simonides (556-468 BC) is reputed to have invented the art of memory (Boorstin, 1985, pp. 480-481; Rose, 1992, pp. 62-63; Yates, 1992, pp. 17-18). Simonides is also the first poet to have been paid for his services. In *De Oratore*, Cicero recounted the way in which both of Simonides's inventions came together. Simonides attended a banquet hosted by a noble of Thessaly. He had been hired to compose a panegyric in honour of his host. In this poem, he included a long passage honoring the divine twins, Castor and Pollux.

When it came time to pay, his host announced that since half the poem had honoured the two gods, he would pay the poet only half his fee. It would be up to Castor and Pollux, the host announced, to pay the balance.

Soon after, a message was delivered to Simonides that two men wanted to see him outside. He went out to speak with them. In his absence, the roof of the banquet hall collapsed, crushing the nobleman and all the other guests.

The corpses were so disfigured that it was impossible for the relatives of the dead to make the identification needed to bury the right bodies. Simonides, however, was able to help. He remembered by location which person had been seated at which place, and by mentally reconstructing the seating at the banquet was able to help relatives identify and bury their dead.

Afterwards, Simonides understood that he had been rescued from death by Castor and Pollux. This story offered three lessons. The first deals with generosity and the duties of a host. The second deals with proper honour to the gods. The third opened a new way of working, using place to anchor memory.

According to Yates (1992, p. 17)

> ... this experience suggested to the poet the principles of the art of memory of which he is said to have been the inventor. Noting that it was through his memory of the places at which the guests had been sitting that he had been able to identify the bodies, he realized that orderly arrangement is essential for good memory.

Cicero writes of Simonides that: 'He inferred that persons desiring to train this facility [of memory] must select places and form mental images of the things they wish to remember and store those images in the places, so that the order of the places will preserve the order of the things, and the images of the things will

denote the things themselves, and we shall employ the places and images respectively as a wax writing-tablet and the letters written on it'.

It is fitting that we best remember Simonides for his connection to a specific place. He wrote the epitaph at Thermopylae: 'Go tell the Spartans … that here, obedient to their laws, we lie' (Oxford, 1964, p. 502).

A century and a half after Simonides, Aristotle wrote that sequential memory was a paramount tool, stating (in Bailey, 1996, p. 64) that '... whatever has some order, as things in mathematics do, is easily remembered. Other things are remembered badly and with difficulty.'

Between Simonides and Aristotle, Socrates and his student Plato considered the issue of externalized memory in the then-recent technology of writing.

Socrates (Plato, 1998, unpaged) considered the problems of writing in his Phaedrus, where he describes the encounter between the god Thoth and the god Thamus. Thoth was a thinker: he had invented arithmetic, calculation, geometry, astronomy, draughts and dice. His great invention was the use of letters. He wanted to give letters and literacy to humankind
to make human beings wiser and to improve memory and intellect both.

Thamus was opposed to the idea. He opposed letters because he believed that letters would 'create forgetfulness in the learners' souls because they will not use their memories; they will trust to the external written characters and not remember of themselves. The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth. They will hear many things and learn nothing. They will appear to know everything and generally know nothing. They will be tiresome company, having the show of wisdom without the reality.'

Socrates's point was that writing 'pretends to establish outside the mind what in reality can only be in the mind ... writing reifies, it turns mental processes into manufactured things' (Rose, 1992, p. 62).

Socrates's view notwithstanding, it is this external characteristic that makes writing a powerful and useful invention. No longer is memory the key art in human thinking, and no longer are things remembered subject to the vicissitudes of biology, time and chance in the same degree as when memory was considered that art above all arts. While no externalized medium is perfect, the very act of externalizing writing and recording it gives memory a more stable quality than it had before. The human mind was freed for analytical work and many people were able to work on the same problem at the same time. This shift from an internal world to a distributed intelligence has characterized most of the great shifts of social patterns that accompany the new social technologies of communication. So, too, the pattern of telecommunication and information technology. The difference is that the new tools externalize farther and faster, and engage more people than ever before.

If, in other words, the text or document moves from ‘mental process to manufactured thing’, at the same time the ability of many minds to work together on the same problem - often at the same time - also strengthens the dimensions of the process itself.

Donald Norman (1993, p. 43) considers ‘the power of representation’. He notes that ‘the power of the unaided mind is highly overrated. Without external aids, memory, thought, and reasoning are all constrained.’ He goes on to state that we have ‘increased memory, thought and reasoning ... by the invention of external aids. It is things that make us smart.’

Norman (1993, p. 45) quotes Plato’s *Phaedrus* (1961) to address the issue of critical thinking. Norman reaches an intriguing conclusion. While Plato’s Socrates seems to be disturbed by the externalization of memory in the form of writing, one of his reasons is that it is impossible, as he sees it, to interrogate written text. Norman (1993, pp. 46-47) argues the contrary. Books make it possible for us to interrogate authors, to interrogate history, to externalize, represent and interact with ideas.

Socrates’s putative method was not designed for a robust exchange among equals, nor yet for the proper development of critical thinking in the young. It was, rather, an induction ritual in which an older man raises up a younger man in his likeness or pointedly dissects the fallacies of those whom he considers lesser men for the rather showy benefit of his acolytes. In pedagogical tone, Socratic dialogue is a catechism masquerading as critical thinking. It more closely resembles the Sumerian priestly culture that we will consider later than it does the culture of critical inquiry to which it supposedly gives rise.

This is for good reason: it is the externalization of memory and the free application of minds to represented thought that permits the process of growth from data to information to knowledge. It is, finally, the free play of mind through which a scholar may critically engage many authors and pose them one against the next and any against any other. The purpose of teaching is to help students develop method for inquiry and master the arts of analysis, rhetoric and logic by means of which comparison and critical inquiry proceed. On this basis, pupils become students, students become scholars, and scholars becomes independent and reflective thinkers. Socrates’s pupils may be informed - that is, Socrates may have shaped them - but they are unable to make knowledge their own.

The externalization of memory is a key point in several of Norman’s books and papers. Most significant among them is his (1990) classic, The Design of Everyday Things. Here, he considers the relationship between external environments and our representations of them as a primary and far too often neglected factor in usability.

The value of the externalized memory seems so thoroughly an aspect of human behaviour that it can nearly be termed ‘universal’. One professional has

tested this idea in as nearly a universal way as may be possible in today's world, developing a system of externalized memory for meetings and problem solving that he has tested in programmes involving men and women from over 240 different nations and territories. During his career as a strategy planner and process consultant in the telecom industry, Anders Skoe developed a series of problem-solving techniques that rely on the natural information-structuring capacities of the human mind. One of these is the use of flip chart sheets to track a meeting or problem in process. The difference between the way most people use flip charts and Skoe's system is simple but intensely effective. Rather than flipping each sheet which effectively conceals the contents of each past sheet as the meeting moves on, Skoe's system is based on tearing the sheets off during the entire process and posting them on the wall. This system forms an externalized group memory with several significant results.

First, the entire development and course of the meeting remains visible to all participants at all times. If a meeting runs several days, each day's flips are photographed with a Polaroid camera or digital camera for immediate printout by photocopy or PC printer. Skoe developed this technique in a specialized form now known as 'Instaminutes'. These Instaminutes permit new flip sheets to be posted during long meetings as wall space is used up while preserving the group memory in a form accessible to all. This leads to the second outcome, a perfect sequence of meeting records based on the real-time recording of information and process as it took place during the meeting itself. Since all transactions are recorded instantly and subject to immediate correction, no aspect of the process is lost. All facts are substantively visible and verifiable by all participants. For the first time in the corporate lives of most participants, meeting minutes are verifiable and corrected while the meeting is in progress. This means that no one need trust to memory for a proper record between meetings and it means that there is no need to correct and verify minutes at each subsequent meeting. This is externalized memory in its most pure form. The social dynamics that follow from this bring about a third key result. Data and information are common and lead to shared knowledge and better decision making.

It is not my purpose here to discuss this technique in detail. The point is to note the dramatic power of the externalized memory in an application conceived for human interaction that goes well beyond the power of interface and affordance. Interestingly, the technique was born in the urban planning profession. It began when two city planners were required to attend an extremely stressful meeting to discuss a neighbourhood transformation programme. To keep track of the events, they used huge sheets of butcher paper taped to the wall. They noticed that this technique enabled all present to track and follow the discussion far more effectively than most meeting techniques permitted. This brought about a far greater sense of participation and

understanding than normally possible, together with a richer sense of factual comprehension and common agreement on outcomes and results. This fortunate discovery became the core of what is now known as the interaction method. The method is described more fully in Skoe's works (1992; 1994; 1997; Nordby and Skoe, 1997), and in Doyle and Straus (1993).

Skoe himself has had the opportunity to test these methods across so many cultural groups that the claim of universality can be fairly well verified on an empirical basis. Between 1990 and 1998, Skoe conducted programmes for SITA, the International Society of Aeronautic Telecommunications. SITA is one of the world's largest telecom value-added private networks, serving the airline industry in every nation and jurisdiction served by the airline industry itself. During his work with SITA, Skoe conducted over 200 programmes with over 2,000 executives, managers and front-line professionals from 240 different nations and territories. He reports a common consensus on the value and outcomes of the externalized memory system. These findings were further verified in projects involving another 3,000 people conducted for Scandinavian Airlines System (SAS), the International Air Transport Association (IATA), the Norwegian national telecom authority now reorganized as Telenor as well as a host of smaller companies in the telecom, air transport and computer sectors.

Theatres of the Mind

The idea of an external memory goes back to classical antiquity. But if it began with Simonides, it took on new force in the Renaissance with the notion of the memory theatre and the memory palace. The memory theatre was a kind of building - a theatre, generally, with niches and places in which ideas could be placed just as Simonides located ideas in specific places. The rebirth of classical learning saw this concept take impressive hold among scholars, lawyers, rhetoricians and any who had reason to memorize large blocks of information. Some of the famous practitioners of this art were the scholar Erasmus, the alchemist Robert Fludd and the theologian and philosopher Giordano Bruno. This concept of mnemonic space evolved into a number of astonishing, elaborate systems. The most astonishing of these was developed by Matteo Ricci, a Jesuit missionary to China. Ricci offered entire 'memory palaces' to his hosts, as large and handsome and with as many rooms and hooks to hang ideas on as any individual might wish (Rose, 1992, p. 67; Spence, 1994).

In a sense, this art of memory was a way to structure knowledge. The issue of structured knowledge was so crucial to thinking, in fact, that an Italian who created physical memory theatres as an aid to learning the arts of memory was criticized by Erasmus for weakening the powers of mind that he purported to strengthen.

The art of memory can be seen as a metaphorical prelude to the issue of setting up a problem in the rudimentary forms of scientific method. This key to science was stated explicitly in the post-Renaissance rationalism of René Descartes, who 'was among the first to teach this idea: that the efficiency of information processing was contingent on how one set up the problem, and that how one set up the problem was in turn influenced by how one chooses to view the world. Viewing the world in ways that made the subsequent mental effort surer and easier was the essence of Descartes's famous Method' (Bailey, 1996, p. 65). The value of the metaphor is seen in Descartes's own statement that 'method consists entirely in the order and disposition of the objects toward which our mental vision must be directed if we would find out any truth' (Descartes, 1952, p. 7).

While there are sound arguments against the metaphor of the memory theatre as a prelude to the scientific method, there is no question that space and place function effectively to anchor information in the mind. It is not entirely possible to link the memory theatre to scientific method. Neither is it possible to accept the mystical claims that Giordano Bruno offered in his 1582 book on memory titled On the Shadows of Ideas, Circe. 'This is to form the inform chaos,' he wrote, '... it is necessary for the control of memory that the numbers and elements should be disposed in order ... through certain memorable forms ... I tell you that if you contemplate this attentively, you will be able to reach such a figurative art that it will help not only memory but also all the powers of the soul in a wonderful manner' (Bruno, in Boorstin, 1985, p. 486).

From Memory Theatre to Social Technology

At this point, I want to leap forward in time from the world of the memory theatre to the world of today's advanced information technology. This is a world of real memory devices, devices that translate memory into storage and transmission, and it is a world of a new-created inner space in which real-time interaction takes place along with the transactions of memory.

Giulio Camillo built a physical memory theatre of wood, filling it with physical artifacts intended as mnemonic devices. This was the project that Erasmus criticized (Rose, 1992, p. 68). One can imagine the perspective Erasmus might have on internet and cyberspace: scepticism and enthusiasm both seem likely, and for many of the same reasons any reasonable person must be both sceptical and enthusiastic about this new realm. Under any circumstances, it is a new realm, and to realize the value of cyberspace, one must realize the reality of cyberspace. It is a non-corporeal space that has physical ramifications.

Camillo's project was a false model made physical, devaluing the project of the memory theatre by reifying in physical form what was never meant to be physical. The entire programme of the memory theatre was a mental programme. Its goal was to permit any individual to carry a theatre, a palace, a world within the mind, taking it out for display and use whenever and wherever the user might wish. A physical memory theatre would hardly serve that purpose. Much like a map in one-to-one scale, the physical memory theatre would be so cumbersome that it and that to which it pointed would be identical and either would obviate the need for the other. A one-to-one map would hold the space it represented without the genuine sights, sounds, tastes. This is sometimes valuable in modelling, but not for most mapping. Camillo's theatre would be even worse. It would do more than merely replace the reality of ideas with all the internalized sights, sounds, tastes, and experiences that ideas represent. It would also take far more space than the ideas to which the physical template of the memory theatre offers a purported key.

Cyberspace is quite the contrary. It does not and cannot replace the physical world. Even so, it is a world of its own, a world keyed to the other worlds of idea and information through which we move. This has always been the case with human communication technologies and information technologies. This is so because they exist - and have always existed - in mind, in culture and in society as much as in the physical world.

Like all technologies, information technology is as much a social phenomenon as a technical development. The realization that all technologies are social in origin and in influence is a key issue in the writings of the French philosophy of history known as the 'Annales School' (Braudel, 1979, 1992a, 1992b, 1992c; Braudel and Matthews, 1982; Bloch, 1982, 1988; Febvre and Martin, 1997) . In the Anglophone world, the same issue has been explored by scholars in material culture and the history of technology (Flichy, 1995; Gimpel, 1992; Landes, 1983; McNeill, 1984; Needham, 1965; Needham, Ling, and de Solla Price, 1960; Ochoa and Corey, 1995; Pacey, 1992; Petroski, 1994), business history (Chandler, 1977, 1994; Drucker, 1990; Mokyr, 1992; Rosenberg and Birdzel,l 1986; Zuboff, 1988) as well as by those grand-scale thinkers whose frame - like the Annales School - is the progressive sweep of human social development (Bell, 1976; Boorstin, 1985; Rifkin, 1987; Schumpeter, 1981).

The social phenomenon emerges in our lives and our vocabulary under such rubrics as 'information society' and 'knowledge economy' and it is visible in a new conceptualization of social interactive space defined as 'cyberspace.'

Understanding the world of cyberspace requires many approaches, the multiple views that McLuhan labelled 'probes'. The metaphors of cyberspace are both spatial and mental. One of the best was coined in the early 1960s by Fluxus artist and poet Jeff Berner. He saw the world of inner space as a physical

metaphoric realm, and those who explored this realm, he said, are astronauts of inner space (Berner, 1965). The metaphor, originally constructed for an era of philosophical and psychological exploration, works well for the era of cyberspace. Many of the metaphors of the 1960s that have been translated into cyberspace were originally created for Zen culture and beat culture, Fluxus and intermedia, happenings and even psychedelics. The most robust survival traces back to Nam June Paik (1964, 1974). Well known as the George Washington of video art, he is also a distinguish thinker on media culture and mass communication. His metaphor of the 'electronic superhighway' was based on the United States interstate highway system and gave rise to such terms as 'the information superhighway' and 'the infobahn'. While he wrote with a revolutionary concept of television, Paik's conception of the new media society was rooted in a deep perception of Buddhist theology and the Hindu metaphysics that preceded it. His famous statement, 'We are in open circuits' (Paik, 1964) describes a reality equally applicable to the 24-hour, point-to-point, parallel path linkages of the World Wide Web.

Stephenson (1992) posited what he termed 'the metaverse,' a kind of cyberspace world that could be considered a glorified chat room with total-body surround made possible by sophisticated system of earphones and goggles that allowed individuals to live and act in a cyberspace peopled by iconic representations known as 'avatars,' a term that Stephenson coined to denote the self-selected images people could select or create to represent their personae and enact their deeds in the cyberspace of the metaverse. These avatars could be crude artifacts with little reality, rented by the hour. In appearance these down-market avatars are somewhat wooden icons like those we use today. They could also run all the way up to dramatically realistic or specially constructed representations created by talented hackers either for their own use or for sale to wealthy clients.

Stephenson later (1995) extended the metaphor to embrace a matter-management system in which feeds of data were used to shape raw, recyclable material into any desired form. Raw material was delivered in huge pipelines delivered to cities, societies and nations through a sophisticated future plumbing system. The real cost of anything in that world would be locked up in the software, the data and information around which any artifact would come to be structured.

Dan Simmons (1990, 1991, 1996) extended the concept in a different direction in his notions of the datasphere, the megasphere and the metasphere. The datasphere is the world of data surrounding a planet and through which all the planetary information flows. Linking many planets was a future telecom system equipped for transporting bodies and physical artifacts telematically as well as for communication of the sorts of information we can transmit today. The megasphere is the linked universe of many dataspheres, structured through

the world of instantaneous universal transmission. The metasphere is a mysterious, remote world operating above the megasphere, constructed and peopled by the artificial intelligences to whom the megasphere gave rise. The metasphere is nearly inaccessible to normal human intelligences, and it takes on somewhat divine or heavenly characteristics.

All of these, however contemporary or futuristic, draw their intellectual charge from the linkage between information space and physical place. For the reader, they draw their emotional and affective charge on the imaginary play of what it might be like to inhabit these worlds and travel between them ... and from the puzzles and paradoxes that we can imaginatively understand from an intellectual view of those future worlds contrasted with our physical and emotional understanding of the world today.

Information Places

Human beings have feared the conjunction of intelligence and physical place since the earliest times. One wonders if this is an echo of the love of a free life in the forest of our tree-dwelling ancestors and the later forest and savanna life of our remote humanoid forebears. Whatever the reason, the conjunction of intelligence and place has something to do with the cultural taboo against abandoning nomad ways for the tradition to city life. This is the Babel story.

As the Bible tells it, the nations of earth spoke once spoke a single language. The ability to communicate made cooperation on major technological programmes possible, a situation much like the use of Latin and later German as languages of science and technology, replaced today by the expanding use of English (Friedman 1995b). This use of common languages has always accompanied the growth of empires, and the concentration of knowledge, power, and economic force have always been paralleled by a concentration of cultural influence and language. In a sense, the space of flows can be said to have been established by the great hydraulic empires of the Asia - Middle East and Far East both - and of Egypt. In those days, however, the flows were the flows of water, carrying people, cargo and influence while making life possible through the flow of agriculture, government, commerce and military might.

This life was a dramatic contrast to the nomadic life of the monotheistic nomads. The city itself was the emblem of this threat. The urban dwellers decided to ‘build us a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth’ (Genesis 11: 4)

When the Lord saw this, he perceived it as a threat, not merely to his majesty in the heights, but to the very order of things. A tower that could pierce the heavens represented influence and majesty, and a city, a civilization able to

build such a tower could accumulate to itself power over the space of flows, a space previously dominated by the Lord of skies and rivers.

> "And the Lord said, Behold, the people is one, and they have all one language; and this they begin to do: and now nothing will be restrained from them, which they have imagined to do. Go to, let us go down, and there confound their language, that they may not understand one another's speech. So the Lord scattered them abroad from thence upon the face of all the earth: and they left off to build the city. Therefore is the name of it called Babel; because the Lord did there confound the language of all the earth: and from thence did the Lord scatter them abroad upon the face of all the earth." (Genesis 11: 6-9)

Woven into the dense fabric of this myth are four parallel themes. First, that technological cooperation requires a common language. This story echoes the pastoral stories of a common human heritage. It prefigures the project of a universal language and it bespeaks the common languages imposed on great empires. But it also speaks of a state of innocence, suggesting that those who share a common language are known to each other and acceptable to the Lord. The second theme is that through common language and cooperation, mankind generates knowledge. This knowledge is both godlike and a possible affront to God himself. This repeats the theme of the Eden story in another shape, and mankind is once again subject to punishment and exile for challenging the majesty and knowledge of the Lord.

Whether externalized in the form of letters or in the form of architecture, there has been a strange taboo against externalizing knowledge, a taboo that has also been a fascination. One wonders, perhaps, whether the issue is not so much a question of becoming god-like as it may be a fear that our creations will externalize and adapt us. In other words, a fear closer to the fear we feel for Frankenstein's monster than the fear we feel at daring to become gods.

Neal Stephenson's (1992) engaging cybernovel *Snow Crash* is built around an almost Biblical idea, pre-Biblical really, an idea anchored in the mythology of the Sumerian civilization. In this world, 'Primitive societies were controlled by verbal rules called me. The me were like little programs for humans. They were a necessary part of the transition from caveman society to an organized agricultural society. For example, there was a program for ploughing a furrow in the ground and planting grain. There was a program for baking bread and another one for making a house. There were also me for higher-level functions such as war, diplomacy and religious ritual. All the skills required to operate a self-sustaining culture were contained in these me, which were written down on tablets or passed around in oral tradition. In any case, the repository for the me was the local temple, which was the database of me, controlled by a priest/king called an en. When someone needed bread, they would go to the en or one of his underlings and own-load the bread-making me from the temple. Then they

would carry out the instructions - run the program - and when they were finished they'd have a loaf of bread' (Stephenson, 1992, p. 370).

For Stephenson's Sumerians, the 'word for "mind" or "wisdom" is identical to the word for "ear". That's all people were: ears with bodies attached. Passive receivers of information.' (Stephenon, 1992, pp. 371-372). The first, prehistoric hero of Stephenson's novel is a revolutionary en named Enki, not merely an en who received, controlled and passed on the me, but an en who himself could write new me. In Stephenson's (1992, p. 372) terms, he was 'a hacker. He was, actually, the first modern man, a fully conscious human being, just like us.'

Consciousness, in effect, arises from the ability to externalize which itself encourages the analytical senses. But Stephenson's Enki touches off a cosmic war that lasts down to our own era. This conflict is laden with the classic themes. These themes include the agricultural and city-building themes of hydraulic engineering and the classic Bible themes of knowledge, evil and sex. The exchange of bodily fluids links hydraulics and mythology into a post-modern narrative of a primal Prometheus figure.

This theme is the essence of Roger Shattuck's (1996) book, *Forbidden Knowledge*, an exploration that runs 'from Prometheus to pornography', and explores the themes of 'knowledge, curiosity, sexuality, the origin of evil and morality' (Shattuck, 1996, p. 15). Shattuck reminds those of us who have grown up watching the recent version of Frankenstein that it was not the monster played by Boris Karloff or Robert De Niro who was the threat to our better nature, but Dr. Frankenstein. Mary Shelley titled her original book, Frankenstein; or, the Modern Prometheus.

Our greatest and most original sinners have committed the sin of seeking knowledge: Prometheus, Eve, Faust, Frankenstein. Sex was not the original sin. Adam and Eve were not expelled from Eden for sexual crimes. They were expelled because they sought knowledge.

In writing the eviction notice, God said, 'Behold, the man is become as one of us, to know good and evil' (Genesis 3: 22). We read in God's words the notion that Bacon (in Mackay, 1991, p. 21) echoes: 'knowledge is power'. The grand sinners sought knowledge. More than this, they sought to externalize knowledge, place it in human hands and subject it to human control.

Plato's Socrates was a primitive, a traditionalist who acted as though he believed that wisdom belongs to an elite few who develop their wisdom through conversation and tutelage at the feet of the elders. If Socrates was a lover of wisdom, he was no democrat and neither was Plato. (It is sometimes forgotten that Socrates was accused not merely of corrupting the youth, but of fomenting treason against the Athenian state, and he was not condemned to death, but given the choice of death or exile.) Socrates believed in the priesthood of knowledge, and like the Sumerian *en*, he felt that only the priesthood could be trusted with the me on which civilizations are built. Enki and Thoth, on the

other hand, were early Luthers whose goal it was to place the sacred word in the hands of every citizen, noble and common, male and female alike.

One may, indeed, question Frankenstein's sin - the sin of seeking eternal life - but the rest of the great sinners and problematizers, from Thoth and Prometheus to Enki and Luther they sought knowledge and sought to distribute it widely.

The great library at Alexandria was a museum, a temple and university rolled into one. It is not coincidental that the pyramids and the first temples were places for the storage and transmission of information. The Masonic craft of building cathedrals had a great deal to do with coded forms of information. Masters, journeymen and apprentices created the codes through their work. They also created the coded forms of information, the data storage and transmission systems passed the encoded information onward through statuary symbolism, labyrinths, the icons and images of altars and widows and more.

The first global economy was the economy of the church, a force that spread over the boundaries of nations and of empires. Today's distributed multinational corporations echo the large transactions of the great religions. The transmission points - churches, temples, mosques - link the physical and the informational.

Just as place and information are linked, so are places and feelings. Effective information structure draw on both. Thus it is that intelligent correspondence mimics conversation. In the world of e-mail communication, there was a brief attempt to transact feeling through the use of those cheerful little character constructions known as 'emoticons'. The idea was the emoticons would help where mere words didn't.

From my perspective, this was a mistaken view based on false analogies. Words alone can, indeed, convey emotions. They do so through description, through mimesis, through the use of human intelligence to construct an empathic understanding of the world experienced by others when described in common vocabulary. Shakespeare, Sophocles, and Ibsen all communicated through words. Even more to the point, all three found and find audiences among those who have not seen their plays. I have seen a number of Sophoclean tragedies and I have been deeply moved. I have read them all, and feel myself into the world of the protagonists every time. I have seen half a dozen Shakespearean plays live and two or three on film. I have read them all and lived the world of the actors.

Writers from Homer and Snorre Sturlusson to Søren Kierkegaard and Ursula Kroeber LeGuin understand the magic and the power of words. Effective on-line communication mirrors face-to-face communication just as effective letters do. The failure of much on-line communication lies not in the weak powers of the medium of words, but in the fact that the instantaneous speed with which one can send and reply to e-mail sometimes give rise to laziness. The cure is time, and many good e-mail correspondents actually write their documents in a

word processor program as they would write a letter, developing, changing, editing, and polishing, before copying the letter into an e-mail document for posting.

In text and in thinking both, good information is like good art and good science. It reflects reality. The virtual reality of cyberspace is based on the physical reality of the space into which our physical bodies are born.

The cityscape and the landscape are the physical spaces within which cyberspace is anchored. The space of flows moves through channels of communication laid down by geography, and if the space of flows contains neither odour nor taste, it bears language and culture together with sight and sound.

Cyberspace is also coming to influence the physical world as the concept of interaction between physical space and conceptual space becomes ever more visible. One example is a recent conference titled ‘Scripted Spaces’ at the Art Center College of Design in Pasadena. The conference, held in April 1998, covered the subjects of ‘Entertainment Design, Narrative Architecture, and Virtual Environments’ (ITA, unpaged). The conference announcement considered the issue of the scripted environment by noticing and - in an important sense - denying the distinction between exterior world and interior environment, the physical and the psychological.

The conference was planned as a ‘discussion about how space can be designed to tell a story, moving from malls (think Universal City Walk) to theme parks (Disneyland as the granddaddy of them all), from special effect-driven blockbusters to the latest in computer games like Riven.’

The space of flows, at first physical, now becomes physical again and it bends and stretches the social and economic world around it. But these worlds in their union create strange new morphologies. Many writers note the possible futures with alarm. Others interpret the current moment in alarmist terms. Saskia Sassen (1991, 1994, 1997) has seen things in a more balanced perspective. She outlines the huge transformative qualities of the space of flows as it translates into physical, economic and informatic. Her reading of the current situation reminds one of the grand historical narratives of Needham on science and technology in China, of Schumpeter on innovation and progress, of Chandler on the history of business and industry or of the Durants on philosophy.

The judicious conclusions of a careful narrative are serious and somewhat terrifying, all the more awesome because they represent events already in place and under way. The change to societies and economies in a change of the space of flows is always dramatic. Consider, for example, the revolutions that came about to the economy and the socio-political environment in America’s first two great flow mechanisms, the Erie Canal and then the railroad.

The canal transformed the face of America, guaranteed one city economic supremacy as a port of entry and two others an early lead in the race for industrial supremacy. It revolutionized freight rates, destroyed more expensive methods of transport, and energized the economic life along its path. The calm, slow-moving waters of the Erie Canal changed the face of America far more effectively than any raging flood had ever done. 'Freight rates dropped to one-tenth what they had been before the canal, and business boomed all along the towpath. In the first years, revenue repaid the cost of construction, guaranteed the supremacy of New York as prime entry port to Americas, carried twelve hundred immigrants a day to Detroit and turned Chicago from a village into a city' (Burke, 1996, p. 84).

Twenty years later, a new revolution brought about by yet another new technology made 'the Erie Canal (and every other canal) instantly obsolete. It was railroad, and it beat canals hands-down because it provided a more direct route, was cheaper to build over rugged terrain, didn't need a constant supply of water, was less expensive to main and, most important of all, was the first-ever form of freight transportation to move faster than horse-drawn barges' (Burke, 1996, p. 84).

There are some inaccuracies in Burke's analysis of the superiority of railroads over canals. Canals still have uses in appropriate situations. Rivers are huge, natural canals. And the speed advantage of the train only applied to overland transport: the fast sailing ship had moved faster than the horse for thousands of years. Even so, the point is well taken.

Moreover, the different forms of technological development encouraged each other, creating the framework within which advances could be made and linked: better chemistry and engineering skills led to the improved metals that created possibility of better engines which in meant better transport. This, in turn, called for better time-keeping and a dramatically better industrial organization that shaped better factories which again gave rise to better engineering and better metallurgy.

Rosenberg and Birdzell (1986, p. 151) note that 'from about 1830 on, the construction of railroads and the construction of factories moved in tandem. This was inevitable: the Industrial Revolution was of necessity also a revolution in transportation; in the supply of raw materials and food - in mining forestry, and agriculture; and in trading specialties: wholesaling, retailing, commodity traducing and finance.'

These spaces of flows, at first physical, necessitated an information revolution in the form of time-keeping. These spaces would finally pave the way for the converging world of information, commerce and telecoms that we know today. 'In the nineteenth century, [the Industrial Revolution] also became a revolution in communication. The invention of the telegraph, the laying of the Atlantic Cable in 1859, and the application of steam power to the printing press

(which led to cheaper books and daily newspapers whose readers numbered in the hundreds of thousands) revolutionized communication long before the invention of the telephone and radio ... where the railroad improved communication by speeding the movement of mail, the telegraph and then the telephone permitted even faster - indeed almost instantaneous - communication in nearly every part of the nation' (Chandler 1977: 89).

So it is that information, place and policy intersect in the space of flows, the space that is synonymous with cyberspace. Building cyberspace is a technological programme, but building cyberspace is a social and cultural project in even greater dimension. It is important not merely because it is new and exciting, though it is. It is vital not merely because it shifts the energies of business and changes the gearing ratios on the wheels of commerce, though it does. Cyberspace is important because, more than anything else, it is changing the quality and structure of the physical world in which we live.

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