not only in societies, states, economies, families, sexes, but also in species, bodies, brains, weather patterns, ecological systems. There is turbulence at so many scales that reality itself seems suddenly on edge. Centers are subsumed by peripheries, main-streams overwhelmed by their backwaters, cores eroded by the skins which were once supposed to be protecting them. Or-ganizers have found themselves eaten up by whatever they were trying to organize. Master copies lose their mastery, and every-thing valued for its size and strength finds itself overrun by microprocessings once supposed too small and insignificant to count.

nets

Of all the media and machines to have emerged in the late twentieth century, the Net has been taken to epitomize the shape of this new distributed nonlinear world. With no limit to the number of names which can be used, one individual can become a population explosion on the Net: many sexes, many species. Back on paper, there's no limit to the games which can be played in cyberspace. Access to a terminal is also access to resources which were once restricted to those with the right face, accent, race, sex, none of which now need be declared. Using the Net quickly became a matter of surfing, a channel-hopping mode facilitated and demanded by information which is no longer bound together in linear texts or library classifica-tions, but instead needs to be laterally traversed.

As the system began to spill out into wider academic usage over the course of the next twenty years, other networks also emerged. Businesses developed local, and then wide area net-

works; commercial on-line services appeared; electronic mail
and bulletin boards proliferated alongside fanzines and the
samizdat press. While the network was doubling in size every
year, the screens were gray, the options limited, and the number
of users relatively small until the late 1980s. Access was hardly
limited to students, hackers, and academics, but certain skills
and commitments to computing were prerequisites of any tan-
gible input into the system, and the users of the network occu-
pied a strange frontline between state institutions and anarchic
private use. In the wake of a massive expansion of the Net, the
arrival of cybercafes, public terminals, falling costs, and a com-
plex of other economic and cultural tendencies, use of the Net
has grown not only in the West but in almost two hundred
countries of the world. Usenet gives readers and writers access
to thousands of articles in thousands of threads in vast popula-
tions of newsgroup conversations, continually adding to them-
selves and fading out of use. On-line worlds scrolled down the
screens in IRC (Internet Relay Chat) networks, MUDs (Multi-
User Dungeons, or Domains), and MOOs (MUDs Object Ori-
ented), where softbots—software robots—and pseudonymous
users interact in labyrinthine virtual worlds. With the develop-
ment of the World Wide Web, a user-friendly, interactive, mul-
timedia interface which uses Hypertext Markup Language
(HTML) to map and interlink the information on the screen to
another, and in principle, *any* other site, the Net gained both a
gleaming corporate mall, and also a degree of interconnectivity
which has continually drawn more computers, pages, links,
users, and characters into a network which soon hosted gal-
leries, libraries, shopping malls, company showcases, S&M dun-
geons, university departments, personal diaries, fanzines . . .
every page linked to at least one other, sometimes hundreds,
and always proliferating.

The Net has not caught up with the more expansive hopes of unfettered, free-flowing information which were once attached to it. But the technical potential it opens up comes close to the enormous system of lateral cross-referencing which the hypertext networks Ted Nelson first named *Xanadu* in the 1960s, and the system Vannevar Bush called the *memex* in the 1940s. Both these conceptions were far more interactive than the system of the mid-1990s allows. The user of Bush's imagined system left "a trail . . . of interest through the maze of materials available," adding links and connections, inserting passages, and making routes through an immense virtual library whose composition continually shifts as a consequence of the activity of those who are using it. Ted Nelson's envisaged system, which, to some extent, has been realized by the World Wide Web, has the enormous advantage of facilitating this same level of influence with the introduction of (very) small payments of electronic cash for the use of material on specific sites. With the flat-rate subscription system currently in place, links have to be deliberately made and do not, as with pathways across a field of grass, emerge from the sheer force of numbers making them.

As well as potentially facilitating new modes of information circulation, this grass-roots commerce poses great threats to the corporate interests currently in play. But if large-scale commercial activity tends to turn the Net into a shopping mall, it had its beginnings in 1969 as ARPAnet, a U.S. military defense project which quickly joined cockroaches on the short list of those most likely to survive nuclear attack. Developed at the height of the cold war, the Net had also learned from the Viet Cong, whose networks of tunnels and guerrilla techniques had forced a centralized U.S. military machine to adopt unprecedented tactics of distribution and dispersal in response. These military influences on the Net are betrayed in its messages'

ability to route and reroute themselves, hunting for ways round
obstacles, seeking out shortcuts and hidden passages, continually
requisitioning supplies and hitching as many rides as possible.
The network and its traffic are so dispersed that any damage to
one part of the system, or even a particular message, will have
little effect on the whole machinery. Information is transmitted
in packets which rarely take the same route twice, and may take
many different routes to a destination at which they weave
themselves together again. Maps of the network cannot be
stolen, not because they are closely guarded, but because there is
no definitive terrain. Any map adds to the network and is always
already obsolete.

The growth of the Net has been continuous with the way
it works. No central hub or command structure has constructed
it, and its emergence has been that of a parasite, rather than an
organizing host. It has installed none of the hardware on which
it works, simply hitching a largely free ride on existing com-
puters, networks, switching systems, telephone lines. This was
one of the first systems to present itself as a multiplicitous,
bottom-up, piecemeal, self-organizing network which, apart
from a quotient of military influence, government censorship,
and corporate power, could be seen to be emerging without
any centralized control. Not that such lateral networks or boot-
strapped systems have "an irresistible revolutionary call-
ing . . ." The leading corporations are now expending all
their energies on processes of molecularization and virtualiza-
tion, continually downsizing and turning themselves into flat-
tened horizontal operations and, in effect, getting all such
modes of activity on their side. No matter how spontaneous
their emergence, self-organizing systems are back in organiza-
tional mode as soon as they have organized themselves.

This conflict is inscribed in the double-edged quality of

Technology !

the word itself. Technology is both a question of logic, the long arm of the law, *logos*, "the faculty which distinguishes parts ('on the one hand and on the other hand')," and also a matter of the skills, digits, speeds, and rhythms of techno, engineerings which run with "a completely other distribution which must be called nomadic, a nomad *nomos*, without property, enclosure or measure." The same ambivalence is inscribed in the zeros and ones of computer code. These bits of code are themselves derived from two entirely different sources, and terms: the binary and the digital, or the symbols of a logical identity which does indeed put everything on one hand or the other, and the digits of mathematics, full of intensive potential, which are not counted by hand but on the fingers and, sure enough, arrange themselves in pieces of eight rather than binary pairs.

The techno and the digital are never perceived to run free of the coordinating eyes and hands of logic and its binary codes. But logic is nothing without their virtual plane. They are the infrastructure to its superstructure: not another order of things, but another mode of operations altogether, the matters of a distribution which is "demonic rather than divine, since it is a peculiarity of demons to operate in the intervals between the gods' fields of action . . . thereby confounding the boundaries between properties."

"You know I am a d——d ODD animal! And as my mother often says, she never has quite yet made up her mind if it is the Devil *or* Angel *that watches peculiarly over me; only that it IS one or the other, without doubt!*

"(And for my part, I am quite indifferent which.)"

Ada Lovelace, December 1841

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digits

The vast majority of what are now assumed to be the West's mathematical terms and axioms are either Arabic or Hindu. The word algebra is taken from the title of the *Al-gebr we'l mukabala,* a book written in the ninth century by one of the most sophisticated Arab mathematicians, Alkarismi, who gave his name to the algorithm. The *Al-gebr* is in turn based on the work of Brahmagupta, a Hindu mathematician and astronomer who, in the seventh century, consolidated India's sophisticated but unwieldy arithmetical principles in the form of twenty basic processes "essential to all who wish to be calculators."

The system of notation and calculation which emerged from this fusion of Hindu and Arabic arithmetic was introduced to the West by both Arabic scholars and Asian traders. Indian arithmetic had already been carried by merchants as far west as Baghdad, and Alkarismi's own arithmetical prowess is said to have resulted from his own travels in India. It was a great space-saving device when compared to its far more cumbersome counterparts, most of which had been developed in conjunction with the abacus, a device which was unknown to Hindu culture, but had been widely used in the Egyptian, Babylonian, Greek, and Roman worlds. While the abacus had removed the need to process and store numbers in concise written form, India had developed a sophisticated system of notation which it used both to calculate and record results.

India had effectively developed a written abacus, using its written numbers in place of pebbles or beads, giving them the same signs regardless of the positions they assumed, and using 0