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Three Propositions on Informational Cultures

THE MEANING OF INFORMATION

Is there an informational quality that defines twenty-first century culture – a quality that makes such culture unique, that gives it, so to speak, its most characteristic and peculiar trait? Such a question would appear to be based on two problematic assumptions: in the first place that there is something like *a culture* that defines a century; and, above all, that we do know what such informational quality is about – that is, that we do know the 'meaning of information'.

If the notion of *a culture* raises important questions about the relationship between the heterogeneous and the homogeneous, the idea that we do not know what information is might appear as less of an issue. After all, information has become such a common word and is used so freely and with such ease that we should have no problem at all in defining it. We know at least two things about information: that it is the content of a communication act; and that there is something less than material about it – at least judging from the ease with which it goes from mouth to ear and ear to mouth. This immateriality of information has been further amplified by technical developments that have made possible the instant transmittal and multiple distribution of any type of information at all (images, sound, music, words, software, statistics, projections, etc.). It is this ease of copying, it has been argued, that makes of information such a shifty and yet valuable commodity. We know that information can be sold and bought and that a good deal of the world economy is driven by an emphasis on the informational content of specific commodities and we are also aware that information itself can be valuable (when it is used for example to make a profit in the stock market). We know that anybody is always potentially an information-source or even an information-storage device and that science suggests that information constitutes the very basis of our biological existence (in as much as, we are told, we contain information that can be decoded within our very cells). In all these cases, information emerges as a

content, as some kind of 'thing' or 'object' but one that possesses abnormal properties (ease of copying and propagation, intangibility, volatility, etc.) that contemporary technological developments have exacerbated and amplified.

These features of the informational commodity have opened all kinds of issues around the question of *rights* in the digital age – and more specifically the right to own and copy information. Thus we have a political struggle around the right to keep medical information private; the right not to have one's personal correspondence or data monitored and/or sold; the right to copy and distribute music and video over the Internet; the right to make low-cost copies of patented medications in cases of national health emergencies (such as the AIDS epidemics in Africa); and the right to profit from information that has been produced at great cost to the producer. In all these cases, however, information is still treated as a content of a communication – a content to be protected whether in the interests of individuals, institutions, companies or the commonwealth at large. Surely, if there is a political struggle around information at all, then it must be about issues such as copyright and intellectual property. As far as the rest of contemporary culture is concerned, surely it must be business as usual – with the usual conglomerates and political parties trying to manipulate media representations for their own hegemonic purposes.

And yet, useful and important as such struggles are, they do not really address for us the larger problem of the relation between 'culture' and 'information'. Information, that is, might be more than simply the content of a communication. We are no longer mostly dealing with information that is transmitted from a source to a receiver, but increasingly also with informational dynamics – that is with the relation between noise and signal, including fluctuations and microvariations, entropic emergencies and negentropic emergences, positive feedback and chaotic processes. If there is an informational quality to contemporary culture, then it might be not so much because we exchange more information than before, or even because we buy, sell or copy informational commodities, but because cultural processes are taking on the attributes of information – they are increasingly grasped and conceived in terms of their informational dynamics.

It is thus important to remember that, as a historical concept pointing to the definition, measurement, analysis and control of a mathematical function, information does not coincide with the rise of a digital media system. On the contrary, the appearance

of information theory parallels the emergence and development of modern mass media such as telegraphy, telephony, radio and television. Unlike previous media such as print and writing, modern media, in fact, do not use the code of a workaday language, but 'make use of physical processes which are faster than human perception and are only susceptible of formulation in the code of modern mathematics'.[1] We could refer to the informatization of culture as starting with the analogue function of *frequency*, that is with the encoding of sound in the grooves of a gramophone record, where speech phonemes and musical intervals were recognized for the first time as complex frequency mixtures open to further mathematical analysis and manipulation.[2] For Friedrich Kittler, it is also with telegraphy that information, in the form of massless flows of electromagnetic waves, is abstracted for the first time. In this sense, information is not simply the content of a message, or the main form assumed by the commodity in late capitalist economies, but also another name for the increasing visibility and importance of such 'massless flows' as they become the *environment* within which contemporary culture unfolds. In this sense, we can refer to informational cultures as involving the explicit constitution of an *informational* milieu – a milieu composed of dynamic and shifting relations between such 'massless flows'.

And yet, one could suggest that these massless flows are far from being immaterial (or at least not in the sense in which the term is used, that is in the sense of something that is not quite of this world). An assessment of the informational dynamics of culture forces us to confront/address the analytical and political categories informing our understanding of cultural politics and its relation to the informational quality identified above. In the English-speaking world in particular, the last 30 years have seen a predominant focus on analytical categories such as meaning, identities and representation opening up onto a cultural politics of *identity, representation,* and *difference*. The question of media and communications has thus been related mainly to the problem of how a hegemonic consensus emerges out of the articulation of diverse interests; and how cultural struggle is waged within a representational space, marked by the relationship between self and other, or the identical and the different. The political dimension of culture has thus been conceived mainly in terms of *resistance to dominant meanings;* and the set of tactics opened up have been those related to the field of representation

and identity/difference (oppositional decodings; alternative media; multiple identities; new modes of representation).

The emergence of informational dynamics has thus caught the more militant strands of media and cultural theory as if by surprise. Information is no longer simply the first level of signification, but the milieu which supports and encloses the production of meaning. There is no meaning, not so much *without* information, but *outside* of an informational milieu that exceeds and undermines the domain of meaning from all sides. Unless we want to resign ourselves to the notion that culture has been made immaterial and transcendent by an informational deluge, we need to reassess the ways in which we understand the relationship between culture, power, and communication. What is proposed here is that an engagement with information theory is rich in analytical insights into the features of contemporary cultural politics where such informational dynamics are increasingly foregrounded. In particular, it allows us to move away from an exclusive focus on meaning and representation as the only political dimension of culture. In as much as communication is not simply the site of the *reproduction* of culture, but also that of an indeterminate production crossing the entirety of the social (from factories to offices to homes and leisure spaces), it also constitutes a kind of common informational milieu – open to the transformative potential of the political.

Keeping these questions in mind, in this chapter we will focus on the 'meaning' of information. In particular, I will turn to information theory (and specifically the early work of Claude E. Shannon and the cyberneticians) to catch the points where information ceases to be simply the content of communication and gains, so to speak, a body – that is a materiality in its connection with the world of physics, engineering and biology. I will thus isolate three definitions of information as related by Shannon's 1948 paper: information is defined by the relation of signal to noise; information is a statistical measure of the uncertainty or entropy of a system; information implies a nonlinear and nondeterministic relationship between the microscopic and the macroscopic levels of a physical system. These hypotheses are the basis out of which Shannon built his mathematical definition of information, but they also offer some other interesting considerations or *corollaries* on informational cultures. These corollaries suggest that within informational cultures, communication is crucially concerned with the problem of noise and contact; that the cultural politics of information are not only about

privacy, property and copyright, but also open up the question of the *virtual,* that is the relation between the given and the (allegedly) unlikely; that information flows displace the question of linguistic representation and cultural identity from the centre of cultural struggle in favour of a problematic of mutations and movement within immersive and multidimensional informational topologies.

INFORMATION AND NOISE

> The fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point.[3]

Proposition I: Information is what stands out from noise
Corollary Ia: Within informational cultures, the struggle over meanings is subordinated to that over 'media effects'
Corollary Ib: The cultural politics of information involves a return to the minimum conditions of communication (the relation of signal to noise and the problem of making contact)

As elaborated by the researchers working for telecommunication companies in the first half of the twentieth century, information theory is fundamentally concerned with the accurate reproduction of an encoded signal. The reproduction of information is at the heart of the communication process in as much as the latter fundamentally involves the accurate reproduction of a pattern from a sender to a receiver through a channel. If such information is transmitted accurately, that is with minimum distortion and corruption, then the communication act can be said to have been successful. If the information is distorted or does not reach its destination, then the communication act has been unsuccessful. The new techniques of communication management are crucially concerned with the relation between signal and noise with the explicit intent of generating a 'media effect'. The nature of such media effects, however, needs to be reconsidered within the larger context of an 'informational milieu'.

In order to better understand the implication of introducing an informational perspective into our evaluation of culture, we need to engage with information theory in more detail. The modern scientific concept of information has a mixed and hybrid genealogy, at the crossing of science and engineering, involving a cross-disciplinary dialogue between physics, mathematics, biology and even sociology

(in its positivistic, 'social physics' version). A rigorous mathematical theory of information, however, was developed only in the 1940s by members of the cybernetic group and by engineers at AT&T's Bell Laboratories (and in particular by R.V.L. Hartley, Harry Nyquist, and Claude E. Shannon). For Jérôme Segal, the milieu of communication engineers working in corporate labs in the United States was particularly rife for such technical and scientific breakthroughs. On the one hand, the US engineers did not share the narrow vocational focus that kept their European peers within the social hierarchy of a theory/practice divide. North American telecommunication engineers had been trained in physics departments (for example, on MIT's *Electrical Engineering* course) and had thus a good knowledge of the most abstract and complex physics debates.[4]

On the other hand, US communication engineers were also confronted by complex problems of speed and accuracy in signals transmission posed by the large telecommunication networks of the United States, where signals had to be repeatedly relayed before reaching their destinations. It would also be hard to underestimate the importance of the internationalization and interdisciplinarization of science during and immediately after World War II – a process that provided the material circumstances for the constitution of a theory of information linking physics, statistics and telecommunications and that prepared the ground for the informatization of life in molecular biology. The concept of information was part of research taking place within the field of 'communication and control engineering' – a branch of engineering that depended on a larger theory of messages involving the contribution of linguistics and cryptoanalysis to the understanding of communication codes. Norbert Wiener went so far as to argue that the difference between the older field of power engineering and communication engineering marked a shift from the long nineteenth century of the industrial society to a new cybernetic age of communication, command, and control.[5]

Shannon established his reputation as the pivotal point around which a century of attempts to conceptualize information as a physical quantity revolved on the basis of a paper on what he called 'the mathematical theory of communication', published in the *Bell System Technical Journal* in 1948. Shannon's paper advanced a set of theorems that dealt 'with the problem of sending messages from one place to another quickly, economically, and efficiently'.[6] Shannon's 'Mathematical Theory of Communication' was republished by the University of Illinois Press in 1949, together with Warren Weaver's

less mathematically oriented paper. As a result, the mathematical theory of communication is often referred to as the Shannon–Weaver model – a ground-breaking effort in the field of communication engineering and a necessary reference in all attempts to tackle some of the implications inherent in an informational understanding of communication. The modern concept of information is explicitly subordinated to the technical demands of communication engineering, and more specifically to the problems of the 'line' or 'channel'. Shannon's definition of information is dependent on the problematic of the accurate reproduction of a weak impulse or signal across a range of different media channels (telegraphy, telephony, radio, television, computing). Information is thus described through a mathematical function that could be used to maximize the transmission of a signal through a channel. His logarithmic measure of information is still fundamental to the 'design of every modern communications device – from cellular phones to modems to compact-disc players.'[7]

The problem identified by researchers at the Bell Laboratories is well known to all communication engineers and high fidelity sound enthusiasts. When a signal travels through a channel, it often produces a characteristic background static that is not solved by amplification. In this sense, the signal is always identified in relation to what threatens to corrupt and distort it, that is noise. Communication engineers identified the noise in channels with the discrete character of the electrons carrying the current. Amplification did not correct the disturbance because messages or signals ended up swamped by their own energy.[8] The problem could not be solved simply by increasing or decreasing the amount of energy flowing through a channel, but various types of filters proved to be a partially effective solution. What was needed, however, was a technique to encode the signal in such a way that it would minimize loss of quality by some kind of error-control instructions. Engineers thus needed a function that would enable them to build systems that could distinguish noise from signal and hence correct the corruption of messages. But in which ways is a signal mathematically distinguishable from noise? This question required a method for identifying information as an entity that could be separated from the meaning that could be made of it. For Claude E. Shannon, messages '[f]requently … have *meaning;* that is they refer to or are correlated according to some system with certain physical or conceptual entities. These semantic aspects of communication are irrelevant to the engineering problem'.[9] From the point of view of information theory, 'two messages, one of which is heavily loaded

with meaning and the other of which is pure nonsense, can be exactly equivalent…'[10]

In order to frame his concept of information properly, Shannon drew his famous diagram that, beyond becoming indispensable to the technical development of communication and information technologies, was also to have substantial repercussions for the emerging fields of mass communication research and media and cultural studies. Shannon's diagram identified five moments or components in the communication process: an information source, a transmitter, the message, the channel of communications and the receiver. It is a deceptively simple diagram. The information source, or sender, selects a message to be coded into a signal that is then transmitted through a channel to a receiver. Information is the content of communication, in the sense that it is what needs to be transported with the minimum loss of quality, from the sender to a receiver (as if in an older mode of communication when the latter mainly referred to physical transport). At the same time, this content is not defined by its meaning, but by a mathematical function – a pattern of redundancy and frequency that allows a communication machine to distinguish it from noise. As all information theorists will emphasize, although we can attribute meanings to information, the latter does not coincide with its meaning. An encoded television signal or a piece of software has no meaning in the conventional sense.

Information, that is, is far from simply constituting a kind of degree zero of code, in the sense of a basic, denotative level of meaning. The postmodern lesson on the cultural politics of information is that meaning has evaporated as the main point of reference within the scene of communication. Or, in a different way, information can be understood to involve a larger spectrum than meaning, as F. J. Crasson suggested when he compared information to phenomenological understandings of perception where 'the meaningful is related to the continuous fulfillment of expectations and is opposed therefore (by Husserl) to heterogeneous discontinuity or (by Merleau-Ponty) to complete homogeneity'.[11] Meaningful experiences thus disappear

> at each end, as it were, of the information spectrum, both its maximal and minimal points. In terms of its meaninglessness, maximal randomness in the visual field is hardy distinguishable from minimal randomness. Information is thus a term of far greater extension than meaning.[12]

From an informational perspective, a meaningful perception, one that can be made sense of and articulated, is a statistical compound of the familiar and the unfamiliar. It is both redundant and random; we grasp it because it is partially new and partially familiar. Thus Crasson draws the conclusion that meaning is 'what makes sense, produces no surprises, requires a minimal amount of information to define its shape'.[13] Indeed, Crasson (like Jean Baudrillard 20 years later) will conclude that information and meaning might be inversely proportional: the more information the less meaning. In this sense, the proliferation of information spells the drowning of meaningful experiences in a sea of random noise. In an informational culture the middle zone of meaning is increasingly difficult to construct and maintain, in as much as the noise always implicitly carried by information hedges in from all sides. In this sense, an informational culture marks the point where meaningful experiences are under siege, continuously undermined by a proliferation of signs that have no reference, only statistical patterns of frequency, redundancy and resonance (the obsessive frequency and redundancy of an advertising campaign, the mutually reinforcing resonance of self-help manuals and expert advice, the incessant bombardment of signifying influences). Holding on to the 'message' in order to drown the noise of contrasting information is what allows the stability necessary in order to establish a contact. But in this case, what stops information from being just another name for brainwashing? And does that imply that the scene of communication, the cultural politics of information as such, is exclusively a theatre of manipulation favouring the expertise and concentrated knowledge of a new breed of communication managers? If information identifies an operationality of communication strategies, spreading out from military technology to civil society at large, isn't it another name for communication as a sophisticated form of mind control?

There is no doubt that the manipulation of affects and signs is an essential part of the politics of communication in informational cultures. What is more difficult to uphold, however, is the behaviourist perspective that identifies the influence of the media with that of a simple command in a drastic simplification of the physical dynamics of communication as such. Information theory, thus, highlights the minimum conditions for communication, and thus attributes a *secondary* importance to the question of the *meaning* of messages when compared to the basic problem of *how to increase the effectiveness of the channel*. Information can be anything: a sound, an image, a colour,

and of course also words. The problem of communication is reduced to that of establishing a bridge or a contact between a sender and a receiver. The two extremities of the channel 'are on the same side, tied together by a mutual interest: they battle together against noise'.[14] Resistance to communication is not related to misinterpretation or dissent, but to an inhuman interference (what Michel Serres calls the 'demon of noise'). The scene of communication is reduced to its minimum condition: that of making contact by clearing a channel from the threat of noise.

This conception of communication is well suited to the technical demands of the channel within modern media such as telephony, radio and television, where the integrity of the signal is always potentially undermined by the distortion of noise. At the same time, however, this does not really imply the ultimate influence of a technological determination, but more a return to the minimum condition of communication as such. The minimum condition for communication (in the animal and the machine, as Wiener put it) is contact – a temporary suspension of the multitude of tiny and obscure perceptions out of which information emerges as a kind of fleeting clarity, as if a space had been successfully cleared. It does not matter who the sender or receiver are, whether they are machines, animals, bacteria, genetic sequences, or human organisms. Reason and meaning, dialectics and persuasion, truth and falsehood are all temporarily evacuated from the scene. There is no longer an interlocutor or an audience to address, there is no rhetorical play of ideas, but a kind of bare set, where all communication is reduced to a drive to clear out a channel for transmission between two points separated by space and united only by the channel. From an informational perspective, communication is neither a rational argument nor an antagonistic experience based on the capacity of a speaker to convince a listener or to impose his perspective. The information flow establishes a contact between sender and receiver by excluding all interference, that is by holding off noise. Interlocutors are not opposed, as in the traditional conception of the dialectical game, but they are *assumed* to be on the same side. Opposition to the agreement between sender and receiver cannot be subjective, but only objective and external, appearing only in the non-human form of meaningless *noise* (or the form of an enemy intent on disrupting the communication between two partners in agreement). '*To hold a dialogue is to suppose a third man and to seek to exclude him.*'[15]

The appearance of a modern informational problematic, then, is related to a conception of communication as an operational

problem dominated by the imperatives of the channel and the code rather than by a concern with exchange of ideas, ethical truth or rhetorical confrontation (a definition that dominates the liberal and enlightened concept of communication). It is not about signs, but about signals.

This technical (rather than simply technological) conception of communication is what for us opposes, for example, the ethics of modern professionals of communication (such as journalists) to today's communication managers (PR agents, advertisers, perception managers, information strategists, directors of communication). While journalists who subscribe to a professional ethics rooted in a liberal modernity, for example, would argue that information must be assessed in terms of its accuracy (or truth value) and relevance (meaningfulness), communication managers seem to have another type of grasp of the informational dimension of contemporary culture – which they reduce to a Manichean battle between signal and noise. The latter, in fact, understand the power of a communication act as determined by the overall dynamics of the informational milieu, where what counts is the preservation of the message/signal through all the different permutations and possible corruptions which such a message/signal is liable to undergo. This is why, for example, this social management of communication favours the short slogan or even the iconic power of the logo. The first condition of a successful communication becomes that of reducing all meaning to information – that is to a signal that can be successfully replicated across a varied communication milieu with minimum alterations. Whether it is about the Nike swoosh or war propaganda, what matters is the endurance of the information to be communicated, its power to survive *as information* all possible corruption by noise.

When a television debate is held, for example, between competing politicians in the wake of an election, can we say that such a debate is won or lost on the basis of a dialectical argument involving the interplay of truth and persuasion? Can we say that politicians are really conveying a persuasive content? Or isn't the main problem that of clearing out a channel through a noisy mediascape, of establishing a contact with the audience out there? In this context, the opponent becomes noise and the public becomes a target of communication: not a rational ensemble of free thinking individuals, endowed with reason, who must be persuaded, but a collective receiver to which a message can be sent only on condition that the channel is kept free of

noise (competing politicians, but also the whole noisy communication environment to which such politicians relate, where, for example, more young people vote for reality TV shows than for general elections). Or in another context: don't the techniques of advertising involve, first of all, an attempt to bypass the noise of a crowded informational milieu by establishing a connection with potential customers? The purpose of communication (the exclusion of noise and the establishment of contact) is simultaneously presupposed, technically produced, and actively reinforced. It is understandable, then, why cultural activism of the *No Logo* variety should have focused so much on what Mark Dery has called 'culture jamming' – signal distortion, graffiti on advertising posters, hijacking of corporate events, all kind of attempts at disrupting the smooth efficiency of the communication machine. Or, as Gilles Deleuze suggested, why cultural resistance within control societies might also involve the creation of 'vacuoles' of non-communication able to elude the latter's command. Or why, in conditions of media monopoly, the problem becomes that of undermining the stronghold of such tyrannical contact by opening up as many other venues of communication as possible (from festivals to the Internet, from demos and workshops to screenings, dancing and public performances).

The conditions within which a cultural politics of information unfolds are thus those of a communicational environment that has been *technically* reduced to its 'fundamental problem', as Shannon put it (or its minimum conditions as we would say). It is such minimum conditions that must be recreated each time by the techniques of communication: the successful constitution of a contact, the suspension of all competing signals and the filtering out of all possible corruption of the message in transit. There is nothing inherently technological here, in the modern sense of a Frankenstein monster which has been created by human will but which is now threatening to destroy it. It is not so much a question of technology as of techniques and forms of knowledge that all converge – through a variety of media and channels – on the basic problem of how to clear out a space and establish a successful contact.

Does that mean, then, that journalists and activists who hang on to relevance and truth and meaning have been made redundant by communication managers with a much better grasp of informational dynamics? The problem here is not that of arguing for the obsolescence of meaning and truth in favour of sheer manipulation within an informational milieu. It might be the case, that is, that such managers

and entrepreneurs might have themselves misunderstood the informational dimension of communication as such and that their repeated efforts at amplifying the signal in order to drown out the noise might be as counterproductive in a social sense as they would be within the circuit of a stereo system. As ARPANET directors J. C. R. Licklider and Robert W. Taylor will later put it, such theory is based on the unsatisfactory assumption that communication is simply about two people now knowing what only one knew before (the name of a brand; the central message of a political speech).[16] The tactics of amplification, the attempt to control the scene of communication by sheer power, might backfire because it does not take sufficiently into account the powers of *feedback* or retro-action – increasingly cynical or even angry audience/receivers or just a kind of social entropy that nonlinearizes the transmission of messages as such.

In this sense, the critique made by Gilbert Simondon of the technical theory of communication (as he called the work of telecoms engineers) opens up an interesting perspective on the dynamics of communication beyond meaning but also beyond the operational demands of the channel. For Simondon, the mathematical theory of communication underestimated information by reducing it to what is transmitted between two distinct and individuated extremities: a sender and a receiver. The relation of communication for Simondon does not take place between two preconstituted individuals (such as a politician and his audience, for example), but between the pre-individual (what within the formed individual resists individuation) and the collective (the dimension within which another type of individuation takes place). Both the sender and the receiver, the politician or his director of communication and their audience, are in fact immersed within a larger field of interactions that packs within itself a constitutive potential that the mathematical theory of communication does not capture. All communication always involves a metastable milieu, characterized by an incompatibility among different dimensions of a pre-individual and collective being. Information is thus not so much the content of communication, as one of its dimensions, and more specifically it indicates the direction of a dynamic transformation. For Simondon, information theorists underestimated the conditions of turbulence and metastability that define information as a kind of active line marking a quantic process of individuation.[17] What this comes down to, in relation to our understanding of the cultural politics of information, is that the act of establishing a contact might not be reduceable to a kind of

informational command – where the ultimate target is the control of what audiences think and feel. On the contrary, the informational dimension of communication seems to imply an unfolding process of material constitution that neither the liberal ethics of journalism nor the cynicism of public relations officers really address.

For example, in some ways the informational dimension of communication seems to implicate a production of reality in a way that does not only involve our capacity to signify – that is, to know the world through a system of signs. In as much as information concerns the problem of form it also poses the question of the organization of perception and the production of bodily habits which it foregrounds with relation to the emergence of social meanings. Within design and architecture, for example, information is also about the active transformation of bodily habits as this takes place around keyboards and chairs, games, trains and cars, buildings and small objects with which we perform all kind of daily actions. Information is not about brainwashing as a form of *media effect*, but it does also involve a level of *distracted* perception; it thus informs habits and percepts and regulates the speed of a body by plugging it into a field of action. In this sense, the informational dimension of communication is not just about the successful delivery of a coded signal but also about contact and tactility, about architecture and design implying a dynamic modulation of material and social energies. Information works with forms of distracted perception by modulating the organization of a physical environment.[18] This active power of information is everywhere: it is in the interfaces that relay machines to machines and machines to humans; it is in material objects including chairs, cars, keyboards, and musical instruments. It is in bottles and telephones in as much as they lend themselves in a particular way to the action of a hand. It is not an essence, understood here as a transcendent form, but it indicates the material organization of a possible action that moulds and remoulds the social field. The return of communication to its minimum conditions makes the whole field of culture and society (not simply the media) open to the informational redesign and hence, to the action of a code. A cultural politics of information, as it lives through and addresses the centrality of information transmission, processing and communication techniques, opens up a heightened awareness of the importance of minute and apparently inconsequential decisions as they are implemented in architecture and design, on television and the Internet, in medical research and news-making, in personal

relationships and working practices. In this sense, the relation of signal to noise with which we have opened our understanding of information and which dominates the perspective of the social engineering of communication does not exhaust the informational dimension of culture as such. As we shall see, in fact, this dimension is concerned not only with the successful transmission of messages, but also with the overall constitution of fields of possibilities – of alternatives and potentials that are transforming the problem of *representation* as cultural theory has come to think of it.

THE LIMITS OF POSSIBILITY

> Suppose we have a set of possible events whose probabilities of occurrence are *p*1; *p2*; …; *pn*. These probabilities are known but that is all we know concerning which event will occur. Can we find a measure of how much 'choice' is involved in the selection of the event or of how uncertain we are of the outcome?[19]

> *Proposition II: The transmission of information implies the communication and exclusion of probable alternatives.*
> *Corollary II: Informational cultures challenge the coincidence of the real with the possible.*

Information theory understands all codes as operating within statistical constraints that make the succession of symbols more or less likely (which allows the maximization of information transmission through a channel). Another key implication, however, is that all events (from the occurrence of a symbol within a code to all communication acts) can be described as a selection among a set of mutually excluding and more or less probable alternatives. The communication of information thus implies the reduction of material processes to a closed system defined by the relation between the actual selection (the real) and the field of probabilities that it defines (the statistically probable). The relation between the real and the probable, however, also evokes the spectre of the improbable, the fluctuation and hence the virtual. As such, a cultural politics of information somehow resists the confinement of social change to a closed set of mutually excluding and predetermined alternatives; and deploys an active engagement with the transformative potential of the virtual (that which is beyond measure)

The breakthrough that gave Shannon's paper such relevance outside the circles of telecom engineers was a little parenthesis that he opens up in the middle of his paper on the mathematical theory

of communication, entitled 'Choice, uncertainty, entropy'. As he somewhat self-deprecatorily explained,

> This theorem, and the assumptions required for its proof, are in no way necessary for the present theory. It is given chiefly to lend a certain plausibility to some of our later definitions. The real justification of these definitions, however, will reside in their implications.[20]

In this section, he identified information as a measure of the probabilities of occurrence of an event (including the choice of one symbol over another within a code) – and hence a single selection among possible states. This measure was provided for him by statistical mechanics – a discipline that tackled thermodynamic processes through the tools of statistics. As we will see, the nineteenth-century physicist Ludwig Boltzmann identified the entropy of a closed system (that is, the tendency of such a system to lose structure while also running out of useful energy), with an uncertainty in our knowledge of the system. For thermodynamics, all irreversible processes involve the interaction of a large number of particles that can be distributed in a variable number of states. Because of the numbers involved, we cannot really know such systems in detail. All we can have is a statistical description that allows us to calculate the *probabilities of occurrence of events*. Not an absolute and determinate description (as in classical physics), but a probabilistic evaluation of the states in which a system might be.

Shannon's breakthrough was to apply such a statistical understanding of entropy to the theory of messages or information theory. 'Entropy is a probability distribution, assigning various probabilities to a set of possible messages. But entropy is also a measure of what the person receiving the message *does not know* about it before it arrives.'[21] Shannon applied this statistical understanding of sets of messages to the problem of 'code'. In particular, he looked at language as a code and observed that codes such as the English language obeyed definite statistical laws that determined the likely frequency of any combination of letters (there is a higher probability that *c* will be followed by *h* than by *z*, for example). The English language was thus defined as a code that involved approximately 50 per cent individual freedom in the choice of symbols and 50 per cent necessity as established by the statistical laws of the code. By

mathematizing the relationship between redundancy and freedom in a code such as English, one could devise some means to encode the message more effectively. The 'choice' of the individual speaker is constrained by the statistical laws of language.

Warren Weaver, among others, drew from such theory a key consequence. Such definition of information implied that the action of a code on a situation was also a kind of *containment* of the openness of the situation to a set of mutually excluding alternatives. The code predetermines, and it does so statistically. 'The concept of information applies not to individual messages (as the concept of meaning would), but rather to the situation as a whole … *Choices are, at least from the point of view of the communication system, governed by probabilities …*'[22] For Norbert Wiener, 'the transmission of information is impossible save as a transmission of alternatives. If only one contingency is to be transmitted, then it may be sent most efficiently and with the least trouble by sending no message at all.' Hence, it is convenient for transmission and storage purposes, to consider a unit amount of information as 'a single decision between equally probable alternatives'.[23] Each transmitted unit of information is thus a *selection* (hence Shannon's theory is also referred to sometimes as the *selective* theory of information).

Let us look at a concrete example of such a selective and statistical conception of information as given by another cybernetician, W. Ross Ashby.[24] A man has committed a crime and been arrested. He does not know whether his partner in crime has been arrested or not. His wife must communicate to him an essential piece of missing information (whether or not his confederate has been caught by the police). The only communication allowed between her and her husband is a cup of tea (in this case the channel); she will either put sugar in the tea or not depending on whether the confederate has been caught or not (this is her code); the jailer can also be expected to try to interfere in the communication if he can (he is the noise). There is here a priori information (the crime–jail scenario); a degree of uncertainty in this system (as determined by two probable states: the confederate has either been caught or not); a sender and a receiver (the wife and husband); a channel (cup of tea); a code (presence/absence of sugar); an interference (the jailer).

This situation and its uncertainty can thus be measured on the basis of a statistical distribution of probabilities. In this case, there are two alternative or probable states given to the information source (or wife): the confederate has either been caught or not. The field

constituted by the husband, the wife, the prison, the prison guards, the cup of tea, the confederate, and the police gives rise to a closed set of messages. The confederate might have got away with it or might have been caught; hence the uncertainty of the situation can be expressed through a simple binary code (yes or no), that is one bit (or binary digit). However, the information source or sender (the wife) is limited in the information that she can send by the channel (there is not much information that you can communicate through a cup of tea). Because the only transaction that is allowed between herself and her husband is a cup of tea, then the latter is the channel and the capacity of such a channel will put constraints on the coding of the uncertainty of the situation. For example, they might agree that sweetened tea would be a yes and unsweetened would be a no.

Of course, communication also includes the possibility of a corruption of the message in transit by noise. The jailer might have figured out that the tea can be used as a means of communication and he might interfere by telling the prisoner that he had sweetened it himself. If the wife wanted to make sure that the message got through, she would thus need some way of inserting some redundancy into the code, thus doubling the probability of the information surviving the noise (she might have agreed also to add or not to add milk, for example). Although the code might be different, both cases are equally likely, so the amount of information that needs to be transmitted is ultimately low (a choice between two possibilities expressible by way of a single bit). What the example illustrates is the principle that, as Warren Weaver put it, 'the unit information indicates that in this situation one has an amount of freedom of choice, in selecting a message, which is convenient to regard as a standard unit amount.'[25] The measure of the information that is produced when the message is chosen from the set is the amount that the woman can communicate to her jailed husband. This amount of information can be reduced to the logarithm of the probabilities of the situation and thus be prepared for communication through a suitable channel. The value of information theory for cybernetics, according to Ross Ashby, lies exactly in its representing a given situation as a set of mutually excluding alternatives. It does not ask what individual answer it can produce, but 'what are *all* the possible behaviours that it can produce' and how likely one behaviour is when compared to another. The value of information theory is that it deals with such sets of probabilities.

This example challenges us to think about information in ways that are markedly different from the commonsensical ways in which we have come to regard it – not simply as content but also as a kind of representation of a reality out there. Communication theory explicitly states that information involves the reduction of both a set of messages and a milieu of interaction to their statistical properties. Information thus operates as a form of probabilistic *containment* and *resolution* of the instability, uncertainty and virtuality of a process. It is thus implicated in a process by which alternatives are reduced and the uncertainty of processes is prepared for codification by a channel. Uncertainty can be measured and solved by applying a set of constraints to a situation that unfolds into a binary mode of 'either/or'. 'The transmission of information is impossible save as a transmission of alternatives.'[26] Within the mathematical theory of communication, information represents an uncertain and probabilistic milieu by reducing it to sets of alternatives that determine more or less likely sets of possibilities on the basis of a given distribution of probabilities as determined by the relation between channel and code.

What the communication of information implies, then, is not so much a relation between the 'real' and its 'copy' (or its representation), but the reduction of a process to a set of probabilities. It still holds true, that is, that information does not only address the dimension of interpretation or meaning (even though it also carries meaning and it is also subject to interpretation). But this operation of signification is secondary with relation to a primary operation which is that of the reduction of a situation to a set of more or less probable states and alternatives as constrained by the interplay between a channel and a code; and the reduction of communication to the resolution of such uncertainties through the selection of one of the alternatives from the set (this selection does not necessarily involve a human subject, but can be spontaneously generated). In this sense, for many critics of information and communication theory, the latter are almost exclusively modes of power involved in the reproduction of a system.[27] The communication of information related, for example, to a new deal between a government and a trade union, adds to our knowledge of the situation only in as much as that situation has been reduced to a set of possible outcomes (deal/no deal; strike/negotiations) that can be easily encoded within the medium of the news. The communication of information about a possible war similarly reduces the complexity of a situation to a set of pre-closed

alternatives. Nothing new is really added, only some (im)probable alternatives eliminated (such as other modes of knowledge or methods of analysis).

The transmission of information concerns alternatives formulated on the basis of known probabilities within the constraints set up by the interplay of code and channel or medium. That is why the most effective and concise modality of information transmission today is that of the opinion poll, the survey, risk assessment and all other types of information that can be easily encoded for survival in the meta-medium of an informational milieu. What is the probability that I will develop a fatal disease if I keep smoking? How is the popularity of the government doing today? How many points did the Dow Jones lose today and what are the chances that it will go up? Is it by chance that there is a whole sector of the financial markets, such as that of futures, that is based on a kind of legal gamble on the probable future? Whether it is marketing research, polls-informed public policy, or medical decisions, the transmission of information involves the action of a code and a channel setting the limits within which the problem can be presented and mapping out sets of possible alternatives. The political technology of information societies is crucially concerned with the organization of the field of the probable or the likely. It thus produces a sensibility to social change (and forms of subjectivity) that are informed by the relation between the real and the possible – where the real is what remains while all other competing possibilities are excluded.

Once again what we are presented with here is not simply the effect of a technological organization of communication, but a set of relays between the technical and the social. The closure of the horizon of radical transformations that is implied in the probabilistic nature of information and the code is not simply the effect of information and communication technologies. On the contrary, it is once again a matter of techniques and impersonal strategies as they distribute themselves on the macroscopic consensus about the ultimate triumph of the existent. A cultural politics of information thus also implies a renewed and intense struggle around the definition of the limits and alternatives that identify the potential for change and transformation. The cultural politics of information, as it unfolds across the distributed networks of communication, often involves a direct questioning of the codes and channels that generate the distribution of probabilities – that is the production of alternatives as such. It is exactly because all information assumes the

constitution of a closed field of possibilities that the cultural politics of information is often centrally directed to constraints and 'lack of choice' as is. A cultural politics of information is crucially concerned with questioning the relationship between the probable, the possible and the real. It involves the opening up of the virtuality of the world by positing not simply different, but radically other codes and channels for expressing and giving expression to an undetermined potential for change.

Even as mediated by the space of statistical probability, in fact, the relationship between the real and the probable that is enacted within the informational dimension of communication does not ontologically exclude the possibility of the extremely improbable (or of the *virtual*). As Marco d'Eramo has put it, the probability of a system's being in a certain state is not a property of its being. Probabilities do not exclude the possibility of a fluctuation that violates the organized space of the real and the possible.

> If we say that water boils at 100 degrees Celsius, we are really saying something else: that, at 100 degrees in a pot, water has a very high chance of boiling, but, at the same time, there is a possibility that at 100 degrees water freezes. It is an infinitesimal possibility (we can calculate it), but it exists.[28]

Information expresses the determination of probability, but it does not exclude beforehand the occurrence of the extremely unlikely. It is because communication, as a political technique, attempts to enclose an informational milieu around the informational couple 'actual/probable' that it also opens up another space – that of the fluctuations that produce the unpredictable, of the inventions that break the space of possibility, of the choices that are no choices at all but a kind of quantum jump onto another plane.

This is why the cultural politics of information can be said to bypass the relationship between the real and the possible to open up the relation between the real and the *virtual* – beyond the metaphysics of truth and appearance of the utopian imagination informing the revolutionary ideals of modernity. What lies beyond the possible, in fact, is not a utopian time and space to be realized against the harsh alienation of the present. This improbability that can only be predicted with the benefit of hindsight can be made to correspond to the category of the *virtual* – as it is formulated in the work of Henri Bergson, Gilles Deleuze and more recently Brian Massumi and

Pierre Levy.[29] The virtualization of a process involves opening up a real understood as devoid of transformative potential to the action of forces that exceed it from all sides. In an informational sense, the virtual appears as the site not only of the improbable, but of the openness of biophysical (but also socio-cultural) processes to the irruption of the unlikely and the inventive.

What lies beyond the possible and the real is thus the openness of the virtual, of the invention and the fluctuation, of what cannot be planned or even thought in advance, of what has no real permanence but only reverberations. Unlike the probable, the virtual can only irrupt and then recede, leaving only traces behind it, but traces that are virtually able to regenerate a reality gangrened by its reduction to a closed set of possibilities. Whether it is about the flash-like appearance and disappearance of the electronic commons (as in the early Internet), or the irruption in a given economic sector of a new technology able to unravel and disrupt its established organization of production (as in the current explosion of file-sharing systems), or whether it is about the virtuality of another world perceived during a mass demonstration or a workshop or a camp, the cultural politics of information involves a stab at the fabric of possibility, an undoing of the coincidence of the real with the given. In this sense, if we can talk about a cultural politics of information at all it is not because of new technologies, but because it is the reduction of the space of communication to a space of limited and hardly effectual alternatives (as in the postmodern sign) that poses the problem of the unlikely and the unthinkable as such. The cultural politics of information is no radical alternative that springs out of a negativity to confront a monolithic social technology of power. It is rather a *positive feedback effect* of informational cultures as such.

NONLINEARITY AND REPRESENTATION

> From our previous discussion of entropy as a measure of uncertainty it seems reasonable to use the conditional entropy of the message, knowing the received signal, as a measure of this missing information.[30]

Proposition III: Information implies a nonlinear relation between the micro and the macro.

> *Corollary III: Within informational cultures, the centrality of the couple difference/position within a closed dialectics is displaced by that of mutation/movement within open systems.*

Because information theory draws its theoretical underpinnings from thermodynamics and statistical mechanics, it understands material processes as implying a nonlinear relation between macrostates (such as averages, but also identities, subjectivities, societies and cultures) and microstates (the multiplicity of particles and interactions that underlie macrostates in as much as they also involve irreversible processes). This has a double consequence for our understanding of the cultural politics of information: on the one hand, it implies a shift away from representation to modulation which emphasizes the power of the mutating and divergent; on the other hand, it locates informational dynamics outside the perspectival and three-dimensional space of modernity and within an immersive, multidimensional and transformative topology.

For Jérôme Segal, we cannot really speak of a unified theory of information until the late 1940s, but we can definitely see how the preliminary labour started in fields such as statistics, physics and telecommunications at least since the 1920s. The question of information was posed first of all in the context of statistics of 'populations'. The question that the statistical theory of information addressed was that of

> the scientific reduction of a mass of data to a relatively small number of quantities which must correctly represent this mass, or, in other words, must contain the largest possible part of the totality of relevant information contained in the original data.[31]

The mathematical tools through which this reduction was made possible were derived from the field of social physics as inaugurated in the mid nineteenth century by the Belgian astronomer Adolphe Quetelet (the inventor of the average man in society, a compiler of mortality and criminality tables and also the author of a statistical study on the 'propensity to suicide', which later came to provide the foundations of Emile Durkheim's famous sociological study). The modern theory of probability, however, had started as early as the mid seventeenth century, when a long-standing problem in games of dice was subjected to mathematical treatment.[32]

The statistical tools of probability theory had found a use in physics as well at least since James Clerk Maxwell started treating

kinetic systems such as gases as 'collections of tiny particles rushing about at varying speeds and colliding with each other … Since it is impossible to establish the exact speed of each particle, Maxwell treated the whole collection of particles statistically.'[33] At the end of the nineteenth century, Ludwig Boltzmann had established that since human beings could not know and should not be interested in the specific behaviour of each individual molecule at a particular moment, they could at least know how vast collections of particles behaved on average. As the system becomes more disorderly and temperature differences are lost, its entropy (the amount of 'energy unavailable for work') increases and even the limited knowledge allowed for by the average disappears: 'when the system is in a high state of entropy then it is *improbable* that [such parts] will be found in any special arrangement at a particular time'.[34] In a state of high entropy, both the randomness and the uncertainty with regard to the state of a system are at their maxima.

The entropy of a system thus corresponds to an uncertainty in our knowledge of it. Boltzmann's theorem identified a function *H* which measured the difference between the distribution of probabilities at any given time and those that exist at an equilibrium state of maximum entropy. As entropy increases and the system becomes more disorganized, the value of the function *H* would decrease and so would our knowledge of the probable state of any particle within the system. Shannon determined that Boltzmann's H-theorem also worked as a way to measure information.

Shannon repeatedly remarked how his theory of information was only concerned with the problem of communication engineering (and specifically the problem of the relation of noise to signal within a channel). And yet, the mathematical link that it established between information and entropy caused information theory to become the basis for the reunification of knowledge so much yearned for by twentieth-century science. The task of developing and expanding on the consequences of a quantitative definition of information fell to theorists such as Norbert Wiener (who published his bestselling book on cybernetics in the same year that Shannon's book was published and who, on the basis of seniority and prestige, claimed for himself priority over Shannon's work), Warren Weaver (director of the Rockefeller Foundation and author of a key explanatory essay on Shannon's theory) and later physicist Louis Brillouin, the controversial author of several texts on the relationship between information theory and science (such as *Science and Information*

Theory, in 1956; and *Scientific Uncertainty and Information,* in 1964). The first symposium on information theory took place in London in 1950, but it was the Macy conferences on cybernetics that really focused the scientific debate around information.

It is difficult to underestimate the resonance that the link between entropy and information had in the mid-twentieth-century scientific environment. Nineteenth-century thermodynamics identified through entropy a principle of irreversibility in physical processes, and more specifically a tendency of life to run out of differences and hence of available energy in its drive towards death. By identifying an equivalence between information and entropy, Shannon's work threw a bridge between the twentieth-century sciences of cybernetics and quantum theory and the nineteenth-century interest in heat engines, energy, irreversibility and death.

The link between information and entropy also referred back to a thinking experiment that had troubled physicists since the mid nineteenth century, Maxwell's Demon. The question posed by Maxwell's Demon was whether it was possible to counteract the tendency of closed systems to run out of energy, whether, that is, it was possible to identify a physical capacity that ran against the stream of entropy. The experiment suggested that a fictional being with perfect knowledge of the state of each individual molecule in a gas could counteract the increase of entropy within a heat engine by sorting out hot from cool molecules. The idea that Maxwell's Demon was nothing other than an abstract informational entity and that information involved an expenditure of energy had already been suggested – and with it the notion that information played a key role in the struggle of living organisms against the entropic tides that threatened them with death. As stated by quantum physicist Erwin Schrödinger in a key 1945 lecture, 'What is Life?', what needed to be explained for many physicists was not so much the physical tendency to dissipation that made all forms of life mortal, but its opposite. If the universe tended overall towards homogenization, life somehow expressed an upstream movement against the entropic tide. What is life if not negative entropy, a movement that runs against the second law of thermodynamics, whose existence is witnessed by the varieties of forms of life as they exist in the physical world? In asking a question that was to define the discourse of the life sciences for the next 50 years, Schrödinger argued that 'living organisms eat negative entropy' (that is, negentropy). Negentropic forces will thus be allocated a seat in the human organism – that of the macromolecule DNA, an

informational microstructure able to produce living organisms by inducing the chemical reactions leading to the conversion of energy into differentiated types of cells.

This notion that information was somehow related to anti-entropic or negentropic forces is at the basis of the informationalist perspective that identifies information with a kind of form determining the material unfolding of life. Echoes of informationalism are present in all statements that argue that informational genetic sequences determine not only skin and hair colour, but even our very actions and feelings. This interpretation of the relation between information and entropy is not confirmed, however, by most of the current work in genetic or molecular biology, where the DNA macromolecule is understood as a simple inductor within the complex environment of the cell. Rather than expressing a deterministic relation between informational structures such as the DNA and a biophysical phenomenon such as the organism, the informational trend emphasizes the nonlinear relationship between molecular or micro levels of organization and molar or macro layers.[35] Like thermodynamics and statistical mechanics, information theory suggests that a macro-state or a molar formation (such as an average temperature; or an organism; or an 'identity') does not have a linear or deterministic relation to the multiplicity of the microscopic states that define it (the singular particles and their velocities; the microscopic relations that make up an organism; the mutations and variations that underlie all identities).

In its technical and scientific sense, then, information implies a 'representation' of a physical state, but there is no assumed resemblance between the representation and the state that it describes. Within the statistical model proposed by Quetelet's social physics, for example, the 'average' or 'norm' is the representation of a macrostate to which can correspond a variety of microstates. An average might be the same for a number of different possibilities (an average height of 6 feet in a population of 100 people might be realized by many different distributions of possible heights). As a macrostate, the average does not really exist, but it is a kind of social norm, a strange attractor endowed with the function to regulate the social body and stabilize it. It is the centre of gravity to which 'all the phenomena of equilibrium and its movement refers'.[36] Like the mass society that in those same years was increasingly preoccupying conservative and radical critics alike, thermodynamics and statistical mechanics too were concerned with formations such as masses, quantities such

as averages and qualities such as homogeneity and heterogeneity. An average, however, can only adequately describe a low-entropy, highly structured system and its value as a descriptive measure is undermined in systems that are more fluid, hence more random and disorganized (such as the disorganized capitalism described by John Urry and Scott Lash, for example).[37] The state of a flow is always a function of the aggregate behaviour of a microscopical multiplicity, but as chaos theory showed, there is no linear and direct relation between the micro (the particles) and the macro (the overall flow dynamics). It is at the level of the micro, however, that mutations and divergences are engendered and it is therefore in the micro that the potential for change and even radical transformation lie.

This is why both cybernetics and the mathematical theory of communication involved a shift of representational strategies, such as a preference for the use of discrete quantities (such as digital code) over continuous ones. The difference is all in a relationship to microscopic levels of organizations that are understood as inherently metastable, characterized by sudden and discontinuous variations that the use of continuous quantities cannot capture with sufficient precision. Norbert Wiener, for example, discussed the problems with the continuous representation of physical states in terms of its intrinsic inadequacy in relation to the microscopic instability of the matter–energy continuum. For him, machines that represent the object by following and reproducing the variations in intensity of light, texture or sound on a material substrate always end up producing an unbridgeable gap between representation and reality, a gap which can only produce the dreaded interference of *noise*.

For cyberneticians the discrete cut implied by a digital code made up for the approximation inherent in continuous or analogous quantities (which can only capture a static average rather than the instability of the micro). In a passage that could be read in conjunction with Jean Baudrillard's theory of simulation, Wiener describes the problematic relation between a continuous representational technique (in this case a slide rule, but we could also say a map or an 'identity') and the object represented (the territory, or the actual individuals and pre-individual or unstable dimensions that they contain). For Wiener, analogue machines, unlike digital machines, *measure* rather than count, and are therefore 'greatly limited in their precision', because they operate 'on the basis of analogous connection between the measured quantities and the numerical quantities supposed to represent them'. Wiener points out how digital machines, on the

other hand, offer 'great advantages for the most varied problems of communication and control…', in as much as 'the sharpness of the decision between "yes" and "no" permits them to accumulate information in such a way as to allow us to discriminate very small differences in very large numbers'.[38] If we compare a slide rule, for example, to a digital computer, we can clearly see how the accuracy of the former can only be approximate. The scale on which the marks have to be printed, the accuracy of our eyes, pose some very sharp limits to the precision with which the rule can be read. There is no point in trying to make the slide rule larger, because this increases the problems of accuracy.[39]

Any attempt at using continuous quantities to measure physical phenomena is thus doomed by a material impossibility: the nature of our perception (defined phenomenologically as the power of human eyes), which is imprecise; and the rigidity of analogue machines in general (which can only produce averages and identities whilst screening out all micro-variations and mutations as irrelevant exceptions, and hence miss change). These factors combine to make analogue techniques ultimately too limited. Even if the map could become as large as the territory, it would still be too rigid and inaccurate. Thus Wiener suggests that *numbers* are the best way to capture an intrinsically unstable and unmeasurable matter. Numbers in this case stand for a principle of discontinuity and microvariations which another famous cybernetician, Gregory Bateson, opposed to the continuity of quantities.

> Between *two* and *three* there is a jump. In the case of quantity, there is no such jump and because the jump is missing in the world of quantity it is impossible for any quantity to be exact. You can have exactly three tomatoes. You can never have exactly three gallons of water. Always quantity is approximate.[40]

By extending the principle of counting to fractions and infinitesimal numbers, turning numbers into the infinite combinations of zeros and ones, digitization is able to produce exact and yet mobile snapshots of material processes. Such representations, however, are never either complete or exhaustive, because the relationship between the micro and the macro unfolds within a nonlinear mode. The result of this new closeness through numbers is a blurring: the closer you try to get to matter the faster your counting has to become in an attempt to catch up with the imperceptible speed of matter. Information theory

accepts the existence of an 'incomplete determinism, almost an irrationality in the world … a fundamental element of chance'.[41]

The crossover of information and communication techniques from scientific speculation to market research, from theoretical physics to cultural politics is too complex to map out here. What is relevant to the current discussion, however, is that the rise of the concept of information has contributed to the development of new techniques for collecting and storing information that have simultaneously attacked and reinforced the macroscopic moulds of identity (the gender, race, class, nationality and sexuality axes). Thus, the cultural politics of information does not address so much the threat of 'disembodiment', or the disappearance of the body, but its microdissection and modulation, as it is split and decomposed into segments of variable and adjustable sizes (race, gender, sexual preferences; but also income, demographics, cultural preferences and interests). It is at this point that we can notice the convergence of the cultural politics of information with digital techniques of decomposition and recombination. For Pierre Levy, 'digitisation is the absolute of montage, montage affecting the tiniest fragments of a message, an indefinite and constantly renewed receptivity to the combination, fusion and replenishment of signs'.[42] It is not only the messages that are fragmented and constantly renewed and recombined, but also the receivers of these messages, in the form of bits of information archived and cross-referenced through a million databases.

The emergence of information as a concept, then, should also be related to the development of a set of techniques, including marketing strategies and techniques of communication management – as they attempt to capture the increasing randomness and volatility of culture. Already in the early 1990s, the marketing literature was describing the shift from new media to the Internet in terms of information-targeting strategies. The New Economy apologists, for example, famously postulated three stages of media power: broadcasting, narrowcasting and pointcasting.[43] The latter corresponded to a digital mode in which messages were not simply directed at groups but tailored to individuals and even sub-individual units (or as Gilles Deleuze called them, 'dividuals', what results from the decomposition of individuals into data clouds subject to automated integration and disintegration). These patterns identified by marketing models correspond to a process whereby the postmodern segmentation of the mass audiences is pursued to the point where it becomes a mobile, multiple and discontinuous microsegmentation. It is not simply

a matter of catering for the youth or for migrants or for wealthy entrepreneurs, but also that of disintegrating, so to speak, such youth/migrants/entrepreneurs into their microstatistical composition – aggregating and disaggregating them on the basis of ever-changing informational flows about their specific tastes and interests.

Information transmission and processing techniques, as exemplified in the technical machine that Lev Manovitch considers to be the arch-model of the new media, the database, have helped to discriminate and exploit the smallest differences in tastes, timetables and orientations, bypassing altogether the self-evident, humanistic subject, going from masses to populations of sub-individualized units of information. At the same time, this decomposition has not simply affected the identical, but also the different. Gender, race and sexuality, the mantra of the cultural politics of difference in the 1980s and 1990s, have been reduced to recombinable elements, disassociated from their subjects and recomposed on a plane of modulation – a close sampling of the micromutations of the social, moving to the rhythm of market expansions and contractions.

In this sense, the foregrounding of informational flows across the socius also implies a crisis of *representation* (both linguistic and political). The statistical modulation of information is highly disruptive in its relation to representation because it undermines the perspectival and three-dimensional space which functions as a support for relations of mirrors and reflections as they engender subjects, identities and selves.[44] In other words, the logic of representation presupposes a homogeneous space where different subjects can recognize each other when they are different and hence also when they are identical. This applies both at the level of linguistic representation (where I need to know what a man is in order to know what a woman is); but also at the level of political representation (as displayed in the allocation of positions across a political spectrum that is disposed from left to right as if facing an audience/public somehow always located at the centre). The analysis of the play of differences in representation within the self–other dialectics, in fact, has always implied the support of a space where the other is observed as from across a space. It is this empty space organized by a three-dimensional perspective that gives support to the psychic dynamics of identification, but also to the possibility of linguistic representation of the self and others as they are observed across such space. The space presupposed and engendered by an informational perspective expresses a radical challenge to representation – and hence also to

the cultural politics of identity and difference. It is not only that all identities and even differences are reconfigured as macrostates or averages which belie a much more fluid and mutating composition. It is also that the whole configuration of space within which such politics were conceived has undergone a shift of focus.

The divergence between a representational and an informational space is illustrated by recent developments in robotics and artificial intelligence – two fields of research for which the relationship between representation and information is crucial. Rodney Brooks has given us some vivid descriptions of early efforts to build intelligent machines (such as mobile robots) able to navigate effectively through space. Most early efforts in mobile robotics (or *mobotics* as it is also known) relied on a *representational* approach to cognition and movement. A robot was provided with sensors (such as cameras) able to scan a space for obstacle and directions. The informational stream collected by the robot was translated into a two- or three-dimensional map that the robot would then use to navigate the environment. This approach was ultimately unsuccessful because the information contained in the environment ultimately exceeded the robot's computational capacity. The robot just could not make a map that was accurate enough – it often missed the relevant factors or picked the wrong ones.[45]

Brooks explains how the representational approach that assumed a relation between a three-dimensional space and a 'cognition box' able to provide a two- or three-dimensional map of reality which in its turn gave rise to an action ultimately failed. He sees this failure as an incapacity of such representation to keep up with the complexity and instability of an informational space (representation can only capture the macro-scale, but it misses the abundance of reality and its capacity for dynamic shifts). The robot was not immersing itself in the complexity of informational space, allowing its sensory organs to interact directly with the environment, but was, so to speak, keeping its distance from it in order to represent it. This distance was necessary to the completion of a three-dimensional map of the environment that it then used to navigate the space. (The visualization techniques used in this process laid the basis for developments in special effects and simulational training techniques). This operation was unbearably slow and it failed to deal even with a minimum alteration and the different levels of the environment. The mobotics approach, on the other hand, got rid of the cognition box, and instantiated a direct relationship between sensors and motors in

ways that allowed the robot to interact directly with its environment (substituting the cognition box with a simple memory device). The loop between sensor and motor organs allowed a more direct and dynamic interaction with the huge informational flows generated even by the most simple environment. Space becomes informational not so much when it is computed by a machine, but when it presents an excess of sensory data, a radical indeterminacy in our knowledge, and a nonlinear temporality involving a multiplicity of mutating variables and different intersecting levels of observation and interaction. Space, that is, does not really need computers to be informational even as computers make us aware of the informational dimension as such. An informational space is inherently immersive, excessive and dynamic: one cannot simply observe it, but becomes almost unwittingly overpowered by it. It is not so much a three-dimensional, perspectival space where subjects carry out actions and relate to each other, but a field of displacements, mutations and movements that do not support the actions of a subject, but decompose it, recompose it and carry it along.

An engagement with the technical and scientific genealogy of a concept such as information, then, can be actively critical without disacknowledging its power to give expression and visibility to social and physical processes. We are very aware of the linguistic and social constraints that overdetermine the formation of scientific knowledge, and yet we cannot deny it a *dialogic* relationship with natural processes (as Ilya Prigogine and Isabelle Stengers have put it). As it informs and doubles into the social, the physical world that emerges out of this relationship is not passive, immutable, or even unknowable, but probabilistic, chaotic, indeterminate and open.

As I have described it, information is neither simply a physical domain nor a social construction, nor the content of a communication act, nor an immaterial entity set to take over the real, but a specific reorientation of forms of power *and* modes of resistance. On the one hand, it is about a resistance to informational forms of power as they involve techniques of manipulation and containment of the virtuality of the social; and on the other hand, it implies a collective engagement with the potential of such informational flows as they displace culture and help us to see it as the site of a *reinvention* of life. In every case, this reinvention today cannot really avoid the challenge of informational milieus and topologies. In as much as the network topos seems to match and embrace the turbulent involutions of such microcultural dynamics, the informational

dimension of communication involves the emergence of *a network culture*. It is to the informational *topos* of the network, then, that we will keep turning to in order to catch this *active constitution* of informational cultures.