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The Computational Turn, or, a New *Weltbild*

The fundamental event of the modern age is the conquest of the world as picture. The word 'picture' (Bild) now means the structured image (Gebild) that is the creature of man's producing which represents and sets before.

Martin Heidegger, "The Age of the World Picture," 1977.[1]

Theorists, whether from the arts or the sciences, tend to set up a 'turn' as an epochal change, a radical shift in the perception of the world; for example, a linguistic turn, or a computational turn. But how is the world unveiled in such a turn beyond all its obviousness? What are the metaphysical or even metaphorical meanings characterised in such a turn? These questions prompt us to look back at the origin or foundation of distinctions between humans and their technologies. A trajectory to the past may excite us with the evolutionary progress of humankind but, at the same time, discloses its limitations and poverty.

In this context, how can we understand the computational turn of the late twentieth century? We tend to see computation as simply a tool, or a part of technological culture. In the celebrated cognitive scientist's Brian Canwell Smith's 1998 influential book *On the Origin of Objects*, there is a small footnote: "computers are not cultures, at least not yet …"[2] What then indicates something becoming a culture? Is it the fact that almost everyone in the West has a computer? Or that our everyday activities, ranging from talking to families to accessing a public toilet, rely on computation? Isn't this too obvious or even too late to be pointed out? Haven't we already missed the computational turn?

I want to propose here that a qualitative change has already taken place: the way we understand cultural dynamics is now identical with computational logic. It is not anymore a method, methodology, or tool but, more fundamentally, the way we see and act in the world. My thesis is simply this: let's approach this computational turn from the question of the *Weltbild*, Heidegger's world picture, a fundamental, intuitive and immediate understanding of the world, which projects its significance in every part of our life. Then, what exactly is a world picture?

HEIDEGGER AND THE QUESTION OF *WELTBILD*

In his 1938 essay, "Die Zeit des Weltbildes," Martin Heidegger first raised the question of the world picture. To Heidegger, what characterises the world picture is not the picture of the world, but the world "conceived and grasped as a picture."[3] The world picture presents us the problem of the world and truth; that is to say, the objectification of the world as the concealment of the truth in the darkness. It is the way that we reduce the unseen to graspable entities. Heidegger's assertion demands a retrospective of the historical development of Western metaphysics. Truth (*Aletheia*) for Heidegger has nothing to do with correctness, as in logic, but rather is an event; the unconcealment of the meaning of Being (*Sein*) through the encounters with beings (*Seienden*). This unconcealment can only be achieved when 'beings' are not simply objects which can be known and manipulated, but rather things which are not yet determined and remain open for the manifestation of Being. Truth is a revealing. Modern science and technology, as Heidegger diagnosed, have evacuated the possibility for the question of Being (*Seinsfrage*), since the world is conceived as an image, which is in front of and against human being, and waiting to be exploited. The ontological difference (being and Being, ontic and ontological) is totally left behind in history, and we come to the self-destruction of modernity. In "The Age of the World Picture," Heidegger leaves us the melancholia of a prophet who has noticed an invisible power transforming humankind into a destiny hidden in the darkness, yet he remains helpless. Pondering upon what he sees as the gigantic force of modern science and technology, Heidegger writes:

> The gigantic presses forward in a form that actually seems to make it disappear – in the annihilation of great distances by the airplane, in the setting before us of foreign and remote worlds in their everydayness, which is produced at random through radio by a flick of the hand. Yet we think too superficially if we suppose that the gigantic is only the endlessly extended emptiness of the purely quantitative. We think too little if we find that the gigantic, in the form of continual not-ever-having-been-here-yet, originates only in a blind mania for exaggerating and excelling. We do not think at all if we believe we have explained this phenomenon of the gigantic with the catchword "Americanism."

What Heidegger proposes is that this gigantic force is neither something imaginary, nor something imported from outside (for example, America: the country that at the time he wrote had pushed to the forefront of technological expansionism); but something originated within European culture, in other words, the destiny of Western history, or metaphysics. Yet time stops in Heidegger's thought, as the prophet is not able to see through the power of the incalculable, the quasi-determinate nature of modern technology. In this article, Heidegger doesn't explain to us the details of the picture; the events wither on the surface, as something merely present at hand. Indeed, Heidegger doesn't identify the world picture as a differentiated stage of development of human knowledge, for example as a possible shift from the ancient to the medieval. Rather he poses it as the consequence of modern science and technology, which identifies with the metaphysics of our time: the world is represented and grasped as an image. Heidegger's continued attempts to grasp this ontological understanding, and use it to reduce the ontic to something floating above the ontological, hindered him from going any further with a consistent theory of the world image. We will see later why this is problematic. If modern technology is to be understood, we cannot stop at the grasped itself, but rather address the shifts of the grasped as such. If Heidegger's question of the measurement and graspability of technology is valid today, we have to ask again, what is the world picture? And we have to go beyond Heidegger by exploring the limits of his position and bring forth a new interpretation.

THE MECHANICAL WORLD PICTURE

If Heidegger's ontological difference has to be rethought, then the ontological cannot be posed as the absolute foundation of the ontic (physical or factual existence), rather the ontological and ontic must be conceived as a temporal unity. In other words, the meaning of existence itself has also to be hermeneutically understood. Here I want to contrast Heidegger with the Dutch Mathematician E. J. Dijksterhuis. In *The Mechanization of the World Picture*, Dijksterhuis investigates the history of the formation of world pictures from pre-Socrates to Newton.[4] The world picture as 'mechanics' was concretised in 1687 after the publication of Newton's *Principia* – an understanding that lasted until the early twentieth century. Dijksterhuis argues that the mechanisation of the world picture is not solely a scientific method, but becomes the form of our culture. The success of the mechanical model pointed to both the scientific revolution, but also the capacity for change inherent within it. We can see here in the history of science and technology a redoubling of the world picture in vision and practice, those ruptures which Thomas Kuhn calls a 'paradigm shift.'[5] *On the one hand, the world picture determines the thought behind science and technological development; on the other hand, the science and technology development reinforces and crystallises the world picture*. This redoubling problematises the ontological difference between Being and beings, since the distinction is blurred in the sense that one cannot simply isolate one's own understanding, as Heidegger did. By introducing the term 'mechanization of the world picture,' Dijksterhuis attempts to make such distinction clear, asking:

> Are we in doing so thinking of the meaning 'implement' or 'machine', implied in the Greek term μηχανή, and considering the universe—the mind of man included or not—as a machine? Or does the term mean that natural events can be described with the aid of the concepts and dealt with by the methods of a branch of science that is called mechanics—the word here being used in quite a different sense and meaning the science of motion?[6]

This question cannot be answered by choosing one option, since the machine, and thus the world picture, is both. The world picture itself is always a redoubling. This process can only be disrupted by a rupture that completely rejects this world picture (and replaces it with another). In the twentieth century quantum mechanics was such a rupture, since it rejected the clarity and certainty of the Galileo–Newtonian models of classical mechanics. The world picture becomes a force which repels the movement of the whole culture, as we can see from molecular biology, the atomic bomb, particle accelerators, microchips, etc. The power of the world picture is frequently and perpetually undermined, because this process of replacement is core to scientific method. In his introduction, Dijksterhuis reminds us that:

> owing to all these factors the mechanization of physical science has become much more than an internal question of method in natural science; it is a matter that affects the history of culture as a whole, and on this account, it deserves the attention of students outside the scientific world.[7]

Today we have to ask, what is the world picture of our time? There has been a shift from a mechanised world picture, based in analogue models of scientific thought, to one formed through the digital network based on patterns and repetitions of digital matter. *It is a specific image of networks, which characterises the computational turn*. On one hand, the networked world image of the computational turn bears an affinity to quantum mechanics' concepts of uncertainty and complexity; on the other hand, it originates from the quotidian uses of telecommunication networks, concreted at the time when the Internet became an indispensible part of daily life (of course one can argue against the coverage and ubiquity of the Internet, but here we are dealing more with a paradigm). Network visualisation or analysis pervades all spheres of Western culture: computing,

sociology, philosophy, neuroscience, biology, art, etc. Mark Wigley has even characterised the network as a symptom: 'Network Fever.'[8] The question of the network seems to be self-evidential, and is already grounded in intersubjective understandings which don't need further interrogation.[9] This consensus is legitimated in our daily life, or what Scott Lash calls the technological form of life.[10] This consensus presents two effects: one is the effect of technological innovation and evolution; and the other is what Heidegger characterised as the completion of metaphysics in modern technology, specifically cybernetics.[11]

The question now is where is this network image from? What do we mean by a networkisation of the world picture? What is the significance of a networked world picture to the understanding of our culture, especially if we are already immersed within the 'computational turn?' Furthermore, why does this new world picture bother us at all? The remainder of this essay will briefly bring this networked world picture into the light; hopefully this process will be sufficient to open up further critique and discussion. I will propose that two apparently distinct domains, namely communication networks and language, converge and fulfil this image of networks. The concept of network is not new, but what really brings this particular framing of the network to the fore is the computational turn.

NETWORK IMAGES AND HUMAN LANGUAGE

The most referred network models by computer scientists and cultural theorists are still those developed in the early 1960s by Paul Baran of RAND Cooperation. In Baran's models networks are categorised as centralised, decentralised and distributed. The difference between decentralised and distributed requires elaboration here. In his 1964 essay "On Distributed Communications," Baran proposes that a decentralised network is a hierarchical network with multiple centres, while a distributed one is a network without hierarchy. A distributed system contains many switching nodes linking to each other, with a redundancy in linkage ensuring the service of connection to the users. The files to be sent over the network are divided into small packets (called 'datagrams'), which travel on the network from the sender and are received and reassembled in the receiver's machine.[12] As Abbate explains, in Baran's model of a distributed network "there is no central control; only a simple local routing policy is performed at each node, yet the overall system adapts."[13]

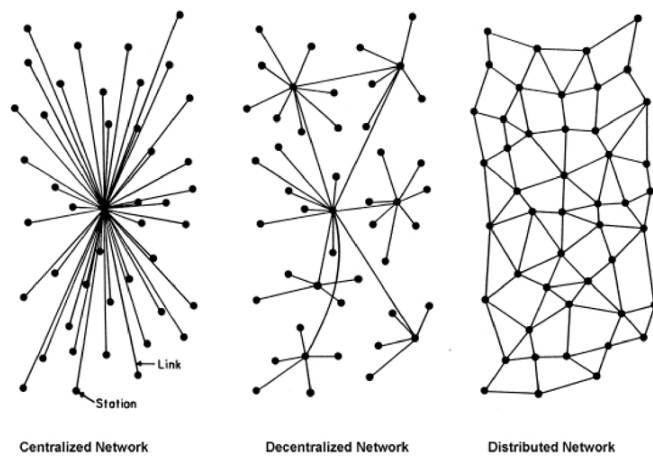Figure 1. Paul Baran, "Diagram of Centralized, Decentralized and Distributed Networks", from the introduction to "On Distributed Communications Networks", first presented in September 1962 and subsequently published by RAND Corporation in their RAND Memorandum series. http://www.rand.org/pubs/research_memoranda/RM3420/. Reproduced with permission.

Centralized Network   Decentralized Network   Distributed Network

In the more recent development of network topologies, especially in P2P networks, we can see other forms of networks dependant on the purposes of the distributed system. In 2004, the Hungarian physicist Albert-László Barabási showed that the World Wide Web has a scale-free topology, which demonstrates several characteristics, for example, the preferential growth of hubs and the power-law distribution.[14]

We can also relate this distributed image to the understanding of communication (or, more precisely, human communication). Baran's dot-and-line structure has its origin in semiotics and language. Human communication since Aristotle has been understood as a coding machine which involves both encoding and decoding.[15] Meaning is encoded and has to be decoded at the receiving end. This applies to signs as well as semantics.[16] The coding machine is always relational, and each sign – though it may signify multiple meanings – nevertheless commits to a relation that one can link with a line. Coding and decoding, as Sperber and Wilson point out in *Relevance: Communication and Cognition*, is not a broad enough model to generalise the whole method of communication, since things such as "the time and place of utterances, the identity of the speaker, the speakers' intention" cannot be included in the semantic meaning of the sentence.[17] So there is another model needed, which Sperber and Wilson call the inferential model.[18] The inferential model works separately with the coding model through logical inferences. It always has the tendency to reduce the meaning of sentences or words to propositions, in order to carry out logical operations. This inferential system is today what we can map as the XML data structure, the semantic web (a project proposed by Tim Berners-Lee ten years ago, also known as data web), or any formalised data set which allows the generation of relations and hence networks through logical inference.[19] Berners-Lee writes,

> I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A 'Semantic Web', which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The 'intelligent agents' people have touted for ages will finally materialize.[20]

In the semantic web (popularly known as web 3.0), linked data forms a network that is once again visualised in the form of dots and lines. There are numerous similarities between Baran's original models and the working principle of computer networks and the semantic web. For example, in the digital computer system, the message is chopped into packets as an encoding process and distributed to the network to be reassembled (decoded) and interpreted (inference) as a complete language. In the semantic web, the message is encoded according to specific ontology, and the machine will decode the message according to syntax specified by XML or RDF and infers the propositions to arrive at a solution. The semantic web is the ultimate vanguard of the computational turn.

Figure 2. Richard Cyganiak and Anja Jentzsch, "Linking Open Data cloud diagram," (last updated 22 Sep 2010), http://richard.cyganiak.de/2007/10/lod/ Early version reproduced by Orchestr8 as the "alchemyAPI" (2009), http://www.alchemyapi.com/api/entity/ldata.png CC-BY-SA

DISCURSIVE NETWORKS AND THE ALTERMODERN

These kinds of network visualisation, or even network images, understood as the representation of 'cultural dynamics,' today rely on two foundations: the instrumental use of language (grounded in traditional logic) and different forms of network topologies.[21] This double foundation was unthinkable in the mechanised world, since such a picture had always to be in order and finite. The shift from the mechanisation of the world picture to the networkisation indicated by the computational turn implies a renewed intuition of the world (*Weltanschauung*), a sophisticated, graspable, yet contingent dynamics.

The computational turn shows us a network formed though increasing complexity, which is also discursive since it is based on logical language; in other words, it is a discursive network. The French cultural theorist and art critic Nicolas Bourriaud also uses the discursive network to characterise – what he calls – the Altermodern.[22] The Altermodern emerges from the end of both the celebration of the modern and the mourning of the postmodern. According to Bourriaud's analysis of art history, modernism substituted spatial perspective with temporal perspective, that is, history. The postmodern is refractory to both spatial and temporal perspectives, as in the mourning of the end of history. In a sense, Heidegger's critique returns, situated in between the modern and postmodern, expressing the melancholia of the coming of destructive gigantic forces, which at this point are unknown to the philosopher. He prophesies the imminence of the postmodern: the mourning of the impossibility of returning to the origin of historicality (that is, violent destruction), because he sees the essence of *technics* shifting from the origin of *poesis* to what he calls enframing (*Gestell*).[23] The transformation

is underlined by technological development, whose time is irreversible; that is to say, the forgetting of the ontological difference cannot be redeemed anymore. Human *Dasein* loses his/her place, or the There (*Da*) of his/her Being (*Sein*) in the world. This melancholia and the desire for origin corresponds to what Bourriaud understands as two stages of postmodernism: firstly, the oil crisis in 1973, marked by the end of the 30 glorious years (1945-75); secondly, the "neurotic pre-occupation with origins typical of the year of globalization."[24]

Bourriaud argues for the concept of the altermodern as the *Zeitgeist* of our time, which begins with the death of postmodernity. The groundlessness which we see in Heidegger becomes the ground of the altermodern: the abandoning of the question of origin in favour of "a positive vision of chaos and complexity."[25] For Bourriaud, the time of postmodernism is a "petrified kind of time advancing in loops" and the time of modernism is a "linear vision of history," while the altermodern is "a positive experience of disorientation through an art-form exploring all dimensions of the present, tracing lines in all directions of time and space."[26] Altermodern history is a disorientation of the present. The term disorientation deserves our attention. It is not a *fault* – the sublimation of the forgetting, as Heidegger says – but the *default* of the origin of global culture.[27] Here I must try to tighten the relation between the computational turn and this concept of the altermodern. As we saw above, firstly the modern concept of the network is technological and has its origin in the computer network as communication tool; secondly, discursive relations constitute a network by reducing time and space to the synchronisable clock time, which opens up a new dynamic of temporal and spatial experience. The altermodern, as I attempt to show here, reflects and co-constitutes the same world image. We can say that the ontological is not thinkable outside the technical reality, the ontic. For example, the use of technology dominates the discourse of the artworks Bourriaud uses to illustrate his theory: Simon Starling's use of radio waves to relocate furniture designed by Francis Bacon from one continent to another; Franz Ankermann's use of GPS to invent a new form of painting, etc. We can even push this suggestion further and state that the altermodern is legitimated by such a technological condition, that is, the computational turn. Indeed, the altermodern and the computational turn both share the disorientation of time and space. There are two implications here; firstly, the altermodern points to the lost of origin, and the proliferation of "cultural strata."[28] Secondly, it implies that time and space have lost their necessary correlation; for example, whereas within modernism an event was indicated by place 'x,' time 'y,' an event of place 'x' can now be linked to an event of time 'z.' This dissociation of time and space legitimate what Bourriaud calls the 'heterochrony.'[29]

Bourriaud asks, "but what is a network?" He answers,

 A connected chain of distinct elements in time or space. Various materials can serve as a 'glue' to hold the component elements together, yet one of them today assumes a particular importance: story telling.[30]

In this sense, the network (both technical and cultural) reconciles the spatial and the temporal, and brings them together into a single narrative. Is this simply another story from the angel of history? We have to realise that this narrative acquires a new temporal form. It is different from Walter Benjamin's storytelling, whose time is based on a mythical origin: the melancholia due to the passing away of the origin. Bourriaud's storytelling doesn't have an origin apart from the groundlessness of the global community. The ground (of the groundlessness) of Bourriaud's storytelling is the computational turn, a networked re-ordering of time and space. It implies relations and connections which are only possible in a technological sense: globalisation; cosmo-exploration; communication networks; the overlapping of patterns of cultural dynamics, etc.

An artwork is not an object anymore, but a network. It is beyond the correlation between time and space, since it is discursive; it follows the logic of language, which is in turn only possible through network technology. Commenting on the artworks of Nathaniel Mellors, Olivia Plender, Ruth Ewan and Spartacus Chetwynd, Bourriaud makes this point explicit:

> References to the past are coordinated according to a system of cognitive logic. To understand the present means carrying out a kind of rough-and-ready archaeological investigation of world culture, which proceeds just as well through re-enactments as through the presentation of artefacts—or again, through the technique of mixing.[31]

In the altermodern, which I identify with the computational turn, cultural logic is identified with cognitive logic, and the technique of mixing implies a total disorientation in which "there is no longer cultural roots to sustain forms, no exact cultural base to serve as a benchmark for variations."[32] Instead, language and network together produce a digital milieu, in which every form of connection is possible within imagination. I cannot go further into those artworks discussed by Bourriaud here; what we have to bear in mind is the strong sense of the digital milieu which promises the connectiveness of space and time within an image. What allows such a dynamic is exactly this connectivity, or discursiveness:

> the discursive is a production cycle, rather than a fixed performative moment in time … It occupies the increasing gap between the trajectory of modernity (understood here as a flow of technologies and demographic development) and the somewhat melancholic imploded self-conscious trajectory of modernism.[33]

The discursive network is dynamic. It doesn't confine itself to a fixed status. It allows the network to expand as new members join, to reorder when time goes by, to include what is said whenever they speak in a logical language. It means we can always define 'same as' and 'different from' as different entities.[34] If the altermodern is the celebration of our age, then the image of the network as world picture is its symbol, indicating its triumph. It is no more true that one has to understand the complexity and dynamic of the world and culture in terms of a discursive network than it is the world itself which is already grounded in such an intuition.

THE SHADOW OF HEIDEGGER AND THE LOGIC OF CULTURE

The artists in this sense are becoming nomads, or more precisely *Viatorise,* who transcend the temporal–spatial limitation of events.[35] This nevertheless is not new to us. Indeed, Deleuze and Guattari developed the concept of the rhizome as a new organisational structure against trees and taxonomies in *A Thousand Plateaus*.[36] The rhizome is at the same time a smooth plane which belongs to the nomads, who demand speed and acceleration. Deleuze and Guattari's critique should also be understood as a response to the technological milieu of their time. We have to remember that, from the 1960s onward until the rise of connectionism in cybernetics in the 1980s, the concept of hierarchy plays one of the most important roles in cybernetics, especially in the work of Herbert A. Simon and the early Noam Chomsky.[37] Deleuze and Guattari opposed these smooth spaces with striations, organisational structures that in some senses seem to prefigure the semantic web. On the other hand, Bourriaud attempts to be critical of the concept of network by asking "whether the era of the worldwide web and global hypermobility is really giving rise to new ways of perceiving human space?"[38] He answers positively with the 'altermodern' – the affirmation of a disorientation characterised by speed and acceleration. In other words, the altermodern is the affirmation of a technological sublime. This means that those who embraced Deleuze and Guattari have to remind themselves that the time of 'rhizome against tree' or the recognition of 'non-linearity over linearity' is

over. Now we are moving to a new tension: the celebration of networks and a new critique yet to come. The 'Altermodern' to us is a new world picture, which must be posed as a limit to be transcended.

In 1938, Heidegger saw the advent of the world picture as a closing down of human history, namely the instrumental use of language as a mere communication tool in cybernetics and the understanding of things as graspable entities or networks. We can identify this trajectory from the early Heidegger's critique of symbolic logic in the 1920s through to the later Heidegger's defence of the non-thematic thing, and finally actualised in "The Question Concerning Technology" (1954). Heidegger's attempt to re-establish a ground for modern culture by separating the ontological from the ontic renders this aspect of his critique insufficient for cultural analysis. Dijksterhuis' work is a crucial extension of the critique of the ontological difference, which subsumes the ontic to the ontological. In the process Dijksterhuis gives us a model of mechanisation equal to that of the network. In *Technics and Time V.1* Bernard Stiegler exposes the forgetting of the ontic within Heidegger's own thought, and unveils that the ontic consists of the 'already there' and thus must be conceived as the *default* of origin.[39] The world image exposes both the insight and contradiction in Heidegger's own thought: the danger of posing the world as an image and the limitation of his understanding of the ontological difference.

Under such circumstances, it probably seems strange or even unrealistic to bring Heidegger's critique back to the computational turn, since the turn already announces his failure, or renounces it as the mourning of the postmodern. Yet the critique from Heidegger remains a shadow in the celebration of the altermodern, the networkisation and datafication as the disorientation of the globe.[40] There is a paradoxical logic here; on the one hand, we believe that we already understand the world in its networked form, and we are able to grasp it, and predict its movements through the harvest of data; on the other hand, a network form also implies contingency and the difficulty to be totalised and subsumed to control. This indeed justifies one's affinity to this particular world image: it is at the same time inside and outside our control and knowledge; like the sublime in the face of the gigantic, it is *a feeling of pleasure without guilt*.

Finally, whether the logic of culture or the world can be understood as the logic of computation remains doubtful in two senses. Firstly, there is the question of truth proposed by Heidegger. The thematic-logical identification of the world through language implies a closure of the meaning of Being. The human conceals himself or herself in the discursive network; this cannot be dismissed as mythical, but is a reminder of techno-logo-centrism. Secondly, the question of cultural dynamics identified with the discursive network, a hermeneutic logic that says that every phenomenon supposes the image of the network; a redoubling of which creates a new culture, which furthermore follows on from what is *presupposed* by this image. This is what Dijksterhuis gives us; the blurring in between the ontological and the epistemological, and the world image becoming the mechanised momentum of cultural development. I am not here making a judgement of the computational turn, nor do I propose to negate the computational turn through a Heideggerian logic, which is an impossible task. The computational turn brought new possibilities and imaginations, also practicality to the world, something that must not be denied. Yet it demands a metaphysical understanding of its position in the global culture. I have proposed here a way of looking at the computational turn through the formation of the new world image, and have identified its philosophical and metaphysical meanings through an analysis of Bourriaud's altermodern alongside a discussion of network technology. As the new time demands a new world image, it also demands a new metaphysical reflection. Bourriaud and network technology both give us a different kind of *Weltbild*, a discursive, potentially emergent construction where an artwork is no longer an object, and where a network forms only temporarily in the gaps between one 'turn' and another. In the end, we may even forget asking what else can escape such a network image, after the computational turn?

1. Martin Heidegger, "The Age of the World Picture," in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York and London: Harper and Row, 1977), 133.

2. Brian Cantwell Smith, *On the Origin of Objects* (Cambridge, Mass.; London: MIT, 1998), 17.

3. Heidegger, "The Age of the World Picture," 129.

4. E.J. Dijksterhuis, *The Mechanization of the World Picture*, trans. C. Dikshoorn (Oxford: Clarendon Press, 1961).

5. Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1996).

6. Dijksterhuis, *The Mechanization of the World Picture*, 4.

7. Dijksterhuis, *The Mechanization of the World Picture*, 3.

8. Mark Wigley, "Network Fever," in *New Media, Old Media*, vol. 1, part 6 (November 2005), ed. Wendy Hui Kyong Chun and Thomas Keenan (New York and Oxford: Routledge, 2005), 375-98.

9. This view is especially popular in the field of computing, where many projects are concerned with network visualisation and social network investigations. In the field of media theory and philosophy, the term 'network' is often used without questioning it; for example, Mark Taylor, *The Moment of Complexity: Emerging Network Culture* (Chicago: University of Chicago Press, 2001).

10. Scott Lash, *Critique of Information* (London: Thousand Oaks, Calif.: SAGE, 2002).

11. "Nur noch Ein Gott kann uns retten" (interview), *Der Spiegel,* 31 May 1976.

12. This mechanism is called packet switching.

13. Baran in J. Abbate, *Inventing The Internet* (Cambridge, Mass.: MIT Press, 2000), 11.

14. Albert-László Barabási and Eric Bonabeau, "Scale-free Networks," *Scientific American* (May 2003).

15. Dan Sperber and Deirdre Wilson, *Relevance: Communication and Cognition* (Oxford: Blackwell, 1986), 2.

16. Sperber and Wilson, *Relevance,* 6. "The semiotic approach to communication … or the semiological approach … is a generalization of the code model of verbal communication to all forms of communication."

17. Sperber and Wilson, *Relevance,* 9. "By definition, the semantic representation of a sentence, as assigned to it by a generative grammar, can take no account of such non-linguistic properties as, for example, the time and place of utterances, the identity of the speaker, the speakers' intentions and so on." So accompanying the coding-decoding model, an inferential model has to be established to infer non-semantic meanings into the communication.

18. Sperber and Wilson, *Relevance*, 24-8.

19. Tim Berners-Lee et al., "The Semantic Web," *Scientific American* (1 May 2001), http://www.sciam.com/article.cfm?articleID=00048144-10D2-1C70-84A9809EC588EF21 [accessed 13 March 2008].

20. *Wikipedia*, "Tim Berners-Lee," http://en.wikipedia.org/wiki/Tim_Berners-Lee [accessed 20 Oct 2010].

21. A three-day international conference titled "A Topological Approach to Cultural Dynamics" was held as an EU project (led by the sociologist Celia Lury) in Barcelona, 10-12 December 2009. Another significant example is the media theorist Lev Manovich, who is developing a new approach called 'Cultural Analytics' through the analysis of network-formed data. See http://manovich.net/.

22. Nicolas Bourriaud, *Altermodern: Tate Triennial* (London: Tate Gallery, 2009).

23. Martin Heidegger, "The Question Concerning Technology," in *The Question Concerning Technology and Other Essays*, trans. William Lovitt (New York and London: Harper and Row, 1977).

24. Bourriaud, *Altermodern*, 17.

25. Bourriaud, *Altermodern*, 13.

26. Bourriaud, *Altermodern*, 13.

27. The concepts of 'default' and 'default of origin' have been developed by Bernard Stiegler from Heidegger's concept of the 'already there.'

28. Bourriaud, *Altermodern*, 11.

29. Bourriaud, *Altermodern*, 14 .

30. Bourriaud, *Altermodern*, 22.

31. Bourriaud, *Altermodern*, 15.

32. Bourriaud, *Altermodern*, 18.

33. Bourriaud, *Altermodern*, 22.

34. See the logical language of OWL proposed by W3C, "**differentFrom**: An individual may be stated to be different from other individuals. For example, the individual Frank may be stated to be different from the individuals Deborah and Jim. Thus, if the individuals Frank and Deborah are both values for a property that is stated to be functional (thus the property has at most one value), then there is a contradiction. Explicitly stating that individuals are different can be important in [sic] when using languages such as OWL (and RDF) that do not assume that individuals have one and only one name. For example, with no additional information, a reasoner will not deduce that Frank and Deborah refer to distinct individuals." *OWL Web Ontology Language Overview* 10 Feb 2004, http://www.w3.org/TR/2004/REC-owl-features-20040210/#differentFrom [accessed 10 Nov 2010].

35 By the term 'viatorose,' Bourriaud means that artists are turning into nomad and travellers, what he calls 'homo viator.' Bourriaud, *Altermodern*, 21-3.

36 Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (London : Continuum, 2004).

37 For the work by Simon on hierarchy see Hubert Dreyfus, *What Computers Still Can't do: A Critique of Artificial Reason* (Cambridge, Mass.: MIT, 1992) and, for the early Chomsky, see David Golumbia, *The Cultural Logic of Computation* (Cambridge, Mass., and London: Harvard University Press, 2009), 37-8.

38 Bourriaud, *Altermodern,* 22.

39 Bernard Stiegler, *Technics and Time: The Fault of Epimetheus*, trans. Richard Beardsworth and George Collins (Stanford, Calif.: Stanford University Press, 1998).

40 We are witnessing tremendous efforts in turning objects into data in logistics, archives, social networking sites, etc. The intensive increase in the amount of data creates a digital milieu which we can hardly escape.