

**ATTENTION, ECONOMY AND THE BRAIN**

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'Whoever treats of interest inevitably treats of attention...'  
(William James)

'I consume my consumers'  
(Grace Jones 'Corporate Cannibal')

'Attention, conatus of the brain...'  
(Gabriel Tarde)

In recent years, the notion of attention has come to occupy a key place within the overall discourse surrounding what has been called 'the new economy' or 'digital economy', but also within the critical analyses of cultural theorists evaluating the politics of digital media. Theories of the attention economy are considered here as a continuation of the modern theme of the 'crisis of attentiveness' (Crary, 1999), this time elaborated in terms of the impact of Internet usage on the cognitive architecture of a neuroplastic and mimetic social brain. This essay maps some of the ways in which the notion of 'attention' is mobilized as an economic category within theories of the Internet, framed in terms of neoclassical or mainstream economics theory *and* within theories attempting to account for processes of psychic transindividuation and social cooperation in contemporary capitalism.

**The Attention Economy**

The centrality of the notion of attention to recent theorizations of the economy of the Internet and digital media marks a significant difference with regard to the centrality of information in earlier theorizations of this kind (Goldhaber, 2006; Barlow, 1993; Kelly, 1999). While information was said to be a radically new type of

commodity that challenged established economic models, attention seems to bring with it a recoding of the economy of new media along more orthodox lines, in as much as it reintroduces a principle of scarcity where there used to be only abundance and limitless possibilities. If information is bountiful, attention is scarce because it indicates the limits inherent to the neurophysiology of perception and the social limitations to time available for consumption.

In an earlier phase, new media economists stressed the abundance of information in the digital economy to assert a new kind of economic Darwinism, based on the capacities of a proliferating, connected life to create the new. This was an artificial kind of life, which the digital entrepreneur had to learn to harness and selectively channel in order to extract surplus value (Terranova, 2004). The *bios* of the new economy, then, entailed a continuity with the Darwinian dynamics of competition, while eschewing the harsh constraints of natural scarcity which framed the notion of the survival of the fittest. The return of scarcity in theories of the attention economy implies a normalization of the new economy. However, the latter manifests a tension between the previous, abundant, inventive *bios* of organic life and the new centrality accorded to the *bios* of a special organ, the brain, but one that is strangely deprived of its capacity for creation and innovation.

In theories of the attention economy, attention is first of all a scarce resource, which is what allows the Internet to become an economic medium again, that is, a medium to which all the axioms of market economics can once again be applied. Scarcity is the condition that can give rise to a proper economy, the ‘attention economy’. Attention is a scarce resource because ‘the sum total of human attention is necessarily limited and therefore scarce’ (Goldhaber, 2006). As Michael Goldhaber explains,

By the Attention Economy, then, I mean a system  
that revolves primarily around paying, receiving,  
and seeking what is most intrinsically limited and  
not replaceable by anything else, namely the  
attention of other human beings. (2006)

According to theorists of the attention economy, in as much as attention is both scarce and measurable, it can become not simply a commodity like others, but a kind of capital. The abstract quality of attention and at the same time the fact that the ‘attentional assemblages’ of digital media enable automated forms of

measurement (as in ‘clicks’, ‘downloads’, ‘likes’, ‘views’, ‘followers’, and ‘sharings’ of digital objects) open it up to marketization and financialization (from the floating value of Internet companies to the accumulation of celebrity capital by means of a number of followers on Twitter to the changing value of ‘clicks’ as calculated by Google’s software AdSense and AdWords).<sup>1</sup>

While already in 1999, Georg Franck attempted to describe attention as ‘the new currency of business’, proposing that attention constitute a new kind of capital (‘attentive capital’) and even a kind of wage or income (attention income such as that generated by fame and celebrity, for example) (Franck 1999), the attempts to capitalize attention have recently gone even further. Thus, for example, the Wikipedia entry for ‘attention economy’ reports proposals for ‘attention transactions’ (Goldhaber); the institution of new property rights in attention; and, of course, also the issuing of ‘attention bonds’, that is, ‘small warranties that some information will not be a waste of the recipient’s time, placed into escrow at the time of sending’ (Loder, Van Alstyne & Wash, 2004). Hence ‘...receivers could cash in their bonds to signal to the sender that a given communication was a waste of their time or elect not to cash them in to signal that more communication would be welcome’ (‘The attention economy’, Wikipedia n.d.).

It is true that such theories constitute a kind of ‘fringe’ discourse within the field of economics at large, and one that lacks the legitimacy that is usually granted to more academic work. Published mostly on the Internet, and then also occasionally translated into paperback publications for the market of incumbent and aspiring Internet entrepreneurs, they constitute a specific genre which, while also being somehow ephemeral, in some way translates what are the more general preoccupations of economic actors operating within the context of what used to be called the ‘new economy’. In particular, as Henry Jenkins has argued in his study of ‘convergence culture’, the notion of attention as a scarce resource corresponds to the preoccupations of corporate giants when facing a new context of communication characterised both by a large offer of information and a new type of consumer/viewer who is tendentially in a state of drift (Jenkins, 2006).

Digitization and networking, and the special status of information as a non-rival good, do not produce, as in theories of social production, the conditions for the emergence of a new ‘nonmarket’ mode of production, but rather point to the circularity of normative market

economics. By consuming attention and making it scarce, the wealth of information creates poverty that in its turn produces the conditions for a new market to emerge. This new market requires specific techniques of evaluation and units of measurement (algorithms, clicks, impressions, tags, etc).

### A Poverty of Attention

Within current discussions of the economic implications of shifts in technologies of attention, the latter is seen not only as ‘scarce’ because limited, but also as increasingly ‘degraded’. In a strange reversal of early information theory’s take on entropy, attention here becomes the scarce quantity which is ‘consumed’ by that which is abundant, that is, information. In the recent wave of publishing around the idea of a ‘crisis of attention’ (which parallels and supplements discussions of attention economy), it is common to find the notion of a ‘degradation of attention’ provoked by digital technologies and its economic effects. In an article by Sam Anderson in the *New York Magazine* on the 25<sup>th</sup> of May 2009, one finds, for example, a quote referring back to the writings of ‘polymath economist’ Herbert A. Simon, who in 1971 offered what Anderson describes as ‘maybe the most concise possible description of our modern struggle’:

‘What information consumes is rather obvious: It consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.’ As beneficiaries of the greatest information boom in the history of the world, we are suffering, by Simon’s logic, a correspondingly serious poverty of attention. (Anderson, 2009)

If attention that is actually paid can be measured by numbers of clicks and viewings, however, attention that is lost in paying attention requires a different kind of measurement. If the financialization of attention relies on the possibility of measuring attention by means of techniques operating on data and meta-data abstracted from digital interaction, the poverty of attention is related to the measurement of physiological reactions of the brain to stimuli

and to the new neuroplastic potential of the brain. As Anderson explains,

Before the sixties, they measured it through easy-to-monitor senses like vision and hearing (if you listen to one voice in your right ear and another in your left, how much information can you absorb from either side?), then eventually graduated to PET scans and EEGs and electrodes and monkey brains. Only in the last ten years – thanks to neuroscientists and their functional MRIs – have we been able to watch the attending human brain in action, with its coordinated storms of neural firing, rapid blood surges, and oxygen flows. This has yielded all kinds of fascinating insight...  
(Anderson 2009)

In a widely read essay published in 2009 in *Wired* magazine and later turned into a book, Nicholas Carr weaves together such research to formulate an argument that resonates with current interest on the part of new media economists in the value of attention (Carr, 2010b). Citing research by neuroscientists on experimental exposure to new media objects, Carr argues that such exposure rewrites neural pathways within individual brains. The effect of new media would thus be a rewiring of attention, whereby activities such as multi-tasking and reading hyperlinked texts would produce, both in seasoned Internet users and new ones, a shift of neuronal activity from the hippocampus (where brain scientists usually locate activities such as focused reasoning and long term memory) to the prefrontal cortex (which would be occupied by rote tasks and short term memory). Exposure to new media would thus cause a remodelling of different types of memory within individual brains, making individuals faster at carrying out routine tasks, but at the same time less efficient in the ways they carry out those tasks and weaker at deeper comprehension and understanding (Schwartz, 2011).

In contemporary neuroscience, these ambivalent properties of the brain's attentive capacities are understood through the notion of *plasticity*, which Catherine Malabou in her controversial essay on neuroscience and the spirit of capitalism has called 'the dominant concept of the neurosciences... their common point of interest, their dominant motif and their privileged operating model' (Malabou, 2008: 4).<sup>2</sup> The brain for Carr is rewired by the Web in

such a way as to make it a faster automaton when it comes to routine tasks but at the price of severely impairing its ‘higher’ cognitive faculties. The economic/informational plastic brain is thus caught in a double bind: on the one hand, in order to participate in the attention economy, it must enter a technological assemblage of attention; on the other hand, becoming part of this assemblage implies a dramatic cognitive loss that is translated into a subjectivity more adept at carrying out routine tasks but less capable of reasoning, reflecting and intimacy (see also Berardi, 2010; Turkle, 2011).

The ‘brain scientists’ quoted by Carr, in fact, describe the attentional assemblage of brain and Internet as a *costly* one for the efficiency of thinking:

The Internet is an interruption system. It seizes our attention only to scramble it. ... The penalty is amplified by what brain scientists call switching costs. Every time we shift our attention, the brain has to reorient itself, further taxing our mental resources. Many studies have shown that switching between just two tasks can add substantially to our cognitive load, impeding our thinking and increasing the likelihood that we’ll overlook or misinterpret important information. On the Internet, where we generally juggle several tasks, the switching costs pile ever higher. (Carr, 2010a: 1)

In this sense, the attention economy brings to the fore and makes explicit the long tendency of modern culture to produce what Jonathan Crary has called an ‘ongoing crisis of attentiveness’ in which ‘the changing configurations of capitalism continually push attention and distraction to new limits and thresholds, with an endless sequence of new products, sources of stimulation, and streams of information, and then respond with new methods for managing and regulating perception...’ (Crary, 1999: 13). For Crary, in fact, the crisis of attentiveness goes back to the nineteenth century, where already the notion of attention within the new assemblages of production and consumption of industrial capitalism provided the means by which a new type of subject was constituted. This was then the beginning of what he also calls ‘a revolutionizing of the means of perception’, which for the last hundred years has exposed perceptual modalities to ‘a state of perpetual

transformation, or, some might claim, a state of crisis' (Crary, 1999: 13). As Crary also argues, however, already in its early days, 'the articulation of a subject in terms of attentive capacities simultaneously disclosed a subject incapable of conforming to such disciplinary imperatives' (13).

When read together, both statements about the attention economy and the crisis of attention point to the reconfiguration of the attentive capacities of the subject in ways which constitute attention at the same time as a *scarce*, and hence a *valuable resource*, while also producing an *impoverished subject*. The brain provides the scarce resource that allows the digital economy to be normalized, while also suffering a depletion of its cognitive capacities. This seems akin to what Bernard Stiegler has recently called the '*proletarianization of the life of the mind*', which remains one of the possible outcomes of the diffusion of digital and reticulated technologies (Stiegler, 2010: 21).<sup>3</sup> However, whether the reconfiguration of cognition triggered by new technologies is assessed as an impoverishment of attention or rather as a more ambivalent mutation of subjectivity is still an open question (Hayles, 2007).

### **Paying Attention and Imitation**

The economic subject of attention as it is drawn by theories of the attention economy expresses also another challenge, this time produced not only by individual exposure to new media technologies, but also by the hyper-sociality of the connected brain. It is neither, then, only a matter of what the individual does when accumulating or spending one's limited stock of attention nor simply a question of the degradation of the individual's capacity to pay attention as the cost incurred by being constantly plugged into the attentional assemblages of digital media. Paying attention to what others do on networked social platforms triggers potential processes of imitation by means of which network culture produces and reproduces itself. The brain mobilized by theories of the attention economy in a milieu of reticulated communication is measurably social (Latour, 2011).

Participating in the attentional assemblages of digital media implies becoming part of social processes where paying attention triggers responses of imitation which shifts between the virtual form of a passing impression and the actual form of acts such as reading and writing, watching and listening, copying and pasting, downloading

and uploading, liking, sharing, following and bookmarking. The economy of attention is, then, also the economy of socialization of ideas, affects and percepts, and hence an economy of social production and cooperation. But are theories of the attention economy equipped to deal with the socially productive character of attentional assemblages or do they remain confined to an individual model of cognition which is too centred on the individual brain?

As Charles T. Wolfe argued, in the past ten or twenty years, at least the neurosciences as such have indeed 'begun to take something of a "social" turn ... , with the publication of books, anthologies, and journal issues called *Social Neuroscience*, *Social Brain* and such, picking up momentum in the past five years. Topics such as imitation, empathy, "mind-reading," and even group cognition have come to the fore' (Wolfe, 2010: 185).<sup>4</sup> In particular the 'social' in social cognition 'focuses notably on mirror neurons, which indicate the existence in the brain of a particular recognition or decoding of *action* and thus of the imitation of action, implying an understanding of other people's intentions, goals and desires' (186). The notion of mirror neurons for Wolfe opens up discussion of the brains to new materialist accounts of the social intellect, but unfortunately at this stage it tends to rely on sociobiological theories of primate behaviour and hence sees the 'social intellect' as driven by a 'Machiavellian intelligence' (de Waal, 1982). This is a recoding of networked subjectivity onto the figure of the manipulative primate, whose social intelligence is imitative in nature and where imitation is basically the key to social manipulation by a self-interested, calculative subject endowed with 'strategic rationality' (Haraway, 1989: 147-148). It is, then, a social intellect which is ultimately determined by the calculative, self-interested rationality of *homo oeconomicus*.<sup>5</sup>

What is at stake in the relation between attention and imitation evoked by theories of the attention economy is a new translation in economic terms of the theme of imitative, swarming and contagious behaviours as characterizing networked communication (Thacker, 2004; Parikka, 2010). The neuroplastic brain, then, not only reconfigures its cognitive architecture in response to new media exposure, but, when seen together with the enactive and involuntary impressions produced by paying attention as an act of potential imitation, turns the self-possessive and rational economic subject into a potentially *mimetic node*. And yet, processes of social emergence which characterized the discourse on innovation in theories of the information economy are here downplayed. Recent

theories of financial markets, which to André Orléan appear driven by contagious and mimetic behaviours undermining the notion of the rationality of the economic agent, for example, seem to emphasise the short-circuiting of rational choice produced by imitation (see Orléan, 2010).<sup>6</sup> Paying attention in a socially networked environment, then, exposes the paradox of a self-interested, calculative subject who is, however, at the same time also exposed to the inhuman forces of mimesis and contagion.

### **Attention, Value, Cooperation**

In an early essay entitled ‘For a Redefinition of the Concept of “Biopolitics”, Maurizio Lazzarato asked us to reconsider the well known post-workerist thesis that the information economy no longer captures and puts to work the ‘time of work’, but rather the ‘time of life’ (Lazzarato, 1997).<sup>7</sup> As Lazzarato argued, the concept of the ‘time of life’ implied in the information economy evokes what he calls ‘an a-organic life’ by which he means ‘time and its virtualities’: ‘Not abstract time, measure time, but time as *puissance*, time as “source of continuous creation of unpredictable novelties”, “that which allows everything to be done”, according to some statements of Bergson’ (116). As Lazzarato argued, the information economy mobilizes a new kind of vitalism ‘that is *temporal* and not just *organic*, a vitalism that refers to the virtual and not simply to biological processes’ (116).

In the fifteen years since the publication of Lazzarato’s essay, such a-organic life has acquired an organic character that is evident in the increasing salience of neuroscience and its object, the brain. As we have seen, the cognitive architecture of the brain organized by principles of the neurophysiological limits to attention, the neuroplasticity of brain cells and the imitative capacity of mirror neurons provides the organic reference that determines the way the brain acts as a force in theories of the attention economy and networked media. In his later work on Gabriel Tarde, however, Lazzarato also assumes explicitly the concept of the ‘brain-memory’ as a means to conceptualize the character of such a-organic life, but in radically different ways than those assumed by theories of the attention economy. In particular, Tarde’s concept of the ‘brain-memory’ is at the basis of his critique of mainstream and Marxist political economy in as much as both of these theories, in his opinion, fail to account for the production of value within social cooperation.

Tarde uses the brain as a model for his theory of social cooperation in as much as nerve cells exhibit peculiar features within the larger milieu of biological life. They are the most homogeneous and less specialized of the body's cells, but most importantly, they are connected to each other in such a way as to influence each other's states at even a great distance. Synaptical connections enacted by axons defy physical proximities of neurons, generating what Malabou calls the 'general landscape of memory' (Malabou, 2008: 23). Furthermore Tarde's 'brain-memory' is not an individual organ belonging to a subject, but it is by nature constituted by the outside, a fold crossed and shaped by the currents produced by the circulation of the social quanta of beliefs and desires. In Tarde's psychological economy, brain cells are open monads, infolding the outside and reactualizing it at every turn (Tarde, 2010a; 2010b).

In Tarde's account, communication technologies such as the press enabled the *socius* to become more akin to the network of neural cells in the central nervous system. They imply a conception of subjectivity as that which unfolds in relation to action-at-a-distance by other subjectivities or monads, making our alliances and ideas more fluid and less set in tradition. Economic value, he argued, is derivative with relation to social, cultural and aesthetic values, which are the product of social cooperation or cooperation between brains, whose labour is defined as the 'labour of attention'.

Attention, defined as the 'conatus of the brain', is that which expresses the desire of the brain-memory to affect and be affected through this peculiar form of action at a distance. Memory (or spirit, or soul) expresses our power of acting on the world and its labour is above all the labour of attention. (Lazzarato, 2002: 20)

The labour of attention enables social cooperation and is thus the real source of the production of value – a *social* kind of production steeped in relationality. The openness of the brain-memory to action-at-a-distance by other brain-memories is what allows the value produced by invention to be socialized through imitation. It does not leave the economic subject exposed to the irrational capture by external forces, but it implies that it is sociality as such that realizes value (Tarde, 1903).

### Psycho-powers

Tarde considered the invention of modern communication technologies as positive in as much as they increased such powers of cooperation and extended the reach of mutual influence. Modern media enhanced and extended the range and scope of those processes of invention and imitation that for him constituted the essence of economic life. In Bernard Stiegler's work, however, what he calls 'attentional' or 'psycho' technologies, such as radio, television and digital technologies, have done more than simply extend the powers of mutual affection of connected brains (Stiegler, 2008). Starting from a reading of Husserl's phenomenology that is substantially at odds with Lazzarato's emphasis on 'a-organic life' (and his overall philosophy of difference), Stiegler reads modern media as 'tertiary retentions' or 'mnemotechnic technologies' which concretize modes of 'psycho-power' affecting the relation of self to self and self to other. Attention is the name for that relation between 'retentions' and 'protentions', that is, between the movement of consciousness that retains the trace of that which has just passed and its expectation of that which is to come. For Stiegler, in modern societies, the relation between retentions and protentions is mediated by those specific instances of tertiary retentions that are the media as psychotechnologies.

From this perspective, the contemporary economy of attention needs to be read as a new moment in the long duration of modern media as psycho- and social technologies. Such media have historically enacted 'the systematic capture of attention... resulting in a constant industrial canalization of attention', whose effects on libidinal energy have been substantially destructive. What they have destroyed is on the one hand a set of knowledges which he describes as 'savoir-vivre' (which corresponds to the Foucauldian notion of 'care of the self') and civility (care of others as founded on 'philia', that is socialised libidinal energy), and, on the other, the 'psychical apparatus and the social apparatus' as a whole (Stiegler, 2008).

For Stiegler, it is not a question of denouncing the technical colonization of libidinal energy by technique (in as much as technique, as he argued in *Technics and Time* (1998), following Leroi-Gourhan, is a constitutive element of anthropogenesis), but of considering the harmful effects of the industrial economy, based on the division between production and consumption, and on the quality of socialized libidinal energy (see also Dean, 2010). If the attention economy degrades somehow the quality of libidinal

energy, this is not due to some intrinsic limits of the human capacity to pay attention or to the inevitable effects of technique, but rather to a specific conception and organization of the economic system which overlooks the importance of libidinal energy to the production of the psyche and the social (Stiegler, 2010). This conception and organization has caused the processes of individuation that connect psychic and social life to be short-circuited, resulting in the destructive hegemony of the short term over the long term. Social network technologies, like those associated with the social web, for Stiegler intervene exactly in this milieu of psychic proletarianization provoked by modern media and marketing techniques:

It is a matter of technologies of indexation, annotation, tags and modelised traces (M-traces), wiki technologies and collaborative technologies in general.... After having destroyed the traditional social networks, the psychotechnologies become social technologies, and they tend to become a new milieu and a new reticular condition of transindividuation grammatising new forms of social relations.  
(Stiegler, 2008)

It is important to underline that, for Stiegler, social network technologies are not necessarily bound to extend the psychic and social impoverishment that the marketing and consumption-driven modern media perpetrated. On the contrary, the new forms of social relations grammatised by social networks produce new conditions of transindividuation that might allow a reversal of the hegemony of modern psychotechnologies. Paying attention to social networks can potentially imply truly taking care of self and others in ways that can renew depleted libidinal energy and trigger the emergence of a new collective organisation.

## Conclusion

Tracing the properties attributed to attention in theories of the attention economy we can see, then, how the former enacts a tense relation among a number of attributes of attention as a measurable economic entity: scarcity (as a limit that signals a return of 'normal' economics within the 'new' economy); poverty (the qualitative degradation of attention); and imitation (the vulnerability of the

brain to capture by external forces quantified by measurement of diffusion of behaviours such as liking, following, etc). Attention is scarce from the point of view of the seller/provider of corporate commodities; it is poor when conceived from the point of view of efficient performance (Hayles, 2007). Theories of the attention economy, then, appear locked within the limits of scarcity, unable to account for the powers of invention of networked subjectivities, falling back into ‘herd-like’ models of connected sociality, and delegating to speculative mechanisms of financialization the capacity to create value out of partial attention and continuous distraction.

On the other hand, we have seen how in critics of political economy such as Stiegler and Lazzarato the concept of attention is enrolled within a general framework aiming at overcoming the impoverishment and scarcity provoked by the subsumption of attention under capital (or, in the terms used in this article, the ways in which attention is used to ‘normalize’ the excessive abundance of the information economy). In such a context, attention does not simply indicate the effort by which the individual brain works, nor can it be reduced to a scarce, and hence tradeable commodity, or to that which exposes the individual to a dramatic cognitive impoverishment. On the contrary, attention is the process by which value is produced as inseparable from the technological production of subjectivity – that is, from the invention and diffusion of common desires, beliefs and affects.

What I have mapped here, then, is a bifurcation in thinking about attention and the economy which exposes two very different ways of organizing a practice of paying attention. While theories of attention economy, however, correspond to explicit commercial and business practices of organizing and managing attention, what we need is a further exploration of some other ways in which paying attention can become a practice that will be able to produce different forms of subjectivity and different models of what an economy of social cooperation could be like.

### Notes

<sup>1</sup> For J. McGregor Wise, the concept of ‘assemblages of attention’ is meant to constitute an alternative to the way in which attention is mobilized as a notion by theories of the attention economy. Such theories not only reduce it to visual attention, but also ‘presume a particular model of attention based on an information-based model

of the brain. In this model, the brain acts like a computer' (Wise, 2011: 165). Instead, Wise insists that the concept of 'assemblages of attention' implies a focus on the 'distribution and formation of attention across body, brain, tool and environment. We have a plane of attention, with gravitational points of intensity and valuation... It is a plane of attention not centered around just the perceptual field of an individual, but in devices scattered across our bodies and devices, which note, recognize and attend' (169). On the ways in which attention is capitalized in the form of 'clicks' and 'traffic' and then subjected to financial evaluation in the business of search engines see Battalle (2005). On Google as a parasite of the *general intellect* see Pasquinelli (2009).

<sup>2</sup> For Malabou, the etymology of the word *plasticity* 'from the Greek *plassein*, to mold – ... has two basic senses: it means at once the capacity to *receive form* (clay is called "plastic", for example) and the capacity to *give form* (as in the plastic arts or in plastic surgery)' (2008: 5). The wired brain described by Carr is, however, more than a plastic brain in the two senses of the word, a *flexible* brain that *receives the form* imprinted on it by new technologies in such a way as to make it under-perform. As she argues, the contemporary spirit of capitalism tends to flatten plasticity onto 'its mistaken cognate' flexibility. 'To be flexible is to receive a form or impression, to be able to fold oneself, to take the fold, not to give it' (2008: 13).

<sup>3</sup> The notion that digital network technologies cause a kind of decomposition of libidinal energy and hence a cognitive and political degradation is also to be found in Dean (2010), Berardi (2010) and to some extent also in Turkle (2011). Unlike Dean and Berardi, however, Stiegler also points to the 'the critical intensification of the life of the mind' as another possible outcome of the interaction with digital and reticulated technologies (Stiegler, 2010: 21).

<sup>4</sup> On mirror neurons and imitation learning in human evolution see Ramachandran (2000); see also Churchland (2011) for a critique of the validity of the notion of mirror neurons for understanding social cooperation.

<sup>5</sup> In other cases, however, as in V. S. Ramachandran's account of mirror neurons and evolution, the imitative character of sensory-motor cognition expressed by mirror neurons is nothing else than the key to the emergence of human culture 40,000 years ago – where mirror neurons allowed 'a rapid transmission and dissemination of

ideas', with human brain and human culture co-evolving into 'obligatory mutual parasites' (Ramachandran, 2000: 4-5).

<sup>6</sup> Orléan's analysis of the behaviour of financial actors, however, has been criticized by postworkerist economists such as Andrea Fumagalli, Christian Marazzi and Carlo Vercellone. Vercellone, in particular, quotes recent research by three economists (Stefania Vitali, James B. Glattfelder and Stefano Battiston) from the Department of Management, Technology and Economics at the Federal Institute of Technology in Zurich, who have reconstructed the 'network of global corporate control'. According to such research, 'multinationals (or "transnational corporations") form a structure of giant "butterfly-nodes", and a great part of control is absorbed by a core of tightly-knit financial institutions. This core can be seen as an "economic super-entity" whose existence raises new and important questions for researchers and policy makers' (in Negri and Mezzadra, 2012; my translation). While Fumagalli describes such networks as inherently *collusive*, Marazzi argues that such a core knowingly creates the *mood* of the market, where investors move *mimetically*, as a herd. However, during panic phases, even the core struggles to maintain its control. 'During those phases of panic... when Thaleb's *black swans* appear, leadership enters a crisis and is upset by the unforeseen and the unpredictable. Such black swans are not necessarily those of the financial crises... but rather those social and political events escaping any political-financial modelizations. When panic sets in, even leadership is unsettled' (Marazzi in Negri and Mezzadra, 2012).

<sup>7</sup> The concept of 'time of life' recalls Foucault's thesis that capitalism works through techniques of power that he defined as 'disciplinary' and 'biopolitical'. Biopolitical techniques, Foucault argued, concern a human multiplicity as much as it is invested by processes concerning life, such as 'death, life, production, illness' (Foucault in Lazzarato, 1997: 115).

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