

An evolving apparatus

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Abstract

Language, in all its forms, is a key technology in defining the human. What would we be without language? Would we exist in the sense we apprehend ourselves? Could we reflect upon our existence in a structured manner, differentiating ourselves, others and things? Could we know what our urges and feelings might mean? Would we have a recognisable culture and exist in what we can identify as a society? As McLuhan proposed, language has extended the human and facilitated our evolution. We are profoundly as much a product of language as it is a product of us.

The computer has changed language as profoundly as writing and printing before it. As a symbolic machine, a system of signs that reflexively operates upon and modifies itself, both carrying and making meaning, the computer represents a new linguistic modality. We have rapidly adopted the computer as personal companions, as extensions of ourselves. Many of us are soft-wired into the machine and the possibility of hard-wiring is being explored by artists and scientists. The computer, as a language system, has become part of us and we have become part of it.

A significant development in computing, that has allowed us to see its social potential explicitly represented, was the convergence of computing and telecommunications infrastructure to create the internet. With the development of the hypertext transfer protocol, with its combination of computation and communication, we have witnessed the rapid and protean emergence of the web, a medium that in a short period of time has subsumed, or is close to subsuming, virtually all media before it. The web is not just the dominant media of our age but is becoming a fabric of our society, both instrumentally and culturally.

Given the relation between human ontology and language, the network can also be considered as key to the formation of our personal identity. What are the implications of living in such a media saturated hyper-connected culture? In this context we will consider the work of artists who, in the first instance, allow us to see how the computer and the network can be conceived and, secondarily, offer us visions of what the implications of these technologies are for individual and collective identity and what we can now identify as the homo-technical apparatus.

Introduction

As with all media, the network is a representational and largely linguistic entity¹. Representations arrive in many forms. Entire models of the world can be expressed in images, texts, equations, algorithms, objects, structures and, as we now realise, networks. The forms of representation we employ have significant effects on how we understand what is represented and thus largely determine our world-models and thus our understanding of things and ourselves. This is what we understand to be mediation and we, as self-reflexive entities, are necessarily mediated through and through. We know ourselves, and others, through our representations and we exist, to a large extent, as those representations. Some have proposed that this is all we might be².

Language, in all its forms, is a key, perhaps the key, technology in defining the human. What would we be without language? Would we exist in the sense we apprehend ourselves? Could we reflect upon our existence in a structured manner, differentiating ourselves, others and things? Could we begin to identify what our urges and feelings might mean? Would we have a recognisable culture and exist in what we can identify as a society?

On the other hand, just what capabilities does language afford us? To what extent can we trust what we apprehend through it. Media distort and corrupt information as much as facilitate its transmission. There is always a signal to noise ratio.

Language as revelation and disguise

Marshall McLuhan proposed that language has extended the human and facilitated our evolution as a species, suggesting we are as much a product of language as it is a product of us.

It is the extension of man in speech that enables the intellect to detach itself from the vastly wider reality. Without language, Bergson suggests, human intelligence would have remained totally involved in the objects of its attention. Language does for intelligence what the wheel does for the feet and the body.

¹ Here a broad definition of what constitutes language is employed, including conventional and other, more unusual, visual, aural and diverse media forms.

² Jean Baudrillard's concept of the Simulacra is relevant here

It enables them to move from thing to thing with the greatest ease and speed and ever less involvement. Language extends and amplifies man but it also divides his faculties. His collective consciousness or intuitive awareness is diminished by this technical extension of consciousness that is speech. (McLuhan 1964)

Robert K. Logan, closely following key elements of McLuhan's proposition, argued:

Syntactilized verbal language extended the effectiveness of the human brain and created the mind. Language is a tool and all tools, according to McLuhan (1964), are extensions of the body that allow us to use our bodies more efficiently. I believe, that language is a tool which extended the brain and made it more effective thus creating the human mind which I have termed the extended mind. I have expressed this idea in terms of the equation: mind = brain + language. (Logan 2005)

It is of interest here that Logan's reading of McLuhan is focused primarily, if not entirely, on the positive aspects of McLuhan's original statement and appears to ignore the inherent warning in its tail. Logan's is a reductivist and selective reading of McLuhan. McLuhan states, language divides human faculties and in this sense he can be seen to be suggesting that language functions to quantise subjective experience in such a manner that we can lose access to the prior capabilities we might have had in the illusive prehistoric territory of the pre-linguistic (and, we have to assume, the pre-social). Given that we are bound and constrained by our linguistic capabilities we cannot know what these ancient abilities might have been, or whether they ever existed. We can only imagine what it must have been like to be without language, to live amongst others without language. This leaves open the question what we were and how we became what we are.

McLuhan's equivocal statement and Logan's positivist, algebraic, conception of mind seem disconnected. Logan's conception of the mind would seem unable to encompass or address what we can understand as the subconscious - that part of the mind that is possibly pre-linguistic. Logan asks us to consider the mind as fully realised through language but are we able to conceive of the mind as only that visible ten percent of the *iceberg* of the self - a self that is not only conscious and unconscious but also linguistically and socially mediated - as such, extended. Can we deny what must lie beneath the surface and beyond our physical bounds? This

indicates a problematic relationship between what we think language is and how it functions and what we understand of the mind and the brain.

Noam Chomsky has, at least initially (Chomsky 1981), gone as far as suggesting that language is somehow hard-wired into the human brain, the outcome of biological evolution, and that human beings thus share some form of universal grammar. In such a model language would be seen as a precursor to consciousness, rather than emergent from it. Although there is no evidence for the kind of universalist view Chomsky proposes, and many have disagreed with such a bio-determinist model of the human, the proposition repeating similar logic to that which Logan employed and evoking the same denial of a heterogeneous self, it is nevertheless an interesting proposition and gives us reason to ask where language comes from and why we have it?

Chomsky's proposition of a "language acquisition device" may or may not exist - indeed, Chomsky himself has distanced himself from the idea in subsequent work. However, if we are to address our questions considering networked communication media, we do need to consider how language is used and the role it plays in individual and collective ontology, allowing us to speculate upon what is subsequent to this question. We should ask how language and representation, the basic tools of artistic apprehension, inform network media and in what manner such media affect artistic means if we are to begin to apprehend what the network can mean to us, how we might employ it for creative activity and what effect this has on those engaged as a consequence of this.

As will hopefully become apparent, there are multiple questions involved and they are intrinsic to one another, such that concepts like network, language and representation cannot really be differentiated or addressed independently. In a sense, we have always lived, certainly since the beginning of our capacity to write histories, and possibly before that, in a networked and mediated social context. We do not need the explicit technological communication media we are familiar with, such as print, radio, television or the internet, to understand the manner in which we have existed in an historically mediated world. As is so often the case with technological change, the emergence of new technical capabilities and affordances, whether print, moving image or the network, do not so much enable novel human capabilities but, rather, reveal emergent sublimated characteristics. Further to this, and as will hopefully become clear here, we should not seek to understand what

human capabilities might be without considering the full context in which we live and function. What we are incorporates the social and the technological - most fundamentally language, but also other systems.

The proposition here is that technological development is less concerned with the emergence of new capacities and more concerned with revelation. Here we might keep in mind Heidegger's conception of the revelatory capacity of technology and recognise that, especially in more prosaic contexts, technology can also function to conceal. McLuhan's warning, concerning the manner in which language can divorce us from our innate capabilities, is again relevant here. As we have observed, we are our representations but there is no requirement that our representations are truthful. Humans seem to be expert at self-delusion, both individual and collective. If we are our own constructs then there is every chance we are as much the product of delusional imaginings or purposeful obfuscation as any other process. In fact, it would seem all too likely that we are in perpetual disguise - a disguise so effective we are unable to apprehend ourselves, or others, in any other guise.

An artist whose work plays with how language can both reveal and conceal is John Cayley. Cayley was, for many years, a translator employed at the British Library, where he worked in the Chinese section. As an artist and translator he has looked to the work of Walter Benjamin, who was also a translator, and specifically his text "On Language as Such and on the Language of Man" (Benjamin 1979). Cayley's (with Giles Perring, audio) generative text and sound work 'Translation' (Cayley 2005), which takes Benjamin's essay as its source, produces an ever-changing 'linguistic wall hanging' - as Cayley refers to it (Cayley 2004). Here the term "wall-hanging" might be seen to evoke the Chinese screen, which functions both to carry an image but also to screen one domain from another, in turn evoking how translation might be seen to function. Cayley writes 'my literal art, has been involved, in terms of one of its most obvious formalisms, with transliteral morphing from one given text - transcribed in machine-encoded alphabetic script - to another' (ibid).

As a translator Cayley is aware of what Benjamin refers to as the 'kinship' of languages and how translation is not so much concerned with similarity but an 'affinity of difference'. This can be understood as a structural correspondence where the difference between components are similar to one another, even when the instrumentality of languages are mutually alien. Cayley's automated script creates an

infinite deferral of meaning but never compromises our apprehension of an instance of language writing itself.

In 'Translation' the abstracting of a text into an a-semiotic but nevertheless linguistic phenomena can be seen to evoke this 'affinity of difference' in its emphasis on structure and the internal relations of the work. In this work the relationship between signifiers and the things they signify is absent.

Here the 'text' Cayley has produced is one composed of signs that are both more abstract and concrete. These are signifiers that have no signified associated with them, assuming their meaning exclusively from their relations with one another. This is linguistic form predicated only on difference - perhaps language in its most pure form. The components of this work are not recognisable words from any specific language, although the work incorporates French, English and German, but rather the structural patterns that form writing and speech. In this instance these are visual or aural in their nature, where word 'shapes' are sustained but their semiotic potential denied.

Writing becomes writing

Terry Winograd proposed that the computer is a new form of writing – not a medium for writing but writing itself, reformulated. His argument was premised on a theory of computation that considers computing to be a recursive symbolic process, where a symbolic system (language) acts upon itself to create new instances of the system - effectively, writing that writes itself. In this respect the computer appears to be, in human experience, a novel form of language – language that is auto-semiotic. Winograd observed that "the computer is a physical embodiment of the symbolic calculations envisaged by Hobbes and Leibniz. As such, it is really not a thinking machine, but a language machine" (Winograd 1991). Winograd's central argument is that computational processes are intrinsically symbolic and therefore language per se. His argument is that the computer is an evolution of writing, where that writing can be autonomic.

If we accept Winograd's argument then we can also accept that the computer can be considered to have changed language as profoundly as writing and printing before it. As a symbolic machine, a system of signs that reflexively operates upon and modifies itself, both translating and generating meaning, the computer represents a

new linguistic modality. However, again, we must remember that this is less about technical development and more to do with human revelation. What we see here is an emergent apprehension of the human, an evolving ontology for something that already exists. In this respect the computer is itself a representation - a model of how we understand what it is to be human. But what comes first here - the model or the thing it represents?

Michel Foucault developed the concept of the *dispositif* – a heterogeneous system that connects its constituent elements through relations of power and knowledge. This can be considered as an apprehension of how we, as individuals and as a collective, operate together as a self-regulating apparatus and, given the above observations concerning the networked human, offers a potentially powerful model for how we might understand our current condition. Foucault situated language at the heart of the *dispositif* as the symbolic system that allows abstract processes to emerge and become socially instantiated - a form of expanded hermeneutics. He described this as:

"...a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions - in short, the said as much as the unsaid. Such are the elements of the apparatus. The apparatus itself is the system of relations that can be established between these elements". (Foucault 1980)

Interestingly, Foucault's model (unlike Logan's or Chomsky's) places as much emphasis on the "unsaid" as the said. Foucault allows for a self that is not always fully "in the light" cast by language but incorporates that which is in the shadows as part of the apparatus of the self and the social. Most importantly, he identifies the system of relations between things as the primary subject. It is in the relations between things that the totality of things emerge.

Actor-Network-Theory, in some respects, develops and applies Foucault's *dispositif* in both the theoretical and practical domains of sociology and the related area of socio-technical systems. In this context the term "technical" does not necessarily imply material technology. The focus is on processes and knowledge - it refers to the ancient Greek term "logos". Thus socio-technical here refers to the interrelatedness of the social and technical aspects of an organisation or society as a whole. This is a

vision of the dispositif as a socio-technical apparatus that encompasses the human condition.

N. Katherine Hayles has suggested (Hayles 2012) that humans and technology are co-evolving, a process she terms technogenesis. This might seem a novel insight – however, without wishing to diminish the import of Hayles's excellent work on this topic, is this proposition that different from Heidegger's view of people's relationships with things, with technology, or McLuhan's notion of the extended human? Arguably not. However, Hayles recognises that the machinic element, particularly in the form of the internet, is now so sophisticated and explicitly symbolic, conditioning how we perceive the human-machine relationship as not only physical but also linguistic and social, that we can no longer ignore our technologised condition. We are, in this sense, the machine.

We have rapidly adopted the computer as personal companions, as extensions of ourselves. We routinely employ the computer to make calculations on our behalf. We rely on our electronic memories to store the details of our contacts and, in the age of the smart phone, rarely direct dial somebody's phone number. Rather, we invoke that person with a tap on their address book entry or, with some devices, the uttering of their name. Personally I no longer remember what my own phone numbers are. I have too many to remember and rely on my electronic "organs" to recover them and share with others over Bluetooth or Wi-Fi, those invisible webs that interconnect and weave us all together. Thus we are ethereally wired into the machine, wireless together.

Whilst the possibility of hard-wiring is being explored by artists, scientists and others (e.g.: Stelarc's robotic appendages and embedded sensors and Kevin Warwick's attempts to convert himself into a cyborg) in a way such activities appear a less radical proposition when we recognise the degree to which we are already softly wired to the machine and to one another. The computer, as a networked language system, has become part of us and we have become part of it. As has been observed by Hal Varian (Milikan 2010), chief economist at Google, we are already cyborgs. Thus this is not an entirely new situation. However, the expressivity of the technology involved, the manner in which we mediate and perform ourselves, is. In this sense technology can be revelatory. However, as with all representations, it can flatter to deceive.

Things from things

A concept that might offer us insights into how the machine, the organism, the human and the social can be considered altogether, if you like, of an ilk, is autopoiesis. Proposed by Humberto Maturana and Francisco Varela, autopoiesis describes how biological units make themselves. A foundational concept of third order cybernetics, autopoiesis provides a model of how the cell can divide and how this might be applied to understanding both organic and artificial systems as auto-generative. Keeping in mind the homo-technical apparatus or network outlined so far, we can reconsider the concept of autopoiesis not as a function of specific things but as a characteristic of a system, the network of relations manifest as the dynamic of a distributed dispositif.

Thus it is perhaps not surprising to find that Maturana and Varela, in describing the autopoietic as an organising principle of autonomous living things, literally a self-making, consider this process as linguistic in character, underpinning what they have termed a "biology of cognition". They transfer this proposition explicitly into the linguistic and social domains when they write "The central feature of human existence is its occurrence in a linguistic cognitive domain. This domain is constitutively social" (Maturana & Varela 1991). Here an ontology of the individual, within a model of social emergence, can be envisioned that places language, and representation generally, as central in this process.

An artist whose work addresses the generative relations between people, things and places within the network is Eugenio Tisselli. His current project Sauti ya Wakulima (Tisselli 2012), translating as 'The Voice of the Farmers', seeks to reveal and share tacit knowledge and best practices in the form of a networked multimedia folksonomy. Tisselli describes the project as a "mutual learning, observation and community memory: networked communication tools for farmers in Bagamoyo, Tanzania" (ibid). It's difficult to define Sauti ya Wakulima as an art work or project and it is probably not important whether it is considered as such or not. What it is, however, is an example of emergent culturalisation, employing cheap and easy to access mobile technologies, that allow members of the community to connect to and share information via the internet. The manner in which this develops is that of the folksonomy, an emergent collective representational web of information that would otherwise remain restricted to a small and co-located group of people or in the even more private space of individual tacit knowledge.

Tisselli's project reveals the twin dynamics evident in how the participants are working across linguistic and technological platforms. In the first instance they are working in a pluriliterate manner, employing a mixture of indigenous, colonial and contemporary global languages, shifting between these as required. Olivia Garcia has defined the concept of pluriliteracy (Garcia 2006) as when certain individuals and communities function within highly multilingual environments where multiple languages are employed in various contexts. A central feature of this form of linguistic activity is that multiple languages are acquired at the same time but do not necessarily have similar value. Different languages are used for different purposes in different contexts - whether in the home, the street, at school, when trading or dealing with government officialdom.

Similarly, the participants in Sauti ya Wakulima are employing a diverse range of media in what has been termed a transliterate manner, which they then integrate within the context of the web. Transliteracy, a term coined by Alan Liu, seeks to understand how, in a technologised and mediated world, we learn to be literate across diverse technological platforms, from print to television, theatre to radio, music to film, dance to computer games and speech to the internet (Liu 2006). Such a transliterate capability is something many of us take for granted, and not just in the post-industrial West (as Tisselli's project evidences), but is nevertheless an acquired set of competencies in comprehension and expression, as complex and subtle as other forms of literacy. Such skills acquisition requires significant creativity and skill, in both reading and writing, in the distinct media involved and across them - transliteracy is a form of meta-literacy.

Tisselli writes "I want to provide a guide to the Tanzanian farmers' collaborative knowledge base, but this time from the perspective of agriculture", pointing us to a number of examples of such knowledge. This includes evidence, generated and uploaded by the participants, in the form of images, videos, sound files and written texts, on subjects as diverse as a species of palm tree threatened with extinction due to changes in farming practices, particularly the development of drainage systems; the practice of inter-cropping - growing different crops in amongst one another to sustain a plural economic model mixing subsistence and commercial farming - and organic pest management, resisting the corporatisation of agricultural practice that seems to be the outcome of employing more high-tech methods for pest control, such as genetically modifying crops to be resistant to particular synthetic pesticides.

The key to appreciating this work is recognising that all the data and materials on the project website have been produced and uploaded by the members of the community engaged in the project. This is not a curated project but a bottom up process of accumulation that gradually creates an emergent critical mass of information that, altogether, presents a picture of a complex web of knowledge and social activities around the practices of indigenous farming. It is a creative cultural activity as generative as farming itself.

James Leach has reflected upon this kind of generative socialisation in respect of the people's of the Rai Coast of Papua New Guinea, observing and describing cultural practices where the creation of new things, and the ritualised processes of exchange enacted around them, "create" individuals and bind them in social groups (Leach 2003). Leach has observed "the role of 'creativity' in the ways people generate new places in the landscape" and has argued that,

"...in so doing, they also generate new people, who emerge from these places, and objects which facilitate or even participate in these creative processes. Making people and places involves relations to other people and to spirits and ancestors that embody, through song/design/dance complexes, the generative potential of land itself". (Biggs & Leach 2004)

Tisselli's work can be read similarly, as a form of networked multimedia ethnography that functions to reveal the relationship between people, community and knowledge. This reminds us of Foucault's original conception of the *dispositif*, as being of the relations between people, knowledge, systems and things that constitute the social. However, this is a *dispositif* profoundly different in character to the one we conventionally envisage when considering Foucault's work in relation to the technologised society in which it was developed and in which we apprehend it - but a *dispositif* it is, and one that reminds us that we should not assume this term carries particular associations and values. The socio-technical apparatus is neither a product of industrial society nor part of an ideological terminology.

The mesh

Tisselli's work allows us to appreciate, from a rather unusual point of view, what a major shift in social potential has been facilitated with the bringing together of the

computer and telecommunications to create the internet. With the development of the hyper-text transfer protocol (Tim Berners-Lee), with its combination of computation and communication, we have witnessed the rapid and protean emergence of the web, a medium that in a short period of time has subsumed, or is close to subsuming, virtually all media before it. The web is not just the dominant media of our age but is rapidly becoming the fabric of our society, both instrumentally (e.g.: banking) and culturally (e.g.: Facebook).

Tim Ingold has employed the term *textility* (Ingold 2010: 1) to describe how the processes of making and communicating need not be considered as teleological forms of agency, one thing acting upon another in a mono-directional determinist manner, but as a complex interweaving of relations between things, where agency is multi-polar, multi-directional and polyvalent. The term *textility* evokes the notion of textiles, with their warp and weft of elements in a soft adaptive structure. In this apprehension of things notions of agency, authorship and identity become fluid, with people and things "entangled" with each other. This can be considered an autopoietic process. It is rhizomic in structure and offers us a compelling visual metaphor for the internet - what Ingold himself has referred to as "the mesh", borrowing and adapting Henri Lefebvre's term "meshwork".

In "Bringing Things to Life" (Ingold 2010: 2) Ingold considers how the metaphor of the mesh can be employed to apprehend how meaning is made in the relations between things. He writes of "the generative capacity of that encompassing field of relations within which forms arise and are held in place". He argues that our attention should be directed not to the materiality of things, as proposed in the recently reheated materialist philosophy of Object Oriented Philosophy, but rather "to the fluxes and flows of materials", the dynamic and motile traces of things. Ingold has described these flows as "lines *along* which things continually come into being. Thus when I speak of the *entanglement* of things I mean this literally and precisely: not a network of connections but a meshwork of interwoven lines of growth and movement" (ibid).

Ingold here explicitly evokes the 'entangled bank' of Charles Darwin's *Origin of Species* to describe how things can interconnect, interact and evolve. It suggests that agency is a very complex thing indeed and not so easy to trace. Ingold's intent is not to analyse the internet, although his observations are, in the current context, applied to that subject, but to consider what creativity and the making of meaning are. His subject is bi-fold - creativity and life and, within this, the role of representation as key

to the processes of making, not just of things but of people becoming as generative relationships. This is an autopoietic conception of being that is as much socially (representationally) drawn as biologically.

Given these observations on the relation between human ontology and language, the network can be seen as key in the formation of our personal identity. The implications of living in such a media saturated hyper-connected culture are profound. The proposition here is that we are evolving as a homo-technical apparatus. However, we are less the cyborg of Kevin Warwick's experiments and more akin to the fictional Borg of the Star Trek TV series and film franchise, deeply interconnected through the soft-wiring of language and the network. The greatest fear for the Borg is being separated from their hive-mind, unable to communicate with one another and thus rendered effectively paralysed. The Borg draw their existence from the collective. They cannot exist in isolation. So perhaps we too.

To be offline in today's culture might be considered not only an existential threat but also be perceived, by others, as deviant. If we rely upon one another for our mutual generation then those who do not play the game are seen to have abrogated their social obligations as part of a collective co-dependency. It is hard enough to find the context to go off-grid and, when we do, we are held accountable during our perceived absence. We are expected to be accessible by email, tweetable on Twitter and pokeable through Facebook - to always be 'on'. When we wish to connect to others we are frustrated when they do not promptly respond and that frustration rapidly turns to disillusion when their 'radio silence' is sustained. Our interconnectedness might collectively and individually empower us but it also binds us, as social bonds always have.

Perhaps the issue we should be addressing, identified by Alan Liu when describing, with heavy irony, how technology appears to be "leading us on an exodus out of the pharaoh's land of routines, procedures, standards, and protocols toward a land of milk and honey far beyond the reach even of company rafting trips, rock climbs, desert hikes, and other such retreats of corporate culture" (Liu 2004), is not how to facilitate widening access to the network but rather how we might create the social conditions where it is permissible to disconnect - at least for periods of time. John Naughton, in an opinion piece in the Guardian, discusses the manner in which our lives are, more and more, governed by invisible algorithms - the processes that underpin our Google searches, Amazon shopping or our apparent clout in social

media. This is the case - but we should remember that these algorithms are models, and thus representations and proxies for processes that have existed in similar forms whenever humans have collected together and sought to live collectively. That such processes condition our lives is not new. Network technology simply recasts the form these processes take. In the process the apparatus is rendered, at least partially and fleetingly, visible - as are we, for we are part of this system. This is about power, but it is also about survival and our identity. The choice that faces each of us is whether we network or not and what price we pay, regardless of which choice we make - for there will always be a price.

Simon Biggs, Edinburgh, November 2012

References:

Benjamin, W (1979) *On Language as Such and on the Language of Man* in *One Way Street and Other Writings*, London: NLB.

Biggs, S & Leach, J (2004) *Autopoiesis, Novelty, Meaning and Value*, London: Artwords.

Cayley, J (2004) *Overboard*, Dichtung Digital, <http://www.dichtung-digital.org/2004/2-Cayley.htm> (accessed 13 December 2012).

Cayley, J (2005) Translation, <http://programmatology.shadoof.net/index.php?p=works/translation/translation.html> (accessed 13 December 2012).

Chomsky, N (1993) *Lectures on Government and Binding: The Pisa Lectures*, The Hague: Mouton de Gruyter

Foucault, M (1980) *Confessions of the Flesh* in *Power/Knowledge: Selected Interviews and Other Writings* (ed. Gordon), Hassocks, Sussex: Harvester Press.

Garcia, O (2006) with Bartlett and Kleifgen; *From biliteracy to pluriliteracies*, in *Handbook of Applied Linguistics on Multilingual Communication*, Mouton.

Hayles, N K (2012) *How We Think: Digital media and Contemporary Technogenesis*,

Chicago: University of Chicago Press.

Ingold, T (2010: 1) *The Textility of Making*, Cambridge Journal of Economics, 34, 91-102, Oxford: Oxford University Press.

Ingold, T (2010: 2) Bringing things to life: Creative entanglements in a world of materials, Realities, ERSC National Centre for Research Methods, University of Manchester,
<http://www.socialsciences.manchester.ac.uk/morgancentre/realities/wps/> (accessed 9 December 2012).

Leach, J (2003) *Creative Land: Place and procreation of the Rai Coast of Papua New Guinea*, Berghahn Books

Liu, A (2004) *The Laws of Cool: Knowledge Work and the Culture of Information*. Chicago: University of Chicago Press.

Liu, A (2006) Research in the Technological, Social, and Cultural Practices of Online Reading, <http://transliterations.english.ucsb.edu/post/research-project/the-transliterations-topic#more-302> (accessed 15 December 2012, date stamped 12.06.06)

Logan, R K (2005) *The Extended Mind Model of the Origin of Language and Culture*, in Gonthier, N. van Bendegem, J. P. & Aerts, D. (eds.) *Evolutionary Epistemology, Language and Culture*, Dordrecht: Springer.

Maturana, H & Varela, F (1972) *Autopoiesis and Cognition: The Realization of the Living*, Dordrecht: D. Reidel Publishing.

McLuhan, M (1964) *Understanding Media*, New York: McGraw Hill.

Millikan, A (2010) *I Am a Cyborg and I Want My Google Implant Already*, The Atlantic, available at: <http://www.theatlantic.com/technology/archive/2010/09/i-am-a-cyborg-and-i-want-my-google-implant-already/63806/> (accessed 10 July 2011).

Naughton, J (2012) *How algorithms secretly shape the way we behave*, The Guardian, <http://www.guardian.co.uk/technology/2012/dec/16/networker-algorithms-john-naughton> (accessed 17 December 2012, date stamped 16.12.12)

Tisselli, E (2012) Sauti ya Wakulima, <http://sautiyawakulima.net/bagamoyo/about.php?l=1> (accessed 13 December 2012)

Winograd, T (1991) James Sheehan and Morton Sosna, eds., *The Boundaries of Humanity: Humans, Animals, Machines*, Berkeley: University of California Press.