THE PLASTICITY OF THE BRAIN – AN ANALYSIS OF THE CONTEMPORARY TASTE FOR AND LIMITS TO NEUROPLASTICITY
LA PLASTICITE DU CERVEAU – UNE ANALYSE SUR L'ENGOUEMENT ACTUEL ET LES LIMITES DE LA NEUROPLASTICITÉ

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Within the neurosciences, reductive and neurocentric positions have had to accept the idea of the plasticity of the brain, a precious and vulnerable organ of potentials. One might talk of a knowledge-political tension and indecisiveness between a "biologisation" of social life and a "sociologisation" of human biology. Neither biology nor the social exist in pure, mutually independent forms, and neither biology nor sociology have a monopoly on explaining what and how the plastic brain is a priori.

To answer the question as to whether there are limits – human, social and neurobiological – to neuroplasticity, it is necessary to scrutinise our concepts of the fundamentally unclear and multi-semantic phenomena of "plasticity" and "limits". The physiological, socio-cultural, normative, epistemological, scientific and ontological-phylogenetic limits to neuroplasticity are eg not at all identical. These six perspectives will be examined in the article.

Dans les neurosciences, certaines orientations dites réductrice et neurocentrique ont du accepter l'idée d'une plasticité du cerveau, un organe aux potentialités encore inconnues, précieux et vulnérable. Certains diraient, qu'il existe au sein des

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neurosciences des tensions et des indécisions entre les deux orientations que sont la "biologisation" de la vie sociale et la "sociologisation" de la biologie humaine. Ni la biologie, ni le social n'existe en soi, indépendamment l'un de l'autre et ils n'ont pas le monopole de l'explication sur ce qu'est la plasticité du cerveau et son fonctionnement à priori.

Pour répondre à la question de l'existence ou non des limites – humaines, sociales et neurobiologiques – à la neuroplasticité, il est nécessaire d'examiner et de clarifier nos concepts dont les dimensions de "plasticité" et de "limites" sont foncièrement opaques et polysémiques. Les limites physiologiques, socioculturelles, normatives, épistémologiques, scientifiques et ontologico-phylogénétiques à la neuroplasticité ne sont, par exemple, pas du tout identiques. Ces six perspectives seront examinées dans cet article.

INTRODUCTION

> The human brain is the most complicated material object in the known universe. (Edelman (2004:14))

> Neuroplasticity, capacity of *neurons* and *neural networks* in the *brain* to change their connections and behaviour in response to new information, sensory stimulation, development, damage, or dysfunction. /…/…since the 1970s and 1980s, neuroplasticity has gained wide acceptance throughout the scientific community as a complex, multifaceted, fundamental property of *the brain*. (*Encyclopedia Britannica*)

We are standing on the threshold of the era of the plastic brain. Brain scanning results provide proof that brains are social, individually moulded, lifelong changeable, and surprisingly plastic. The concept 'the social brain' has been transferred from sociology and anthropology to the neurosciences, which thereby seem to have learned from its critics. Ten-twenty years ago it served like an explicit concept of resistance, meant to demonstrate the blindfolded natural sciences, their short-comings and undisguised reductionisms. But today the ambitious and curious neurosciences display and create such a broad and inviting concept of the plastic brain, managing to get all potential non-natural-scientific researchers and laymen into difficulties, if they do not line up with or check out this open paradigm, that possesses a dynamic, but first and foremost a biological, foundation (Larsen (2009a)).

These interpretations of the contemporary taste for the plastic brain, *in casu* neuroplasticity, will now be scrutinised. It will probably be the case that there is no unanimous view as to what can be understood by the term 'the plastic brain' – either among researchers, laymen or communicators of knowledge. Neuroplasticity has

become a concept with a much wider signification than clarity. Something like that has also happened to concepts like paradigm, constructivism, evidence and innovation and to phenomena like post-modernism, creativity, competences and evaluation.

Neuroplasticity is an expansive concept and no one seems to take a stand against it or to doubt its existence. Earlier we have witnessed passionate and knowledgeable political fights on concepts like 'postmodernism' (just think of Jürgen Habermas's harsh critique and his defence of 'the modern' in *Der philosophische Diskurs der Moderne*, Frankfurt am Main 1985) and 'paradigm' (as the originator of the concept, Thomas S Kuhn, certainly did not intend to label scientific revolutions beyond the ranks of the 'hard' sciences – even though these might have happened within the humanities and the social sciences). But in 2012 it seemed to be the time of the plasticity train, whether you happen to be a neuro-surgeon, a neuro-learner (eg a physiotherapist, a rehabilitation worker or a teacher), a neurobiologist (a neuroscientist or a natural historian of evolution), a neuro-marketing agent (eg a business counsellor or a PR-advisor), a 'neuro-enhancer'[1] (a biochemist or a producer of pills) or a 'neuro-aesthetic' theoretician (an artist, an art critic or an event manager).

Neuroplasticity was once a neuroscientific concept that possessed a strict definition of the responsive character of the neurons and the neuronal networks (cf the above reference to the dictionary *Encyclopedia Britannica*). Gradually it has become everybody's expression and in the wake of its success new concepts and scientific disciplines break through. Even the 'hard' sciences (like neurology and neurophysiology) have to acknowledge neuro-pedagogy and neuronal learning processes. These 'hardliners' get tempted to deal with the context[2] of the brain; the

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1 "Neuro-enhancement" baptises endeavours to enhance the performance of the brain with the use of pharmaceutical means (eg neuro-chemical pills). The popular name for these devices are brain drugs and in Germany some critics have given them a negative connotation: "Hirndoping" (cf Galert, Thorstein et al, 2009), Rose, Steven (2005), Rose, Nikolas (2007)). Seven German pro-neuro-enhancement experts – lawyers, doctors, philosophers, a chemist and a psychiatrist – state in a controversal *Memorandum*: "Das optimierte Gehirn" (Galert, Thorstein et al. (2009)), that Neuro-Enhancement is "the continuation of man's efforts to enhance his spirituality with other means" (in German: "die Fortsetzung eines zum Menschen gehörende geistigen Optimierungsstrebens mit anderen Mitteln"). The seven writers proclaim that it is general knowledge that upbringing and socialisation influence the physiology of the brain, and that the new neuropharmaceutical products make it possible to enhance the spiritual level of society with the help of a determinate and conscious formation of the plastic brain (cf Larsen (2009c & 2009d)).

2 It gives food for thought that context-dependent and holistic thinking is blossoming (cf Nielsen, 2009): "Mig og min habitat" ("Me and my habitat"). The bacterial human self cannot be understood as an autonomous self but rather is a "colony of organisms whose interaction and ways of living together we just recently have begun to come to understand." The new

full body, the life-world and the social. This is not to say that the sciences have not been challenged and invited to do so earlier (the 20th century witnessed several critical voices and works, questioning positivism, objectivism, and scienticism), but now they seem to – maybe primarily due to endogenous reasons: eg new scanning results dealing with the social brain and the brain in the social context – at least in principle (but definitely not for real in all corners of the neuroscientific, medical and cognitive communities) to be 'forced' to become a little more open-minded towards interdisciplinary fields of knowledge and to act in a less reductionist and supercilious way than they used to do. Today the neurosciences do not content themselves with expressions like the truth of man is that his brain is a bunch of neurons which create his consciousness and determine his actions.

In a knowledge political perspective we enter a zone of indiscernibility – a two-way landscape – in which to depict and decipher man between a 'neurobiologization' of the humanities and the social sciences and a 'sociologization' of the neurosciences, as the Luhmannian sociologist Werner Vogd precisely describes it in the book *Gehirn und Gesellschaft* (2010).

Within the 'avant-garde' research of the neurosciences the borders between the neuronal dynamics, the phenomenological descriptions, the bodily motor activities and the interactive social processes get more and more blurred. I do not claim that powerful institutions and subjects like law and economics have been transformed to neurobiological labs, or that all the world's neurobiologists suddenly have become crazy about sociological and art historical knowledge. On the other hand it is no longer so obvious and easy to reject the acknowledgements of the others a priori.

We have come to live in an exciting and challenging epoch, in which many researchers and laymen slowly but indisputably come to realise that the brain is a mediator, getting its shape and form according to the lived life, including bodily and social interactions. At the same time the brain is a necessary but not sufficient condition for thinking and motoric and social action.

Agreeing with Vogd I will claim that we have to invent options for "creative controversies (*Auseinandersetzungen*)" (s 25) between the different single scientific approaches in order to produce and fertilise "a new scientific culture of talking to one another" (s 379). It has become a double challenge to avoid declining to either a pure 'biologism' or a pure 'sociologism'.

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breakthroughs of microbiological research depict the symbiotic processes and microbiotic ecosystems, existing between the human body (imagine eg the colon) and those microbes and germs we are surrounded and invaded by: "For every human cell in the body (and we consist of approx one trillion), there are at least ten bacteria".

Self-proclaimed reductionisms do not have much future, and it must be called an operative fiction to think that one might be able to grasp and interpret the brain sciences as a unity, because there is no independent and sovereign "Gottesaugenstandpunkt" (God eyes' standpoint, in English) from where one might be able to observe the brain.

I THE PLASTIC BRAIN

When we say that something is plastic, we refer to something so soft that it can be moulded.

The tricky thing about the concept of neuroplasticity seems to be, that it can be said to function and form itself behind our back (ie beyond our conscious and deliberate will, rationality and drive) but it can also get increased and strengthened voluntarily. Concisely stated, within the sphere of the biology and physiology of the brain the important wisdom is that it is formed and can be formed and that it forms itself. Surprisingly and quite unseen, the twin concepts of the plastic brain and neuroplasticity get loaded with nearly all the traditional metaphysical attributes one can think of.

Inspired by the French historian of ideas Michel Foucault, it might boldly be claimed that the plastic brain is situated within a field, in which mankind's 'nature' turns up in an artificial setting. Decisively this places man's 'nature' and hereby the plastic brain within an artificial political power relation (2008:28-29).

Thus, it becomes of the utmost importance where, how and by whom neuroplasticity become 'discursivated' and implemented. In the wake of the concept major differences occur. Will the plasticity concepts primarily be addressed in relation to phylogeny in general, pedagogical learning processes for the chosen few, physiotherapeutic interventions or will they be placed within the brain's internal capability to cure and repair itself?

We shall see the existence of several powerful agendas for 'artificiality' and many different suggestions, offering us ways to decipher 'the natural' when we choose to focus on the cerebral plasticity *an sich* (in itself) and *für uns* (for us).

II THE BRAIN – NOTHING IN ITSELF, BUT AN INDISPENSABLE MEDIATING ORGAN

In his original and eye-opening book *Das Gehirn – ein Beziehungsorgan. Eine phänomenologisch-ökologische Konzeption* (2008), the German philosopher and psychiatrist Thomas Fuchs claims, that the brain is a mediator, a relational organ. The brain mediates our relations to the world, other human beings and ourselves. An important statement proclaims: "The brain in itself would just be a dead organ" (p 21). With a take-off in a radical critique of the "zerebrozentristische" (p 16)

neurobiology, he writes: "Without brain, no consciousness, but also: Without consciousness, no brain" (p 239). The brain in splendid isolation does nothing and does not manage to do anything. It does not function independently and without continuous inputs and signals from the rest of the body and without vital supplies of fresh blood and oxygen, it would – like all other human organs – not be able to function, not even to survive. Pretty soon it would come to look like the dried up double walnut as it is already portrayed.

The formation of the brain, stems from the committed life. Engagement and human actions get impressed in the plastic biology 'upstairs'. Fuchs proves to be not only a viable critic but also a thinker of options: "The brain is … not a determinant organ, but an organ of possibilities. It is not a producer of, but a mediator of the activities of the person" (p 256). The brain is embedded in a body and is a part of a bigger context. The embodied brain is immensely complex and adaptable, and all your experiences, perceptions and acts leave their stamps on the neuronal structures in the brain. This process already begins before we are born and it continues for life. The brain is not a fully developed apparatus neither isolated from or independent of the rest the body or of the surroundings. Through the experience-dependent plasticity the brain undergoes a persisting metamorphosis. The cortices and the networks in the different parts of the brain get reorganised when we tumble, eat, think, caress (and get caressed!), run, fall, hope, will, memorise, imagine, write, read, bike, sleep, dream and not the least when we learn and experience.

The sounds and skills of a great violinist and eloquent cab driving through the metropolitan jungle are just two examples of innumerable processes possessing neuroplastic effects but more 'profane' and routinised everyday activities – listening to the news, dealing with German irregular verbs, eating breakfast, riding a train – also have influences on the neuronal couplings and upon the brain's interaction with the world. Actually, there seems to be nearly no limits to the plasticity of the brain (cf Larsen (2009a:89-90))[3]. It might be due to the fact that plasticity defined in this way is identical to learning. Plasticity in the brain is what is at stake when learning takes place – and when learning takes place plasticity prevails. Hereby the concepts neuroplasticity and learning prove to bear a family resemblance (cf eg

3 Most surprisingly the Danish authors Christiansen and Sandbeck (2009) in their furious attack on atheists and godless neuroscientists do not have a sense for the actual non-determinist and non-biologist trend within the broader brain study circles. Many scientists also deal with and respect the complex changes of and learning processes in the brain. The two critics portray their 'opponents' (the 'non-spiritual' scientists), as much more stupid than they really are.

Schilhab and Steffensen (eds 2007:16)[4]. They take part in one another: they are each other[5].

The neuronal plasticity takes care of the attunement of the functional circles of the organism and the surroundings. It provides the living human being with a 'mediated immediacy' in which the brain as a mediator is not visible. The brain is a *conditio sine qua non* for human actions but not an object, we can isolate from its usage; especially not when we use it, which we happen to do all the time. One can turn to objects and other sensuous traits of things in the world, without sensing and feeling the brain[6]. Most of the time it happens automatically, undisturbed and without mistakes. The brain seems to provide us with a lens to look through that we do not see when we see. We get linked to the outside world and at the very same time the neuronal structures get adjusted to and mediated by the world that on the other hand only become graspable and present due to the interplay of the refined neuronal structures.

III THE CORPOREAL TURN

The American philosopher and evolutionary historian Maxine Sheets-Johnstone has written a stimulating and rich book: *The Roots of Thinking*. She advocated for the position that the roots of thinking must lead to "a corporeal turn", implying that man's "gnostic tactility-kinesthesia" (1990:337) must be lifted up to become the pivotal field of an interdisciplinary research. The 'gnostic' qualities of the feeling and moving body have formed the brain, and it is her brainchild that it was not only valid for our distant hominid ancestors, that "....thinking...was conceptually rooted not in the brain but in the concrete realities of everyday bodily life" (p 293); it is actually also true for us 'late-comers'.

The conceptual couple 'gnostic tactility' is great and promising because it manages to bind together the cognitive and conceptual dimensions of the human life with the bodily, haptic and tactile dimensions. If we choose to support the corporeal turn within philosophy and the neurosciences the structures of signification and meaning which we imagine that the brain works up and produces

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4 The Danish neuroscientist Christian Gerlach (2008) writes: "plasticity/learning potential" (82). The two concepts are being used indiscriminately (cf 148f and 155f).

5 By this I do not claim that 'learning' (embracing everything this concept contains of didactics, selection, socialisation, cultural formation (*Bildung*), societal expectation, institutional frames, educational politics etc) can ever be reduced to a question of neuroplasticity.

6 Neither does man 'sense' the perception in itself (it its varied and extensive manifold), the body's encounter with the outside world or all these 'things' (including social interactions), which have had or will have power to influence man's behaviour and self-understanding. We are not reflexive omniscient animals in all moments of life.

become embedded and embodied structures: "Meanings are not free-floating entities; meanings are incarnated, anchored in living bodies" (p 121). Sheets-Johnstone reminds us en passant that as to "hominid speciation" in an evolutionary perspective "bipedality" was a long time prior to the development of the big brains ("large neocortex") of our ancestors (p 186).

The brain never speaks and acts on behalf of itself:

> Whatever might be going on in the brain at the time an individual is speaking, it is the speaker, not the brain, who, rather than which, is uttering and choosing words, suggesting a place or a way to find food, expressing opinions, conveying sentiments, and the like. In fact, no stimulation of language areas in the brain has ever produced a word, let alone a suggestion of a place or even to find food (p 295).

The brain, the linguistic system and the locomotor system form a totality in which the brain does not play the first violin. Historically, thinking evolved through human practice. Sheets-Johnstone argues that it is important to come to understand "thinking in movement" (2009:31) and to scrutinise how thinking in itself is kinetic: "It moves forward, backward, digressively, quickly, slowly, narrowly, suddenly, hesitantly, blindly, confusedly, penetratingly" (p 30).

Sheets-Johnstone's very reasonable and convincing phenomenology does not hypostatize the brain. Consistent with Thomas Fuchs it is being depicted and conceptualised as a mediated and contextual and dependent organ. The brain does not provide us with a stable *prima philosophia* take-off, neither is it the telos, nor the finality of everything (eg the human evolution).

What is needed is not braincentristic central perspectivist beginnings nor teleological redemptions but rather specific analyses of the importance of bodily activities and experiences for the development and changeability of the human brain.

While sociobiologists and neurocentrists want to reduce us to nature/biology/brain, posmodernists, according to Sheets-Johnstone, negate the reference to nature and human biology in advantage to explorations of historical discourses and changing linguistic patterns (1994:4f, 328, 334-335). Confronted with these two positions the paradigm of the corporeal turn maintains that man *is* nature and biology (possess an "animate form"), but also that (s)he creates changeable cultural communities of mutual understanding. Man ought not to be reduced to either nature or culture. Neither a biological nor a linguistic essentialism is philosophically attractive, neither for Fuchs, Sheets-Johnstone nor for the author of this article.

IV PLASTICITY

In everyday language the word 'plasticity' is primarily seen positively, like the words flexibility, adaptability and adjustability. But how do the dictionaries and encyclopaedias actually define the different p-words? Let's take a brief look in a *Webster's Dictionary* (1983)[7]:

> **plastic** adj Latin *plasticus* of moulding, Greek *plastikos*, French *plassein* to mold, form 1632) 1: Formative creative forces in nature, 2 a: capable of being moulded or modeled, 2 b: capable of adapting to varying conditions, 3: sculptural, 4: made or consisting of plastic, 5: capable of being deformed continuously and permanently in any direction without rupture, 6: of, or relating to, or involving plastic surgery, 7: formed by or adapted to an artificial or conventional standard; esp.: not genuine or sincere…
>
> **plastic** n (ca 1909) a plastic substance; specif.: any of numerous organic synthetic or processed materials that are mostly thermoplastic or thermosetting polymers of high molecular weight and can be molded, cast, extruded, drawn, or laminated into objects…
>
> **plasticity** n (ca 1782) 1: the quality of state of being plastic; esp: capacity for being molded or altered; 2: the ability to retain a shape attained by pressure deformation; 3: the capacity of organisms with the same genotype to vary in developmental pattern, in phenotype, or in behavior according to varying environmental conditions.

It is worth noticing that the active and dynamic definitions of the p-words are getting transformed from the diverse world of plastic industry, chemistry, art, surgery and biology to describe and label the plasticity of the brain, the moldable organ. Neuroplasticity[8] is both being imagined to be a constitutive trait of the brain, encapsulating its natural 'capabilities' and its inherent-emergent qualities *an sich* – and a field of intervention, telling and showing us how the brain can be moulded with intentions and conscious ideas; a kind of plasticity *für uns*. In play we envisage both plastic(ity) as the capability of being formed by something and plastic(ity) as the capability of forming something, eg itself). The brain is an enigmatic organ, a double 'genius'; it gets formed and it forms at once and nota bene throughout life. A kind of a *win-win situation* takes place when neuroplasticity at the same time is something that happens by itself (unconsciously,

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7 In *Den store Danske Encyklopædi* (1999) one can find similar, but abbreviated versions of the definitions.

8 Of course neuroplasticity is a central and integral part of neurophysiology and so it has been for several years. The new consists of the fact that neuroplasticity seems to cause *Great Expectations* – both within and outside its own realm.

as unforeseen events) and something that can be brought to happen (by will, supported by ideas and wishes). The brain reminds us – and noticeably not only in a metaphorical sense – of plastic explosives which can be moulded according to different practical needs, while they contain powerful, nearly ungovernable and unexpected potential[9].

V THE PRAYING, MEDITATING, SUFFERING AND PLASTIC BRAIN

The Danish biologist and anthropologist Andreas Roepstorff catches the two-fold nature of the brain: "The brain in the 21st Century appears a plastic brain: mutable, open to change and structured by practices" (2009: slide 1). Instead of being a given and stable centre it becomes a dynamic epiphenomenon (cf Larsen: (2008a:6f, 17f & 25f) and (2009a:78-79 & 89-90)). If the cognitive capacities are maintained the older brains do not 'shrink'…so fast. It used to be hold for good just a few years ago that the brain was destined to lose its power, as we grow older, but this is now proven to be wrong (cf eg Weekendavisen Ideer (2009)). The brain is no longer understood as "self-contained", but rather as a "permeable" mind/brain structure. Roepstorff states, that MRI-scannings have shown that meditation (in this case for more than 10hours) alter the left pre-frontal cortex of the brain, which is associated with happiness, while the right-hand side, which handles negative thoughts, is suppressed. Together with other colleagues from the theological, anthropological and neuroscientific research field of Aarhus University, Roepstorff has documented positive side-effects in the brain due to praying practices. The paper has the expressive title: "Rewarding prayers" and with caution the four researchers conclude: "...that the motivational systems of the dorsal striatum may play an important role in motivating frequently repeated religious behaviour" (Schjødt, Uffe et al (2008:167)). 'May' or 'may not' – that is the question. In Schjoedt, Uffe et al (2008:1) it is pointed out: "...that praying to God is an intersubjective experience comparable to 'normal' interpersonal interaction." The researchers were occupied in studying the two sets of alterations that happen in the brain when people pray to a fictional Santa Claus or to a 'real' God. The scanning tests were carried out on 20 young believers; age 21-23 (all of them being members of "Indre Mission", a Christian faction within the Danish Lutheran church).

Chinese neuroscientists have, according to Proceedings of the National Academy of Sciences (cf a paper by Gong Qiyong et al: "High-field MRI reveals

9 Catherine Malabou quotes Jacob and Wilhelm Grimm: *Deutsches Wörterbuch*, Bd 7, Leipzig 1889, column 1900: "Plasticity denotes … the properties of plastic things, ie achieving a form or giving a form" – and emphasises, that since the 19th century the meaning of the word plasticity has incessantly been changing, think eg on plastic explosives (dynamite – and destruction of forms) and artistic creation of forms (sculpture) (cf 2007b:157).

an acute impact on brain function in survivors of the magnitude 8.0 earthquake in China" (in vol 106, no 236, 8.9.2009; in Harmsen (2009)), shown that the brain is being exposed to extreme alterations after traumatic events (in this case 44 survivors after the tremendous earthquake in China on 12 May 2008, being subjected to magnetic resonance scanning just 13 to 25 days after the disaster that killed many of their relatives and neighbours). This type of research might prove to have major significance for the recovery of patients with post-traumatic stress in the future.

Possessing detailed knowledge of the brain processes, the rehabilitators no longer have to wait for the patients themselves to come to realise that something is wrong, asserts psychiatrist Andrea Mechelli, at King's College London (Harmsen (2009)). If the acute altered brain functions and traumas (or the "wounds of the soul", as they are called in the article) are visible on the scanning screens performed just after the catastrophe then proactive initiatives can be taken. The clinical practices will now gain more knowledge and have more options to select among. Earlier recovery plans used to be reactive – and the patients were not treated due to the lack of knowledge of the individual patient's trauma. But now the new neuroplastic and 'objective' data (the results of the individual MRI-scannings) can strengthen the power of the system, because the patients showing the highest risk of suffering from long-term psychological diseases can be identified and given faster treatment. Proactive, neuroplastic measures might also be attributed to people who have been exposed to and experienced war, terrorism, violence and traffic accidents. Future scanning-techniques and progress in gaining neuroplastic knowledge will also come to combine proactivity, prophylaxis and prognostics. It is easy to imagine that the prophylaxis will take place in the realm of the individual patient based on the useful 'production' of prognostic data. Contrary to 'positive' data (eg on the learning pupil's, the taxi driver's or the chess-player's brain and the creation of their new synapses due to their activities) here one has to deal with 'negative data'. Students with learning difficulties, mentally unstable people and ex-sport stars experiencing a decrease in their individual performativity might also be transformed to more or less willing research subjects for these types of scans trying to localise lacks and traumas – and other brain dysfunctions[10].

10 On the face of it is rather questionable whether these attempts to present diagnostic mappings can be accompanied by scanning pictures of the brain can produce valid knowledge. What does it help to count the amount of neurons, to weigh the grey and white matter in the brain, to measure and estimate the blood pressure, and to maintain the shining brain activity or the lack of it, when complex social and individual sufferings have to be understood, interpreted and as far as possible relieved?

VI THE CEREBRAL SUBJECT

The quality of being a plastic brain in a dynamic society has made some researchers undertake a conceptual shift from "personhood" to "brainhood". The comprehension of the self as localised in the cerebral subject can be seen as an expression of "the power of brainhood ideology" that exaggerates and legitimises what it is that the neurosciences have found out (Vidal (2009:9)). Under the headline "From Cortical Maps to Neuroplasticity", the historian of science Fernando Vidal from Max Planck Institute in Berlin writes that the new knowledge of the brain, and not least the new techniques of visualisation, replace the former phrenology and its fixations of properties in favour of the dream of viewing the dynamic metamorphosis of "the mind and the self through brain recordings":

> These techniques confirm the anatomical, functional and developmental evidence that the brain is neither a mosaic of punctuate sites, nor a hard-wired collection of neuronal circuits, but an array of interconnected and parallel networks, highly plastic and capable of developing and repairing itself (p 19).

Vidal emphasises that the new neuro-cultural keyword (from the beginning of the 21st century onwards) is neuroplasticity. Now there is widespread to talk about self-altering and plastic brains – and also about brains which have to be re-moulded, eg in attending brain-fitness and mindfulness courses. At the one end of the spectrum the naturalistic neuroscientists point out that the plasticity of the brain is cause directly of its natural properties and potentials. They understand the brain as pivotal and stress the fact that billion of neurons get created and trillions of synapses get 'woven' throughout a lifetime. At the other end of the spectrum, phenomenological researchers proclaim that the decisive brain processes do not stem from the brain in itself. Instead they must be seen as side-effects of human actions and the associated experience structures. Right in the middle between the two opposing positions, other researchers claim that the plastic brain is 'born' into a culture, that marks it and decides (some might even say: dictate) how it gets the chance to be formed; on the other hand the plastic brain does also have the power to form culture and to 'make' history'.

VII NEUROPLASTICITY AND HISTORY

Daniel Lord Smail is an America historian at Harvard University. In the book *On Deep History and the Brain* (2008), he firmly suggests that we "add a neurohistorical perspective" (p 201) to the writing of history. Without this perspective humanists will not be able to think "Deep History". Smail claims that it is due to the fact that: "Culture is made possible by the plasticity of human neurophysiology" (p 154). The plastic brain is explicitly seen as a *conditio sine qua non* for human culture. The neurobiology is the underpinning for culture. At the

same time Smail asserts, that: "Culture is wired into the brain" (p 159). Thereby culture comes to be the qualitative device to form the neurophysiological patterns ie the synaptic structures of the brain, and the totality of the body and brain chemistry in man.

This dynamic double logic that tells us that the plastic brain forms culture and that culture forms the brain's plasticity Smail expresses in manifold ways. In a neurobiological realm plasticity can be displayed like: "Trillions of synapses are … created by experience during the years of juvenile synaptic plasticity, and they continue to be created and maintained throughout adulthood" (p 135). The synaptic changes do not only happen for children and youngsters, but lifelong. We lose multitudes of neurons if they are not being used, but we refine our brains by means of cultural preferences and habits. On the other hand: not everything is possible. Humans are not able to do whatsoever they want and might think of, and they are definitely not infinitely flexible. In short: there are limits to neuroplasticity. As humans we will eg never come to behave nor to have a 'self-knowledge' like a chimpanzee or a striped horse:

> It is true that noone starting with a human genotype will ever grow up resembling a chimpanzee or a zebra; the development process is not that flexible. But at the level of behaviour, there is more developmental plasticity, more room for cultural influence, than imagined by pop sociobiology and even mainline evolutionary psychology (p 136).

But changes in cultural habits and experiences, work forms and consumer behaviour do influence the formation of the plastic brain. Smail reminds us that "…cultural practices can have profound neurophysiological consequences. …humans possess relatively plastic or manipulable neural states and brain-body chemistries" (p 117). The widespread usage of alcohol, tobacco and opiates has implications for the human biology and physiology. These pleasure products alter the overall body and brain chemistry. New religious rituals, car rides, office work, consumption of TV-entertainment programmes and the usage of telecommunicative devices etc also come to change the bodily aspects of life and the networks in the brain. The Neolithic revolution, the settlements and the agricultural life form 5,000-10,000 years ago did have tremendous consequences for the physiological evolution of man and these societal changes affected the plastic brains and our ways of thinking.

Smail ventilates the outspoken and sympathetic ambition to leave the classic and nearly inescapable either-or discussion on nature versus nurture behind. Acknowledging newer neurobiological and physiological insights he states: "…there can be no nature without nurture and vice versa" (p 119). Biology and

culture are knitted closely together and vice versa they are each other's constituents. None of them can be the only one to wear the yellow jersey.

Simultaneously Smail criticises professional historians for not having taken the longer evolutionary processes into consideration nor to have shown any interest in the newer neurobiological research results – and he also holds to the conviction that neurosciences have to open their eyes towards the humanities and not least to study history. If we "want to understand why our brains and bodies work the way they do, that understanding is impossible without history" (p.201). Even stronger is the final credo of the book: "The new science of the brain cannot make sense without history" (p 202).

Instead of launching a reconciliation argument, preaching a both-and-perspective enabling a simple addition of the two mono-scientific disciplines, biology and history, resulting in a disharmonic synthesis, Smail advocates that new knowledge has to originate from within a brand new epistemological horizon. But as a devoted reader one has to conclude that Smail has not been able to sketch the new constitution of the interrogative horizon nor its conceptual frame and means.

VII THE PLASTIC BRAIN IN THE PUBLIC

Media – newspapers, radio broadcast, TV and the internet - boil over these days when it comes to references to the plastic brain and different other related plasticity words. www.google.com provides us with 242,000/228,000 hits on 'neuroplasticity', 809,000/1,300,000 on 'brain plasticity', and 14,100,000/ 98,700,000 on 'plastic brain'. In addition, one finds 42,400,000/251,000,000 hits on 'learning brain' (visited May 19 2010 and April 22 2012). Of course one has to be cautious with these overwhelming and growing figures. For years the concept of neuroplasticity has been pivotal in the neurosciences. Every college biology book has a chapter on neuroplasticity and the concept is used in the scientific literature and articles. But these remarks do not deny the fact that the concept is increasingly being used outside neuroscientific research circles, nor do they question the fact that the neurosciences apply the concept when they investigate the interplay between the brain (its physiology, chemistry and biology) and the social and bodily learning processes (and other incidences like catastrophes, war, stress and the influence of medical treatment). Neuroplasticity, the plastic brain, the learning brain, etc the concepts have become almost self-blossoming.

In the national Danish serious radio DR P1, undisguised publicity for the coming special exhibition of the "Experimentarium" in Copenhagen was launched:

"The brain – ready, steady, be wise"[11] in a programme called: "From brain waves to radio waves – radio on the brain" (June 11 2009):

> But if you already by now are hungry to become wiser and want to know more about this fabulous organ, please listen to *The World of Sciences* on radio P1. …You can come to hear the story of how the shift in understanding of the brain took place from the fully finished adult brain to the present knowledge that the brain is like clay. It changes and develops itself throughout life.

VIII THE PLASTICITY OF THE BRAIN – WILD SCALE JUMPS AND AN EXCITED TRAFFIC OF PERSPECTIVES

Hyper-concrete plasticity narratives of the brain have their take-off in the elements and processes of the brain, its neurons and synapses[12]. Other perspectives are more concerned with learning processes of the healthy brain and/or programmes for rehabilitation of the injured brain. A third way of thinking stresses the evolutionary origin of the brain's plasticity. Some emphasise that the:[13]

> brain inscribe the plastic brain as a part of a major whole in which the rest of the body, the surroundings (the human biotope and sociotope), other people and not the least act(ion)s, language and communication systems have a say.

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11 In Danish it was called: "Hjernen – klar, parat, smart". A little untranslatable wordplay was used: "smart" (be wise) nearly sounds like "snart" (go!). The broadcast programme can be re-heard via <www.dr.dk/P1/Videnskabensverden>. With a sense of good timing the exhibition opened its doors to the public a few days before the autumn school holidays in October 2009. Parents and children got the opportunity to get *hands-on* the brain and to experience some of the newest endeavours in neuroscience. They had to be engaged in interactive, pedagogical and inviting play scenarios and exhibitional plateaus. Some of the options were that you could lie down in a scanner, read about and come to sense mirror neurons, move small balls with the power of your 'emptied' mind and see a dedicated young male biologist cut up a lamb's brain.

12 Within neuroscience a distinction is drawn between two types of plasticity. Firstly, the neuron is plastic in itself. It takes its form due to the chemical influx it meets when electrical signals from other nerve cells are transmitted to it in chemical ways. Secondly, the neuronal connections are plastic; synapses are created in the brain. The first type of plasticity makes, so to speak, the second type possible. The parts make up a whole that is more than its parts. Neuroplasticity seems hereby to be constituted – and to be conceived – as a pulsating, synergetic phenomenon.

How to understand the plasticity of stem cells is a complicated question. Researchers still quarrel: Can something like transdifferentiation of multipotent stem cells (eg residing in the tissue of bone marrow) to pluripotent (more plastic) stem cells, possessing a potential to be able to become all cells and tissue types in the human organism, be found? (cf eg Frisén (2004: 103-105).

13 Recently the 120 cm high and 50 kg heavy Ardi (*Ardipithecus ramidus*), probably our 4.4 million year old bipedal ancestor, was found (cf Connor (2009)). In evolutionary terms: First comes bipedality, then an increase in brain volume.

It is an important body-phenomenological argument, that the upright position (bipedality) and the liberated hands made the evolutionary brain development possible (cf eg Sheets-Johnstone (1990)).

Therefore, concerning plasticity of the brain, it is worth noticing that major jumps in scales and levels can be envisaged and manifest distinctions when it comes to perspectives and subjects. Phylogenetically the volume of the brain increases dramatically through millions of years of human evolution; onthogenitically throughout a human life billions of neurons are produced and trillions of synapses become established (Larsen (2008a:3-4 & 44-54)). A complex phenomenon and developmental process take place and from life's beginning man also loses neurons. It is important to remember that even new born babies are not simple neuronal 'growth machines'.

X LIMITS TO PLASTICITY

> …Paradoxically the question of limits/borders builds a continuum binding together history, politics, biology, language, art and classic philosophical questions. (Stjernfelt and Troelsen (1992:7-8))

> We cannot think of borders/limits in space as anything else than limits to speed, and we cannot think of limits to speed in any other form than borders/limits in space. (Fink (1992: 25))

The Danish philosopher Hans Fink tells us that Terminus was the Roman God for borders/limits and that the word "grenze" came as a loan word from Slavic language. "The original Nordic word for border was 'mark', ie 'to mark'" (p 11). The word was 'classically' used to draw a line (eg "grænse" in Danish, "Grenze" in German) between our fields (the Danish word for field is "mark") and theirs, between them and us. Fink emphasises the distinction between limits to something and borders between something. In the first sense the concept of limits primarily focuses on the manifest processes of extension and limitation, the second concept of borders deals with the question of how to deal with the normative legitimacy of extension and limitation. "The first group deals with limit(ation)s to being, doing and daring, the second group deals with limit(ation)s connecting to ought-questions" (p 12).

It is quite obvious that both meanings of the concept of limits are activated when questions about possible limits to neuroplasticity are posed. First of all there might be limitations to how many dead nerve cells can be re-created and how many synapses can be 're-knitted'. One might think of certain limits to recovery after violent lesions (eg victims of shooting, automotive accidents, natural catastrophes etc). Moreover it is hardly probable that all neurons across the brain can 'reach' one another and form connections. In spite of the brain's fantastic capability to self-repair, not everything in the brain is replaceable or reversible. Spatial limitations concerning how far synapses can be drawn across disparate neurons play an important role. So does the time dimension. Neuroscientists and theoreticians of

learning talk about sensitive and critical periods and so-called time windows which can be closed so new learning becomes 'prevented'. Evolution has apparently decided that everything in the brain is not within reach at all times nor that the brain is open for anything and anyone that comes around. Moreover not all sense receptors are equally influential upon the dynamic processual set-up of the brain. It is worth noticing that the French psychoanalyst and philosopher Catharine Malabou (2007a) interprets Alzheimer's disease and Parkinson's disease as expressions for 'negative', actually 'destructive plasticity' in the human neurobiology. The brain is not only an organ of positive potentials and possibilities (plus-plasticity); it happens also to be loaded with vulnerabilities and it can be the instigator of serious illnesses (negative-plasticity)[14].

A Summarising these First Considerations

First the 'conviction' is that there exist several physiological limits to neuroplasticity.

If brains (or complete human beings of flesh and blood) are exposed to non-stimulating or definite destructive processes they will not become optimalised – they can 'experience' chemical intoxication, bad nutrition, life-threatening poverty, violence, despair, imprisonment, lousy training and education, lack of love, no recognition, never meet challenges etc. The societal context in which the brain is embedded and embodied can come to play a restricting and negative-formative role on its development.

14 The highest level of plasticity has been found in brain tissue from patients suffering from Alzheimer's disease, according to the Danish doctor and neuroscientist Jesper Mogensen:"Their brains are plastic to the extreme. Their brains are losing neurons, and the brains are reorganizing neurons, but not in an organized way" (2010). Mogensen has confirmed – in a reply to my question – that it makes sense to use Malabou-congenial expressions like negative and self-destructive plasticity. He also conceives epilepsy as an "overactivation of the brain". This extreme form of plasticity has several negative consequences for the patient.

Therefore and secondly, there can be contextual and socio-cultural limits to neuroplasticity[15]. If these limit(ation)s become interpreted in a normative horizon the second fundamental version of Fink's definition of the delicate relation between limit(ation)s and what one ought to do or not to do gets highlighted. Researchers, politicians, patients and their relatives behave like engaged stakeholders when it comes to the question of the legitimacy of maintaining or moving the limits to neuroplasticity – and this bio-political question has the power to come to contain everything from how to interpret scanning screens, the right to donate or demand medicine (and drugs), offer recovery programmes, promote learning, appeal to the will and self-responsibility, the right to free choices, how to pursue happiness, and how to raise the value of the human mental capital etc.

Thirdly the normative perspectives on the legitimate/illegitimate limits to neuroplasticity come into the picture. Basically, the brain is not all there is to say about humans. As the English neuroscientist Steven Rose writes: "…minds are enabled but not reducible to brains" (2006:136). So even though our contemporary taste forms cry out for neuroplasticity, we have to remember that this (neither the brain nor the neuroplasticity) is not everything. The neuroplastic message can (risk to) come to function as water on the metaphysical brain-mill: "The brain should not only be the locus of the human spirit, but also the meta-subject, our thinking's thinker, our acts actor, yes - even the creator of our world" (Fuchs 2006:2).

Fourthly one must stress the epistemological limits to the power, logic, validity, extension, coherence etc. of the concept of neuroplasticity. It might be a good idea to try to develop a capacity to reflect upon these questions in a non-reductionist and non-identical-philosophical way. Neither the "I" or the mind can be reduced to the brain and the tension field between the 'object' (eg that what happens in the brain) and those assertions (and eg possible conclusions based on scanning data and prior neurophysiologic knowledge) which tend to coagulate in a firm conceptual horizon must be maintained and scrutinised in a self-critical way.

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15 The problem of this assertion is that the concept neuroplasticity covers many different phenomena which might be in inner conflict or have tensions with one another, even though they 'stiffen' (become 'frozen') as we grow older. To try to foster clarity one has to differentiate between: (i) a decrease in neuroplasticity (on a plus/minus axis); (ii) stand-by neuroplasticity (*stasis*, standstill); and (iii) negative neuroplasticity (to register loss, a growing tendency to 'stiffen', a less plastic and flexible brain etc).

According to the American cognitive scientist Douglas Hofstadter the plasticity of the brain is closely connected to the brain's rigidity and vulnerability. In *I am a Strange Loop* he writes that the human brain can be defined as an open and very flexible phenomenon: "…a human brain is a representational system that knows no bounds in terms of the extensibility of its categories" (2007:82; cf Larsen (2008a: 83)). It is exactly the interplay between the two extremes: the nearly limitless plasticity of the brain and the same organ's rigid limitations that will have to be explored, conceptualised and interpreted in future research.

"The greatest limits to plasticity is our knowledge how to use it", Jasper Mogensen proclaims (2010). Mogensen is a neuroscientist, leader of UCN (The Unit for Cognitive Neuroscience) and director of RECBIR (Research Centre for Brain Injury Rehabilitation) at Copenhagen University.

Basically we do not possess enough knowledge of the physiology of the brain or the organisation of its networks. Mogensen's credo localises the limitations "in the mind of the scientists, not in the patients", eg it is well-known that cerebral thrombosis kills neurons but it is very difficult to develop drugs to prevent these 'killings'. A type of glutamate being able to boost and block at the same time is also something we need, according to Mogensen who also states that restructuring of the brain is not only a matter of biochemistry. Brains are not static; they are formed by the context in which a person lives and influenced by the tasks and challenges encountered and the motivation for recovery training programmes the person might have or not have. If you use the brain you improve it. Self-training is important. "The brain per se cannot recover; the brain can recover in interaction with the environment." Mogensen states that we do not lack more data; we lack more knowledge and new theory. Due to Mogensen, the overall frame in which neuroscientific research take place is that all neurons are destined to commit suicide and that we have to convince them not to do so.

Point five is that there are scientific limitations to understanding neuroplasticity. We lack research and knowledge – eg desperately needed to help people recover or to prevent them for getting future brain diseases.

Moreover 'come' the inevitable and existential-present knowledge and the basic philosophical-anthropological points that we did not choose to get born and we are going to die no matter how much we love and stick to life. This ontological-phylogenetic mind-set does not stem from neuroscience or biology – but from profound human experiences and philosophy. Basically speaking, there are generational, 'animate' and bodily (biological, corporeal, sexual etc.) limitations to what we can do and to what we can become. Very few elderly people start to go down-hill on racing skis and babies cannot write dissertations on ancient French verbs or manage to communicate fluently in 2 or 3 different national languages. We are not and cannot be everything, and even though our imagination (*Einbildungskraft* and fantasy) is powerful, no individual alone invented the ordinary language or designed human sexuality and structure of diverse desires. We can fly in advanced airplanes but we do not have real wings to fly with, nor can we dive for hours underwater without oxygen masks, or come to try the orgasm of the opposite sex (from within and for real), or come to feel how it is to be a bat or a lion…or live forever.

The sixth point states that there exist ontological and phylogenetic limits to neuroplasticity[16]. These limits are impossible to transgress; they are constitutional and necessary and they encapsulate and form fundamental conditions (the Germans have coined a great expression for these inevitable conditions (*Unhintergehbarkeiten*; literally: something you cannot come behind). Humans are always incarnated, situated and mortal; we are not in all flesh at the same time, and our flesh (bodily presence) cannot be situated all around; neither does it last forever. We invent prostheses and enter the Internet and gossip on mobile phones for hours, but the body in itself cannot crawl across the Atlantic Sea or travel through telecommunicative cables and other invisible devices. Moreover, and paraphrasing the German philosopher Peter Sloterdijk's well-chosen words from *Kritik der zynischen Vernunft* (1983; *Critique of Cynical Reason*), we use the full body to think (with) and not only the 'abcess' that is placed on the top of neck – and newer theories and research results suggest that thinking plays an important role in designing the brain[17].

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16 Some of these limits do of course also touch, or even embrace, the physiological limits to neuroplasticity.

17 "The content of thinking retroacts on the biological machine that 'made' the thinking" (in German: "Der Inhalt des Denkens wirkt zurück auf die biologische Machine, die das Denken erzeugt"), Ulrich Bahnsen writes in the German newspaper *Die Zeit* (2010). Thinking creates new patterns (networks) in the brain every millisecond throughout life. The electric signals of the brain play a role in forming the brain anew. "The brain is a meaning-producing machine, creating everything that man can come to know." Exactly so the mutual, indecisive and indiscernible interplay between a biologisation of the human and a humanisation (in the old days one might even have said spiritualisation) of the biological can be sketched. In thinking the human agent is forming his or her own biology even though not aware of this process at the moment of creation.

This unconscious self-formation process also occupies the French philosopher Catherine Malabou: "The brain is at work, and we do not know. We are its subjects – authors and producers at once – and we do not know it" (2008:1). Apparently strict limitations to our self-consciousness exist. Malabou finds it problematic that: "Humans make their own brain, but they do not know they are doing so…Our brain is plastic, and we do not know" (2008:8), because she has ascertained that capitalism wants to transform the free plasticity of the brain to be a flexible, affirmative and exploitative phenomenon. The neoliberal logic of competition will restrict our freedom to form our own brains and try to make resistance and critique impossible. The system needs flexible behaviour not free plastic thinking. Malabou even italicises her credo: "*What should we do so that consciousness of the brain does not purely and simply coincide with the spirit of capitalism*" (2008:12). For Malabou the fight to defend plasticity becomes a political project. Man has to become his own autonomous sculptor (2008:24) and learn to think and practise cerebral plasticity in new ways.

The wilful Malabou manifest is important and sympathetic but acknowledging that the major part of the neuroplasticity occurs unconsciously and beyond our sensual horizon she still owes us a convincing argument for the vision of a subject(ivity) being able to develop a sovereignty in the form of an a priori logic able to expel the stupid and the system-affirmative flexibility claims from ever entering the brain. Malabou is a prominent heir and ex-student of the French philosopher and deconstuctivist Jacques Derrida and it is quite surprising that it is precisely she who tries to revive a heroic and strong concept of the subject(ivity).

XI TO SET AND SEE THE LIMITS

The physiological, contextual and socio-cultural, normative (legitimate/ illegitimate), epistemological, scientific, ontological and phylogenitic limits to neuroplasticity are definitely not identical. They label very different perspectives on the plastic brain. The physiological limitations make up the domain of the neurosciences in which thousands of researchers around the globe eagerly try to produce new research results managing to push and challenge some of the limitations and borders a little bit further for what we can come to know about the brain; on the other hand the contextual, socio-cultural and normative limitations are being drawn in a major landscape in which we find conflicting interests, represented by and ranging from politicians, parents, teachers, pupils, psychologists, patients, sociologists, journalists to business and sport coaches. Professionally the questions of the epistemological and ontological phylogenetic limits to (neuro)plasticity are being conceptualised and debated among philosophers and epistemologists – but as problematics (cf problématiques in French) they are ubiquitous, due to the fact that no utterance or assertion of the neuroplastic brain can be posed – descriptively or normatively – beyond an ideal (enforced) obligation to reflect upon the epistemological and ontological status of the argument(ation).

Many neuroplastic expressions can be inscribed in a 'classic' two axes diagram. At the one end of the X-axis stands 'objectivity' (ie physiology; a 'mute' object for a neutral third-person observation); at the other end of the same spectrum 'subjectivity' pops up (ie phenomenology; non-reductive first-person experiences); and on the Y-axis it is possible to depict high and low levels of neuroplasticity. A little more advanced version might split the X-axis in scanning data (validated empirical and established theoretical knowledge, theoria) and complex and manifold bodily and contextual qualitative knowledge (practical wisdom, phronesis).

Beyond any doubt the last approximately 20 years of technological breakthrough within the brain scanning techniques have caused two different types of effects. On the one hand neuroplastic knowledge has been refined and become cheaper to produce; on the other hand the vocabulary of neuroplasticity has become widespread also far away from the realm of the neurosciences. Today we become witnesses to a double movement. Some neuroscientists begin to express their views and offer their knowledge outside the neurophysiologic field. They tell us what the brain needs (by and in the social sphere), eg more challenges, better food, new schools, extra physical exercise etc. Simultaneously, often 'weak' and 'soft' sciences try to get the backing of the neuroscientific results in order to tell society how eg learning processes can be organised and optimalised and how aesthetical

experiences can be described in a 'rational' and 'scientific' way. Some assertions about human behaviour – whether dealing eg with politics of health, upbringing, psychology, pain, art, taste preferences and consumer propensity – seem to gain higher legitimacy and thrust in the media, among the grant-giving authorities and within the research networks, if you know how to align and back up yourself and your argument with empirical data from the neurosciences and concepts like the learning, dynamic and precious brain; in short with the plastic brain, with neuroplasticity.

Parts of the humanities and the social sciences try to gain legitimation and support in dealing with the 'evidence' and 'objectivity' of the neurosciences' explorations. Co-operative interdisciplinary research communities are being launched and fertilised. Moreover the neuroscientists are being challenged and have to become more dynamic when they initiate co-operation with some of the (hand-picked, voluntary and/or curious) humanists or social scientists. New strategic and knowledge political alliances see the break of dawn. The implications are both science-external (eg for the public sphere, for the substance of the research applications and for the decisive research political authorities) and science-internal (eg for the subject-matter and content of the research).

XII TO BE CONTINUED...

On neuroplasticity and the plastic brain one might provisionally proclaim: While the neurosciences are immensely occupied deciphering what exactly happens in the brain when it meets external and deliberate influences or functions 'automatically' according to internal rules, philosophy's attention is centred on which concepts and rhetorical arguments one might be able to localise, reconstruct and criticise within the societal and scientific discourses of the brain. Moreover a sociological and critical diagnosis of the contemporary ways in which these different conceptualisations of the brain get loaded with power and interests also have to show which consequences and implications these immense hymns to the plastic brain might have in a broader societal realm.

Within a philosophical frame it is a matter of durable phenomenological practical wisdom that man does not experience the world or our own bodily processes at the micro-level. We do not experience at the level of blood cells and do not feel the neuronal activities (ie the formation of synapses, the firings, etc). We experience at levels of another type. We live among everyday macroscopic phenomena and know 'objects' like neighbours, bicycles, coffee cups and books. We use and understand symbols and sentences much better than we grasp the immune system and normally we do not sense all the delicate (im)balances in our bacteriological flora. The human scale of experience has another wave-length than

biochemistry and neurophysiology. If we continue to reflect upon this human condition for a while it also has to be emphasised that we do not experience the world on the biggest macro-levels: the speed of light, the rotation of planets, the existence of distant galaxies and black holes, the time span since the big bang, etc. These facts remain intangible abstractions. Therefore we seem to be notorious 'in-betweeners' ('middle-beings'); we are living in the midst of things. In daily life we are stretched between the two micro and macro universes which thousands of researchers are engaged in scrutinising, but we do not experience them as integrated parts of our immediate existence. Facing autumn leaves and dead relatives, the first thought that comes to your mind is not compost and putrefaction. Moreover our neurons do not wish to come to read Plato's *Politeia* (*The Republic*) or to go travelling to an exotic beach next summer. Taking our human proportions into consideration it is not surprising that most of us never deal with or sense our neurons and synapses (cf Larsen (2008a:80f) and Hofstadter (2007:172f)). Life is okay and worth living for the majority even though we do not how and where or if the 'I' can be located in the brain, and even though we are not co-present with all the things that happen to and in us when we live. The philosophical temperament involved in writing this text is totally critically against the predominant equation between the brain, thinking, the 'I' and the true subjectivity of man. Moreover it is also immensely preoccupied with the question of how it is that the concept and phenomenon of neuroplasticity seems to become so all-embracing and all-inclusive and such a big success that it might eventually risk being turned into a truism.

Within the field of the social sciences it is worth noticing that the concept of plasticity is not a newcomer in sociology. More than 200 years ago the Scottish philosopher and one of the young founding fathers of sociology Adam Ferguson (1723-1816) stressed the peculiarity and specificity of man: his open-mindedness, learnable and plastic characteristics, enabling the design and development of the most diverse societies, cultural habits, behavioural patterns and life-styles[18]. Societal socialisation benefits from this anthropological plasticity, but if the formation of the individual happens to be too coercive "the plasticity of the individual diminishes" (Kröners *Wörterbuch der Soziologie* (1994:669-670 and 220)), stating that the normative rules for upbringing the citizens can be too harsh and thereby become (self)destructive: The plasticity decays. Ferguson conceptualises several societal conflictual scenarios and advocates at the same for different plasticity options at the micro- and macro-levels of society.

18 GWF Hegel in the "Vorrede" (preface) to *Phänomenologie des Geistes* (1807; *Phenomenology of the Spirit*), when he provided the subjectivity with plasticity, ie the ability not to stiffen, but being able to assume a line of shifting shapes and forms (cf among others Malabou (2007b:157)).

Many years later the English philosopher Martin Hollis (1938-1998) wrote *Models of Man* (1977) in which he offers a sharp differentiation between the autonomous and the plastic man. While, due to Hollis, the autonomous man possesses free will and intends his acts, "the plastic man" is determined by the social structures and biological processes. The self-legislative and self-conscious human being creates the social, against which "the plastic man" gets formed by causalities and powers, "that 'go on behind our backs' including 'unintended consequences'" (*Collins Dictionary of Sociology* (2000:32)). Hollis points out that both models of man have to be brought into play if sociology ever wants to have a chance to comprehend and analyse the social actions and structures which form society as a whole.

Stretched out somewhere between Ferguson's and Malabou's[19] laudative hymns to plasticity and Hollis's somehow more negative view on man's moldable, societal nature the contemporary views on the plastic brain can be recognised and re-interpreted. The brain's potential for learning and its openness to changes are praised but on the other hand neuroscientists, every brain-committed stakeholder and all laymen also know and have to acknowledge that the brain gets formed by 'bad habits', that it is mortal, and moreover that it is not an autonomous, self-transparent and conscious agent, managing to do everything on its own, per se[20].

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19 Cf n 107 above and a thorough interpretation and critique of Malabou's perspective in Larsen (2010).

20 The fundamental neurocentrism (brain-metaphysics) which states in a reductionist and physicalist vocabulary that it is the brain, that does and decide, everything looks like a central perspectivist dogma behind the otherwise broad and open speech of neuroplasticity. If the brain is just adjusting itself to what we do and have to do *who* is it then actually who does so? The active *agency* (the will, the intention, the commitment) seems to be 'forgotten' in this neurocentric world picture. But matter, genes, neurons and synapses do not provide us with a final base of reference – neither does the brain, and we still do not know what consciousness is and how and why it is 'produced'.

Not only do we have to take into consideration that qualitative first-person experiences and thoughts are not reducible to 'objective' third-person mappings of the brain's biology, we also have to remember that man is an acting and thinking creature which *has* and *not* solely or primarily *is* a brain (cf the interview conducted with the German philosopher Manfred Frank (Schnabel & Assheuer (2009)).

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