CoSMo
Comparative Studies
in Modernism

■ LOOKING FROM WITHIN. ON THE CONCEPT OF NEURONAL AESTHETICS

Olaf BREIDBACH

■ The idea of 'looking from within' aims at a new type of neuronal aesthetics. Following that idea I try to envisage a new phenomenology, which does not divide nature and culture into two fields, and apprehends them separately nor reduces one side to the other. On the other hand it is no good to redo any kind of monism, relaunching ideas from about 1900; nevertheless we have to start with the notion that in viewing our environment we orient ourselves on the specific properties of our senses and our brain. We do that in the way, we have been trained in our culture. We find that these properties are modified according to our culture, which not only orients our minds but already directs our brain activity. Neural activity, thus, is not merely an effect of evolution, it likewise reflects a culture, and it should be interpreted in this twofold sense as a unity. To achieve that, we do need an integrative phenomenology that will again connect our experience to our corporeality, while at the same time conceiving the body as embedded in its culture and, therefore, in a history, that points beyond mere nature.

Thus, neuronal aesthetics is not just neuro-aesthetics in the sense that I have to look into the brain to understand what it perceives. In the contrary, the analysis of the neuronal program of perception show, that we have to interpret the basic settings of our perceptions to get an idea how we actually perform our behaviour. My thesis is that representations are not put into the observer, but are formed by him. They are formed to fit into internal predispositions.[1]

Just to give you form the start an impression on what I am to speak about. What do we actually see, in looking on a chair? David Hockney

[1] These ideas are worked out in more detail in Breidbach (2013); here, likewise, the relevant literature is cited.

Cosmo. Comparative Studies in Modernism, 3 ■ 2013:
Diritto e Religione, a cura di Cristina Costantini, pp. 125-136

made us see what we actually look on.[2] He uses some polaroid camera with a narrow focus. To get a view of something, he, thus, had to made a whole series of pictures, he afterward put together. In such a way he actually mimics what is happening when we look on something, scanning it up by eye tracking and combining the series of views; than results in something to be perceived by our brain. As you see, a chair actually is perceived as something much different from we actually expect to see. We actually never perceive parallels, or right angles, but we do make us see such ones. The impact of geometry is a cultural impact leading back to our handling of landscapes and complex forms by certain technical means, the angle metre and the velum. Our image of the world is a construction due to training, our cultural interpretation of our world and the specific needs and functions of our perceiving organ, the brain. Philosophically that means, we could look on what we see according to our way to handle and to interpret those thinks that were perceived. These are not simply informations implemented into our mind. Thus, we do not simply mirror nature, but form out representations according to our means. Already within sensualism that was not thought about as a second world being implemented within the observers head, but a reproduction of what has been received according to the needs and possibilities of the perceiving mind.

The perceiving mind is not an abstract faculty, however, but something, working in and by the brain (Roth 2003). Accordingly, perception could be performed only according the capabilities of such a system – including the sensory organs and their specificities. Historically, such an idea was already substantiated before the actual functional organisation of brain tissue was clarified.

The principle idea about brain functionality was formed out in the start of the 19th century.[3] It was the idea by which James Mill tried to understand the principal functional organisation of the brain. And that was delivered from associative psychology. He thought the brain was designed like a network of strings. A sensory input pulls on certain of these strings. As all of these were in close contact a certain activation resulted in a whole concert of vibrations within a brain. If two or more stimuli were reacted on simultaneously, such a concert would be more complex and might result in a specific coupling of various such string resonances. Thus, activation modes with such a system and by that the stimuli represented in it became associated. This idea was outlined

[2] In his polaroid series.
[3] For details see: Finger 1994; Hagner 1997; Breidbach 2001: 7-29.

before neuroanatomy had identified the neuron and its functional connectivity patterns. Nevertheless this model formed the way by which neurobiologists started to think about brain functions and brain activity. From the start onwards, thus, the brain was looked upon as a kind of associative system. Mill, himself, had adopted the former Hartlean scheme, saying there is a certain pathway within the brain that is stimulated by a certain sensory input.[4] Another sensory experience may stimulate another pathway. The closer these are associated, the more similar these experiences will appear.

Accordingly, there must be a mechanism to detect such functional distances in the signal propagation in the brain. Mill's idea was, that such stimuli may overlay. Thus classification would be simple: the more extended the overlay is, the more similar the stimuli are. It is easy to construct a putative mechanism that may work within the brain to do this calculation. When neuroantomy identified a cellular network of interwoven neurons, the functional units in which such associations could be dealt with, seemed to have been identified. This concept was worked on till the end of 19th century and reinstalled again by Hebb in the 1950ies; it became effective a third time in the late 1980ies, and is still followed on more or less in the principal design formed out by Mill nearly two centuries, ago.

This is something to think about, as it shows us that our concepts according to which we are interpreting mind functions are older than our ideas about brain tissue functionality. Eventually, we may come back to this. Irrespectively from, how the functionality of an associative mind is formed out, the principle message is clear. If the brain is the organ by which we perceive, its physiology determined how we do this. And, therein we should follow any idea up to its consequences. Thereby, interestingly, we have to admit, that most of our knowledge on brain representation and arts and ordering functions is due to optical sensory input.

Yet, there is wonderful material about the way an owl perceives its prey or a bat approaches a moth. And we do know something about how to perceive music and how we understand the subtle messages delivered within auditory communication. How fascinating it is to go into much detail, here, might become pretty clear already from everyday life. There is a person, you know very well attempting to call you up by phone. The signal is digitised in the microphone and transferred via satellite to your

[4] The background is outlined in more detail in Breidbach 2007: 23-33.

own phone where it is reorganized to form out something audible, Nevertheless, in spite of such dreadful dissection and resetting of auditory signals your might be able to understand emotions put into the words delivered. There is something we can take hold of, even if the signals are incomplete or suppressed by a random noise. We do know what we might have gotten and put the signals we noted into the framing of our expectations to get something we actually work on (*blind spot*) (Bexte 1999).

The mind is able to make the incomplete signal understandable by adding on memory projections and expectations to the signals actually registered. Thus far, the operating mind is no simple association device. Yet there is not only association (Jamme, Jeck 2013). Naturally, we have to admit, there are certain centres, needed for certain functions. The brain is an associative device wherein the signals path certain pathways coming from certain sensory input regions, being delivered according to those lines of neurons that have precisely defined functions. These ones have been evolved in mammalian brain evolution. Interestingly, however, already at the first step of such transfer pathways signal were dispersed into a whole network of neurons and receive input by the same network. That starts within the eye already where in humans the number of incoming fibres from the brain even surpasses the projecting fibres to the brain. This is going on in the next steps of signal transfer. Thus far, the visual cortex, the cortex area where the sensory information of the eye is transferred to before dispersing to the frontal cortex, the region associated with the highest brain functions, is already overlaid to a lot of parallel stimulations. Even before some information comes in there, is some general arousal within that region, eventually due to input into this system done before, which is reimplemented in that area within a certain time period. One can speculate a lot on this, but interestingly a model showing such features might demonstrate the very easy tricks of such a complex intermingling of connectivity patterns. As the model shows us, this is a basal feature (Zeki 1993). Thus, it is the principal functional characteristic of real neuronal networks, that is the brain tissue organisation. Accordingly, interchange is one of the central characteristics of data transfer within the brain.

That comes quite close to an other traditional concept, most popular in the Anglo-American world but quite unknown in the German tradition. It is the concept of dissolution as been put forward by Hughlings Jacksonalready in last part of the 19th century. Due to the evidence of clinical studies he proposed, that the specificity of human mind is not the concentration of strict lines of internal references but the complex intermingling of various pathways to squeeze as much of surplus information as possible within the signal transfer of a brain.

Consequently the old idea of separation of faculties – which is already a problem when describing the higher orders of visual integration – is not to be taken as a general scheme to understand brain function.

Furthermore there is a different concept of memory traces that get rid of the idea of storage areas for memories and is working with a much more flexible idea of sorting out and conserving neuronal input. We have to look for such alternatives, describing quite closely what the ideas and metaphors are, that were effective in such models. And this bears massive consequences for our idea about internal representations. In my view it is high time to end up with the Aristotelian scheme separating sensory, associative and memory formation areas and functions. When integrating such various viewpoints, the brain might get some different meaning.

There is no theatre of brain performances. The system is acting as an entity. It has no screen where something is going to look at, but is to describe as a complex interacting unit even combining periphery and central projection sites. Furthermore the network, in which this is performed, is no fixed site – it is not a kind of spider network to catch certain activities in, but is a dynamic system fixed only by a neuro-anatomist. While being alive it is in continuous evolution. The highly complex grid of interacting elements, thus, is to describe in such a complex multimodal interaction describing co-activations between interacting neurons that result in a very complex response, that nevertheless can be traced down to some basic functionality.

A simple calculus may describe the relation of activations employed by such stimuli. That can be done employing some mathematics. Thus, one may succeed to describe the functions of neuronal networks that eventually even have a natural correspondence. We can distinguish different signal inputs by describing the overlay in their internal stimuli characteristics (Breidbach 1993; Braitenberg, Schüz 1998). That can be done in a more sophisticated way, and one does not have to work with the idea of an explicit overlay of fixed grids with elements that are coupled in a fixed way to defined input elements but just look on different overall activity patterns in a non-hierarchically organized network.

Thus, a relative distance matrix can be described where the relation of each element to any other element is determined. The description of these relations allows unfolding homologous similarities in stimulus response characteristics depending on the actual hardware implementation of the neuronal connectivity in such a network. Any signal can be classified regarding to initiated changes in that general activation modes. These might be effective for some short times forming out certain trajectories that may change the system activity pattern in general eliciting new attractors of valid energy patterns. Thus, we can demonstrate what internal representation means.

There the basic mechanism is a simple one, as the system will just look for differences to something that is implemented within itself. But already this description shows that the categorisation of signals may work in reference to a grid of network stimulations. This gives a matrix, in which every element is described by its putative contacts to any other element. If we knew every possible combination of elements in such a grid of interaction, that is, if we could describe the complete set of putative matrices employable by the system, we would find something that resembles the basic grammar of the system. This would allow us to get some meaning into the functional syntax. That idea should be outlined in much more detail:

Following the concept of *internal representations*, signal processing in a neuronal system has to be evaluated exclusively on the basis of internal system characteristics (Breidbach 2007: 23-33). Thus, this approach omits the external observer as a control function for sensory integration. Instead, the configuration of the system and its computational performance are the effects of endogenous factors. Such self-referential operation is due to a strictly local computation in a network. Thereby, computations follow a set of rules that constitutes the emergent behaviour of the system. Because these rules can be demonstrated to correspond to a "logic" that is intrinsic to the system. This idea provides the basis for something we call neuro-semantics (Breidbach 200: 353-363; Breidbach 1999: 34-60). This I cannot discuss in detail here. The principal idea is that the distance matrix formed allows a kind of differential distance calculus which allows setting apart certain signal configuration according to their resemblance

How far such a concept could be extended to give an idea for the much more differentiated scheme of picture analysis or, eventually, even the ideas about categorizations, which is essential to understand how we discern an image and the things been represented by it? Here a closer view on brain organisation and especially the inherent dynamics of human brain development may be helpful. Yet, where culture comes in? Before giving an answer to that, let me outline the contour of another story, told by developmental neurosciences.

In human ontogenesis the numerically most extended brain – in regard to cell numbers or the amount of cell-cell contacts – is not achieved in the end of ones life span, but is established within the embryo. There is an overproduction, the cells form contacts sites and establish certain preliminary neuronal networks. Those cells that did succeed in forming out such contact sites were preserved, those that did not declined (Katz, Shatz 1996: 1133-1138; Catalanom, Shatz 1998: 559-562; Majdan, Shatz 2006: 650-659). Accordingly, a huge number of neurons degenerated. Thereafter, synapses are formed. Hereby, within a network of preliminary contact sites, those that are functionally relevant were sorted out. Contact sites used were preserved, those that did not diminish. Accordingly, within months, the number of contact sites is declined in the postembryonic human brain.

What is the meaning of that? The overproduction of neurons in early ontogenesis allows a reshaping of neuronal networks due to functionality. Thereby the brain can be used in different situations, and nevertheless – using the same program of development – results in optimal adaptations. Following that strategy, the functional units of the brain, the neurons in their development have not to look for predetermined sites in which predetermined contacts could be framed out, thus establishing brain functionality according to a fixed blueprint. On the contrary, that overproduction of putative connection sites allows some flexibility in brain design. As functionality sorts out those parts needed in an overproduction of putative contact sites the brain is able to response to changes in the environments the young animal is going to life in instantaneously during development. Following such a strategy functional contacts could be achieved according to functional needs: Tissue parts that were not used are melted down in ongoing development.

That overproduction of neurons in the embryonic brain of hominoids turns out to allow an evolutionary strategy that might be specific for the human species. The strategy is, to externalize memory functions. and here, culture come in. This is done by establishing and maintaining a specific surrounding, to which the brain is adapted to (by cutting down functional connectivity patterns from an extended offer of putative contact sits and putative integrative units (the neurons)). As this functional adjustment of neuronal connectivity patterns is driven by the sensory input, it is somehow equalizing brain response characteristics in those brains that were exposed to similar sensory input situations: all brains “reared up” in a similar way show an adjustment of neuronal functionalities (Young, Lawlor, Leone, Dragunow, During 1999; Rushton 2001). Thus far, to adapt to new types of experiences within such a group with common experiences, it is not necessary to alter a pre-determined wiring pattern in brain tissue. Thus far, there is no need to form out specific physiological mechanism or/and new genes that had to be stabilized within a population. Such a reaction might allow reacting properly, but it costs time to go on in such a way, as such a reaction works only over a long lasting series of generations. Cultural development, however, is much faster.

Consequently, evolution of behavioural schemes can be done in a small time scale, as there is no need to form out genes that may direct the *anlage* of a completely new reaction specific neuronal pathway. What evolution offers so far is some stuff to deal with and not some prefixed form to stick to in the developing brain: When been used in early life, within that offer putative contact sites are stabilized. Thus, the individual that forms out his brain is adapting to its sensory input situation. If that situation is stabilized by the group it grows up in, the next generation, even that one will adapt to this. Eventually, thereafter, it will secure the same environment for its offspring, stabilizing the way it used to sort out things in experience and behaviour. If this is done in parallel in a group of individuals, this group will form out a common scheme to which their members are allowed to react to and to react with. Thus far, new behavioural features like dispositions to deal with more and more complex sensory input situations, certain improvements in the fine tuning of motor pattern (skills) or eventually the scheme by which communication signals are formed and understood within such a group can be predetermined. Thus, these were inherited not by forming out new sites of gene expressions, but by exposition of certain sensory experiences in early lifetime.

Such standards, however, have to be formed out and maintained within the changing pattern of natural objects seen, smelt, heard or dealt with in or by such a group. Thus, it is not simply sitting at a certain place, which allows man to go on in such an evolution. What is needed for the developing brain is a kind of scheme within a complex situation of putative sensory input sites: Something that is stabilising a brain which in parallel is exposed to a most complex sensory world. By providing such a scheme, something like a first matrix is provided in the organisation of input sites. If such a grid is established in those parts of the brain that deals with incoming information, that one is able to sort out finer patterns within such a grid and thus, gradually, evolves a more and more refined response characteristic. In such a way, at least, information processing of different individuals within one such group can be parallelized and, thus, coordinated in such a group. The way to do that is living together, share experiences and in a second stance: language.

Language is an externalized memory of order characteristics into which group experiences should be implemented in. What language does, is to sort out and conserve common references (Breidbach 2011: 121-155). Thus far, a certain reference to some term can be shared via narratives. Accordingly, group experiences can be parallelized even in the absence of the reference sites represented by certain elements of such a language. Thus far cultural evolution indirectly produces something like an continuous overlay over brain activities and developments in a certain group. I am a bit simplistic here, but eventually that gives you an idea of the general scheme behind.

The nervous tissue will give that material the later worked at, however it is not as simple, that cultural evolution is nothing but the outcome of an adaptation of brain tissue and brain physiology, whose behaviour in its more complicated form has to be described as evolved frame of brain activation patterns. The simplistic idea of neuro-aesthetics as it has been put forward by Semor Zeki or –in a more carton-like form in modern sociobiology by E. Volandt and K. Grammer for example might allow to propose something like this (Zeki, Lamb 1994; Zeki 2002; Voland, Grammer 2003). However – these shortcomings fail to describe more than certain identification of subpatterns of sensory representations in the brain. It is the same story once told me by the late Otto Creutzfeld, who had to test the functionality of certain human brain areas during operations. To do this, he had to be quick, and as he looked for frequency representations, he did not bother the people by presenting a long series of sounds of different frequencies but played of two short pieces of music, both showing much different frequency spectra. The one was played by a classical chamber orchestra the other one by a jazz combo. As suspected, he was able to identify certain sets of neurons who were sensitive to different frequencies of sound spectra. Only a shortcut would produce the newspaper headline thereafter: Creutzfeld detected classical music centre in brain set apart from the localization of jazz music propagation.

Accordingly, to make the point of internal representation clear, it is not that we have just to look into the brain to understand how representations are done. The situation is much more complicated. We have to study the rules of internal activation modes, describe what it meant to from a differential calculus for identification of signals. Representations were not stored away but handled on within an associative brain. Experiences show us where we can point to something different, not known till now. Experience even allows us to put such new things close to something already known and set apart to other things and situations. The way to do is due to the internal mode of propagation. What is to be seen is according to that mode.

There is no “red” which could be transported via the signal cascade from our sensory cells towards the brain.[5] The quality “red” occurs in the brain area activated by the incoming signal. There, the impression of red becomes a quality, as every input is put together to a coherent word image within that brain. Hereby memory is combined to sensor. So we might understand how far y input. It is the Aristotelian *phantasia* that makes the world view a coherent one, into which new inputs could be integrated, thereafter. However, these are no distinct centres but it is the underlying dynamics of network organisation that made such coherence of representation feasible. There are weighting functions by which any step in parallel-processing of information is stabilized and made discernable in the general arousal of network activation.

It is a complex dynamic we had to enface; yet in this dynamic distance function became stabilized, there are positions and horizons that become discernable. There is a complex of putative imaginations into which actual images might fit. Thus, internal representations work out a scheme by which perceptions can be identified, new experiences formed and a world being looked out for.

That is not only the general perspective but the very detail of every day experiences that is formed out in such a scheme: We might select a red cup in a dark cellar and recognize it as the identical cup some minutes later in bright sunlight. The actual physics of the primary input signal have changed completely. This is indicated by side information. That one is overlaid to the primary input resulting in the proper identification of that cap in different lights. Representations, already in such simple state, are no fixed items put into mind. Representations were looked upon according to certain internal settings, according to our intentions and according to our perspectives. Perceptions were looked upon according to certain schemes. Thus, the represented the way we look on them, were qualified according to the perspectives chosen. Thus, they found their place within a pre-configured set of expectations. Representations were seen from within. Accordingly, we can life in a world of changing sensory information identifying identities, correlating past and presence. Thus, we might recognise the former young friend in the old chap, we look upon. That is thinking from within and that may form out at least the scheme of such a new type of neuronal aesthetics – and that has a

[5] Already Schopenhauer was arguing about that.

meaning both for our understanding of imagination and images we deal with.

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