SEEING THE HUMAN BRAIN AS A SOCIAL ORGAN

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The great news that sunny day in California was that I received a one-year fellowship from the Wissenschaftskolleg zu Berlin. What an outstanding opportunity to be immersed in a unique, focus-inducing atmosphere in Grunewald, surrounded by highly professional and friendly staff and by wonderfully creative colleagues coming from the most heterogeneous fields. The bad news, however, was that, due to various commit-

ments I still had hanging back at the University of California, San Diego, I could only come to Berlin for 5 months. (Unless you are dying to pursue an academic career as a Dean or Vice-Chancellor, not my cup of tea, I strongly recommend avoiding such commitments!) So, eventually, in early March, eager to be back in Europe (where I had spent many years of my life), I had the pleasure of joining the Wiko and the focus group convened by Holk Cruse with the rather humble title "Understanding the Brain".

During my wonderful stay at the Wiko I worked on many projects, from academic articles to grant proposals and from the organization of scientific meetings to the planning of a fieldwork in a remote mountainous region in Papua New Guinea right after the end of my stay in Berlin. But, beyond the hectic minutia of academic production, Wiko provided for me the right conditions to work on a deeper level, sketching a line of research I had been trying to figure out for several years. One, when properly fleshed out, would help me address many of the major problems I see interfering with a genuine understanding of the inherent cultural nature of the human brain and the extraordinary phenomena it sustains. That is, an understanding of the human brain as, essentially, a social organ, not – as it is usually conceived in contemporary mainstream science – as the self-contained organ inside our skulls that dictates how to manipulate representations of pre-given beliefs, concepts, and objects of the outside world. The line of inquiry I have been entertaining while at Wiko implies an investigation of how the phenotypical brain is brought into being *outside of natural selection* supporting and making possible what we shape up culturally, which is nothing other than most of what we do: everyday sense-making, language, politics, poetry, music, fashion, religion, business, sports, humor, science, and mathematics, to mention just a few things. My impression is that during my stay at Wiko I made *some* progress.

When studying the human mind, the issues are, of course, gigantic and complex. So in my practice as a cognitive scientist I have attempted to address them in a more tractable form by focusing on some specific aspects of mental phenomenon: human abstraction. An important challenge for understanding human abstraction in naturalistic terms is how to avoid the major well-established dogmas and assumptions existing in contemporary science: that human thinking is best studied via formal logic; that the main feature of human language is grammar; that the mind can be understood mainly in terms of bottom-up mechanisms, from molecules to cells to brain areas to behaviors; that the body is merely a physical "hardware" for the mind, and so on. Such assumptions seem to me to be overly simplistic, reductionistic, and unnecessarily nativist, getting in the way of understanding

the universe of phenomena that makes as humans. An important line of results we have obtained has come from the study of the nature of mathematics and of the use of metaphor and other construals, both in everyday language and in technical conceptualizations. So far the moral has been: human abstraction is intrinsically historical and cultural (i. e., abstract ideas are not genetically determined), and the human brain seems to be a social organ that sustains such productivity through the phenotypical variation of communities of biological beings. Some of the pieces I worked on along these lines while at Wiko can be briefly described as follows:

What is the nature of numbers and arithmetic?

In a piece I completed while at Wiko I argued that number concepts and arithmetic are neither hardwired in the brain, nor do they exist out there in the universe. Innate subitizing and early cognitive preconditions for number – which we share with many other species – cannot provide the foundations for the precision, richness, and range of number concepts and simple arithmetic, let alone that of more complex mathematical concepts. Numbers and arithmetic, and mathematics in general, have unique features – precision, objectivity, rigor, generalizability, stability, symbolizability, and applicability to the real world – that must be accounted for. In this piece I suggest that numbers and arithmetic are sophisticated human concepts developed only recently in human history, realized through precise combinations of non-mathematical, everyday cognitive mechanisms that make human imagination and abstraction possible. One such mechanism, conceptual metaphor, is a neurally instantiated inference-preserving, cross-domain mapping that allows the conceptualization of abstract entities in terms of grounded bodily experience. In this text I analyzed how the inferential organization of the properties and "laws" of arithmetic emerge metaphorically from everyday meaningful actions. Numbers and arithmetic are thus the product of the highly biologically constrained interaction of individuals with the appropriate cultural-historically phenotypic variation supported by language, writing systems, education, and the environment in which they are immersed.

What can we learn from spatial construals in Amerindian cultures of the Andes?

In order to indicate the relative position of ordinary objects, speakers of Aymara – an Amerindian language from the Andes highlands – widely use absolute frames of reference, especially involving the east. Whereas absolute frames of reference are usually encoded in lexemes that refer directly to extrinsic entities (e. g., hills, valleys, or cardinal points), in Aymara they are encoded in lexemes that refer to the body: *nayra* ("eye", "sight", "front") and *qhipa* ("back", "behind"). For instance, an object *A* located to the east

of an object *B* can thus be referred to as *nayra* (in "front") relative to *B*, and *B*, as being *qhipa* relative to *A*. This peculiar use of front-back relationships deeply permeates various levels of Aymara everyday cultural practices, from language to gesture to urban planning. Along with colleagues in Chile, we documented this phenomenon with various data sources: (1) spatial linguistic expressions and speakers' speech-gesture co-production, (2) linguistic patterns involving space in the local créole *Castellano Andino*, (3) metaphorical extensions of these créole spatial patterns to temporal ones, and (4) the eastward orientation of traditional houses. Through the analysis of macro-cultural factors involving the primacy of the sunrise, we showed that these psycho-linguistic and socio-urban manifestations are intertwined embodied instantiations of high-order social symbolic elements.

Is the number line hard-wired in the brain?

Many authors in the field of numerical cognition have adopted a rather nativist view that all humans share the intuition that numbers map onto space and, more specifically, that a mental number line is localized bilaterally in the intraparietal sulcus of the human brain. In a piece I wrote while at Wiko I reviewed results from archaeological and historical (diachronic) studies – especially from early mathematics in Babylonia, as well as cross-cultural (synchronic) studies – and contended that these claims are not well founded. I pointed out that the existing data actually suggest that the mental number line is not innate. I argued that the emergence of even the simplest mathematical entities, such as the number line, require culturally and historically mediated high-order cognitive mechanisms such as fictive motion, conceptual metaphor, and external representational media. These mechanisms, which are not intrinsically numerical and usually are acquired through education, are not genetically determined; they are biologically realized through the systematic phenotypic variation of the human brain.

Wiko, thank you so much!