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Perspectives

Environment, Culture, and the Brain

New Explorations in Neurohistory

Edited by
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RCC Perspectives

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The experiment on healing environments described in this volume was conducted by an international team of scientists made up of **Evgeny Gutyrchik, Lukasz Smigielski, Janusch Blautzik, Maximilian Reiser, Yan Bao, Ernst Pöppel,** and **Edmund Russell**. They are affiliated with the following institutions: the Human Science Center and the Institute of Clinical Radiology at LMU Munich, the Parmenides Center for Art and Science in Pullach, Germany, the Department of Science, Technology and Society at the University of Virginia, and the Department of Psychology and Key Laboratory of Machine Perception at Peking University.

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Introduction: How Can Neuroscience Help Us Understand the Past?

Neurohistory is a nascent field that synthesizes the insights of neuroscience with those of history to deepen our understanding of the past. Daniel Smail coined the term "neurohistory" in his 2008 book *Deep History and the Brain*. History, he argues, inevitably has a psychological component and thus involves assumptions about how the brain works. Nor is culture independent of biology: "Culture is made possible by the plasticity of human neurophysiology. With this insight, we can finally dispense with the idea, once favored by historians, that biology gave way to culture with the advent of civilization. This has it all backwards" (Smail 2008, 154). Neurohistory thus complements environmental history in that it emphasizes the reciprocal character of our relationship with nature. Not only do we alter the environment, our physical surroundings can also affect our behavior.

Neurohistory is so young that it is impossible to predict its future with any confidence, but a workshop hosted by the Rachel Carson Center on 6–7 June 2011 offered a starting point for creating a community of scholars who are interested in thinking seriously about its potential. This issue of *RCC Perspectives* is intended to take the discussion to a wider audience and catalyze broad consideration of the promises and pitfalls of this new approach. It publishes revised versions of most of the papers from the workshop. They range from theoretical considerations of the relationship between the neurosciences and history to concrete applications of neuroscience to specific historical topics. The authors come from a wide variety of backgrounds, including history, philosophy, literature, medicine, and psychology.

The texts in the volume range from broad theoretical considerations of the possibilities of neurohistory to investigations of specific historical, cultural, and biological phenomena. Several authors reflect upon wide-reaching philosophical ideas such as our understanding of learning processes and consumption (Kirsten Brukamp) and the pathology of historic individuals and crowd behavior (C. U. M. Smith). Alejandro Gomez considers neurohistory in the context of the history of representations. Peter Becker, on the other hand, takes a critical view of the evolutionary narrative suggested by neurohistory.

More concrete applications include questions of whether our perception of time and causality are the result of the way our brains are wired (Benedikt Berninger), how the physiological basis for emotions such as shame and pleasure interacts with the development of culture and society (Jörg Wettlaufer and David Matuskey), and whether the placebo effect can be used to explain historical decision-making processes (Karin Meissner and Carlos Collado Seidel). Daniel Lord Smail's contribution integrates a number of these themes, looking at cultural practices which exploit psychotropic mechanisms to gain power. Finally, Frank Zelko suggests that patterns of holistic or religious and rationalistic thought may have parallels in the two hemispheres of the brain.

This issue also includes two texts which look ahead and offer sketches for future research in the classroom and the laboratory. Steve Fuller considers the possibilities of the brain as an organizing idea for education in the twenty-first century and presents a course syllabus outlining such a course of study. The other text is an abstract describing an experiment conducted in conjunction with the workshop by Evgeny Gutyrchik and his collaborators. Workshop participants had the opportunity to watch researchers scan the brains of subjects as they imagined healing and non-healing environments. The experiment focused on contemporary environments, which are the products of human and natural history.

The essays collected here represent only a small selection of the possibilities offered by neurohistory as a field. Yet it is possible to identify several overall questions which inform the discussion. The rest of this introduction will therefore be dedicated to a consideration of the diverse opportunities and pitfalls that neurohistory may face in the future. It will conclude with some thoughts on the relevance of neurohistory for environmental studies in particular.

What ideas and methods have neuroscientists developed that historians can use to shed a new light on the past (and vice versa)?

Neuroscience offers a way of thinking about human beings and a set of experimental methods potentially useful to historians.

Neuroscientists are keenly interested in the physiology of brains, as well as in links between brains and behavior. They recognize that human inheritance occurs through

genetic and epigenetic (non-DNA) mechanisms. Culture is one form of epigenetic inheritance. *This perspective does not mean that evolution determines human history.* On the contrary, neuroscientists recognize that human inheritance has made an astonishing array of behaviors possible, and they are curious about the mechanisms that make such variation possible. The main contribution of neuroscience is not to undermine the importance of culture in human history, but rather to open the black box of the brain to better understand how ideas develop, are processed, and affect behavior.

Neuroscience offers one avenue through which history could become an experimental discipline. The people and brains of today can serve as models for those of the past. Neuroscientific methods available to historians include both physiological and behavioral techniques. One of the most popular methods today is functional magnetic resonance imaging (fMRI), which the experiment conducted with the workshop used.

One of the important discoveries of neuroscience is that human brains are plastic throughout one's lifetime. Patterns of behavior, which derive from culture, can create measurable differences in the volume of brain regions within the space of just a few weeks. This is important because it contradicts the idea that biologists believe in some sort of genetic determinism of human behavior.

What new research questions can neuroscience suggest for historians (and vice versa)?

The neuroscientific focus on links between physiology and behavior can prompt new questions for historians, such as why certain individuals have emerged as leaders, how leaders have capitalized on the physiology of brains to promote obedience (e.g., through the placebo effect or by elevating levels of stress hormones), how cognition (emotion and reason) shapes decisions and social patterns, the extent to which human beings share universal traits, the extent to which they vary, the links between brains and health, the contribution of brain structures and neurotransmitters to behaviors, and the role of sleep in history.

The neuroscientific study of religion offers an example of the kind of findings that historians might find useful and provocative. Historians studying religion have often focused on theology, which tends to guide attention to philosophical differences among

organized relations. Neuroscientific research has shown that meditation and prayer have similar effects on brains, suggesting that religious practices might bring similar physiological benefits to practitioners despite differences in dogma. This perspective could encourage historians to locate the appeal of religion not just in its cultural or social context, but also in its physical context.

What are the biggest challenges in developing neurohistory as a field, and how can they be overcome?

One of the biggest questions facing neurohistorians is how to understand scientific research. Mastering neuroscience is challenging enough for experts, so historians interested in the field need to be willing to invest significant time in understanding the science well enough to use it wisely. Neuroscientists disagree on the extent to which one can generalize from a particular data set and on how to interpret specific results (e.g., activation patterns in brains recorded through scanning technology). It is easy to overreach, and the popular media carry stories about neuroscientific findings that some neuroscientists consider exaggerated or too preliminary to be reliable.

Neuroscience is changing rapidly, so ideas current today will probably become obsolete in a few years. Historians need to feel comfortable with the provisional nature of scientific knowledge, rather than looking to science for eternal truths.

One of the best ways to overcome these challenges is for historians to collaborate with neuroscientists. A team approach enables scholars to complement strengths. Some historians might want to join laboratories and learn about neuroscience firsthand. Others will be more interested in discussing science without practicing its methods. The field will probably be best served by a variety of approaches.

Researchers in any area need to be aware of the ethical implications of their work. Biology and history alike have been mustered in the past on behalf of discriminatory beliefs and malign social policies. Both have been used to argue that certain groups of humans are so fundamentally different than others that they deserve different treatment, a position that all humane scholars must reject.

How might neurohistory shed light on the interaction between people and their environments, in both the past and the present?

A starting point for neuro-environmental history is environmental psychology, which has tried to understand how and why human beings react to specific types of environments. Typically, this field has relied on behavioral studies, rather than specifically neural measurements, but the findings suggest that human beings from a variety of backgrounds favor savannah-like landscapes over forests or built environments lacking plants or non-human animals. A common hypothesis holds that people developed this preference while evolving in the African savannah. Some researchers believe this preference is hardwired in people (more studies are needed to draw a firm conclusion). Environment appears to have a concrete impact on health in ways unsuspected by some medical practitioners. A classic study found that hospital patients recovered from surgery faster, with fewer complications and less need for medication, if their hospital window looked onto trees than if it looked onto a brick wall. It may be that environments that historians have considered to be primarily cultural products, such as English garden parks, reflect something with a stronger biological basis than previously assumed. Neuroscientists are trying to understand the neural bases for environmental preferences. Brain scans have shown differences in activation patterns when subjects viewed urban versus rural scenes, for example.

The impact of environmental modification on brains offers another fruitful avenue of research. Most historians know that lead causes brain damage, but recent research has identified other elements and compounds that are neurotoxins. New research suggests that air pollution and psychological stress also can have a deleterious impact on the brain.

In conclusion, neuroscience offers historians ideas, methods, and questions that might help us understand the past in new and deeper ways than the traditional methods of history alone provide. Environmental historians in particular might find it attractive to help understand broad patterns of history, including how and why people have modified environments in certain ways, and how such modifications have shaped human experience.

Thought Patterns and Structures

Frank Zelko

A Mind Divided Against Itself: Thinking Holistically with a Split Brain

I am an environmental historian by training, and a good slice of my research involves examining the intellectual and cultural history of environmentalism. As part of this story, I have tried to situate environmentalism in the broader context of Max Weber's notion of the disenchantment of modernity. Holistic thought of various types, I argue, has been one of the chief agents of re-enchantment in the twentieth century, and ecological thought and environmental activism have drawn deeply from the well of holism. This is not to say that Weber was necessarily correct and that modernity was inherently disenchanted; nor am I advocating holistic thought as a superior way of attending to the world. Rather, I am describing a sensibility that had considerable impact on twentieth-century Western thought, regardless of its "truth."[1]

Ecology, at least in its more self-consciously holistic manifestations, has functioned as a discourse of scientific re-enchantment. The disenchantment narrative claims that an increasingly reductionist and instrumentalist brand of science has given us a false picture of nature, stripping it of wonder and meaning and justifying our never-ending exploitation and despoliation. It is not difficult to see the cultural mechanism at work here: people like to feel they are living in a world that has some kind of inherent unity and meaning rather than one that is chaotic, fragmented, and essentially meaningless. A holistic science, buttressed by a holistic view of nature, is therefore understandably attractive to people who worry that the modern world is becoming increasingly disenchanted.

Historians who tackle somewhat amorphous topics such as disenchantment and holistic thought tend to employ theories from the social and behavioral sciences: various versions of Marxism or theories derived from Freudian psychology, for example. Rarely, if ever, are they likely to call upon neuroscience or other branches of biology. However, there is strong evidence to suggest that the tension between holistic and reductive thought is not merely an intellectual and psychological characteristic of modernity; it is also closely tied to neurobiology, specifically to the way the two hemispheres of our brains interact with each other and attend to the world.

1 For useful introductions to the topic, see Landy and Saler 2009; Lawrence and Weisz 1998; Ash 1995; Harrington 1996; and Wood 2010.

It is early days yet, but it seems likely that the recent revolution in our understanding of the brain will one day provide historians with deeper insight into the history of human consciousness; that it will elucidate modes of thought and attention to the world that are meaningfully *historical* rather than merely offering frequently tendentious theories about how our hunter-gatherer past shaped our present neurophysiology and behavior. In his dauntingly erudite book, *The Master and His Emissary: The Divided Brain and the Making of the Western World* (2009), Iain McGilchrist, a British psychiatrist and polymath, offers historians some thought-provoking ideas about how to incorporate the findings of neuroscience into their work.

According to McGilchrist, there are two ways of being in the world, both of which are essential aspects of our species' cognitive makeup. He offers the following cogent summary of this complex and conceptually difficult idea:

> [One way of being is] to allow things to be *present* to us in all their embodied particularity, with all their changeability and impermanence, and their interconnectedness, as part of a whole which is forever in flux. In this world we, too, feel connected to what we experience, part of that whole, not confined in subjective isolation from a world that is viewed as objective. The other [is] to step outside the flow of experience and "experience" our experience in a special way: to *re-present* the world in a form that is less truthful, but apparently clearer, and therefore cast in a form which is more useful for manipulation of the world and one another. This world is explicit, abstracted, compartmentalized, fragmented, static . . . essentially lifeless. From this world we feel detached, but in relation to it we are powerful.
>
> I believe that the essential difference between the right hemisphere and the left hemisphere is that the right hemisphere pays attention to the Other, whatever it is that exists apart from ourselves, with which it sees itself in profound relation. It is deeply attracted to, and given life by, the relationship, the betweenness, that exists with this. By contrast, the left hemisphere pays attention to the virtual world that it has created, which is self-consistent, but self-contained, ultimately disconnected from the Other, making it powerful, but ultimately only able to operate on, and know, itself. (93)

If McGilchrist is correct, the bicameral nature of the brain is not merely an anatomical curiosity; it plays a major role in how our species acts in and on the world.

Theories about the way the different hemispheres of our bicameral brain interact with the world have existed since the mid-nineteenth century, when scientists determined that there was a clear asymmetry of function between the two halves. This led to numerous efforts to locate various functions in one hemisphere or the other. Subsequent research, however, indicated that the hemispheres operate in tandem and that virtually all activity is served to some degree by *both* hemispheres working together. Thus interest in the subject waned, and it is only recently that a few scientists and scholars have begun to revisit it. McGilchrist has trawled through an astonishing amount of neuroscience literature in order to further explore this idea. Much of his evidence could be described as "incidental," in that the studies were not specifically exploring the divided brain issue. Nevertheless, hundreds of studies of split-brain patients and patients with schizophrenia and other conditions provide McGilchrist with enough evidence to suggest that the bicameral nature of our brain is important and that it has shaped history, not just on a millennial scale, but over the short term as well, in the course of recent centuries or decades.

Unlike earlier explorations of the divided brain, McGilchrist is not so much interested in what each hemisphere does—which skills it possesses—as he is with how it uses these skills and to what end. The right hemisphere is integrative and holistic, using a gestalt perception rather than merely processing visual data as a sum of the parts. The left hemisphere (which controls the right arm) is more skillful at manipulation and has an affinity for the mechanical and the geometric; its principle "concern" is utility. It sees everything, including the body it occupies, as an assemblage of parts. Patients who have suffered from right hemisphere strokes will often "disown" various body parts, claiming, for example, that they do not recognize their own arm, a process that can be reversed by inhibiting the left hemisphere through vestibular stimulation. The right hemisphere, to use McGilchrist's formulation, is the "master" and the left is its "emissary."

McGilchrist argues that instrumentalism and reductionism are not merely cultural manifestations of a particular scientific worldview. They are also products of our divided brain, the result of a kind of long-term wrestling match between the narrowly focused and instrumentalist left hemisphere and the more empathic and creative right

hemisphere. There is thus a kind of positive feedback between the cultural conditions of modernity, with its need for ever greater precision, calculation, bureaucratization, and reductionism, and the left hemisphere of the brain, which excels at such tasks. In modern Western culture—and quite likely at various other points throughout history—the emissary has usurped the master. Does this involve any actual change in the structure or biochemistry of the brain? Possibly. McGilchrist believes that epigenetic mechanisms—those that do not depend on alterations in the actual sequence of nucleotides in the DNA within the gene, but on factors that influence what is expressed by the same DNA—can account for the transmission of brain capacities and cognitive abilities acquired during a single human lifetime.

Modern Western culture, McGilchrist argues, has become a predominantly left hemisphere culture, one concerned primarily with manipulation, acquisition, and rationalization. In fact, he sees it as quite literally schizophrenic, in that it exhibits the qualities one would expect to see in people with damaged or dysfunctional right hemispheres, characteristics also typical of schizophrenia patients. From this perspective, the re-enchanting holism characteristic of ecological worldviews is not merely an oppositional subculture attempting to counter the sweeping tide of modernity; it is also the right hemisphere's way of fighting back against the dominant left hemisphere. Or to be more concrete, it is an effort on the part of certain people to return to a more holistic, empathic, and intuitive way of attending to the world.[2]

McGilchrist is not a historian, but his work has a clear historical argument, albeit one that grows increasingly shrill as his analysis takes him from the ancient Greeks through to the Renaissance, the Enlightenment, and postmodernism, all the while charting the struggle between the two hemispheres and the rise to dominance of left hemisphere thinking. Many historians will find that his relentlessly declensionist narrative lacks nuance and occasionally even degenerates into an anti-modernist rant. Nevertheless, the crux of his argument—that our brains experience subtle biochemical and structural changes over time and that these shape, and are shaped by, culture—strikes me as offering a potentially useful approach for historians interested in integrating neuroscience into their

2 McGilchrist is here heavily indebted to the phenomenology of Husserl, Merleau-Ponty, and Heidegger. He does not mention the work of David Abram, but it seems to me that that is the type of right brain worldview he is describing, at least in regard to our perceptions of non-human nature (See Abram 1997 and 2010).

work. The idea that the relative importance of the brain's hemispheres can change over time is one that lends itself to comparative history, particularly as neuroscience becomes increasingly global, providing us with data from multiple cultures.

Neuroscientists can already demonstrate that our brains undergo significant biochemical changes in response to various sociocultural pressures and that those pressures bring about predictable behavioral responses. As imaging technologies become more sophisticated and widespread, neuroscience will generate theories about the kinds of biochemical and behavioral responses that generally occur during times of great economic stress or among populations living under authoritarian political regimes (for this reason, I imagine that many neuroscientists would probably give their left hemisphere in order to be able to conduct a comparative neurological study of North and South Koreans). Such theories and insights will enable us to add some neurobiological depth to our studies of the past. After all, our historical explanations already employ numerous modern sociological and psychological theories largely derived from studies of twentieth-century populations. If neuroscience were able to demonstrate, for example, that the stress of Israeli occupation is triggering certain neurological responses among the Palestinian population, then we could assume that similar neurological processes generally occur under conditions of colonization. This may help us better explain historical behavior that otherwise appears puzzling or aberrant.

In addition to giving us much to think about in terms of understanding some key developments in the history of Western thought, including the predilection for reductive thinking at the expense of holism, McGilchrist's brilliant interdisciplinary synthesis also offers a model for how humanities scholars can begin to integrate the findings of neuroscience into their work. This is not to suggest that historians should immediately and uncritically embrace neuroscience. After all, the revolution, for all its intriguing discoveries, is probably still in its infancy. Nevertheless, its insights into the nature of human cognition are too important for historians to ignore.

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Benedikt Berninger

Causality and the Brain

History, while shaped by a variety of non-human factors, is ultimately made by humans, whose actions, in terms of motivations and their capability of understanding different situations, are intricably bound to the design (through biological evolution) of their brains. Since antiquity, historians have faced the problem of explaining historic events, such as the Peloponnesian War or the Second World War, by identifying the *causes* that have led to them. Just as in the natural sciences, the concept of causality is of fundamental importance to the science of history.

Yet it may be argued that the very concept of causality, rather than being a brain-independent reality, may itself derive from the way the human brain encodes and structures experience, that is, by changing the strength of the functional connectivity between neurons according to inbuilt algorithms that themselves depend on the precise temporal order of neural activity (Berninger and Bi 2002). Immanuel Kant ([1765] 1965), in an attempt to solve a problem originally formulated most articulately by David Hume ([1739] 1888), concluded that the notion of causality, rather than being derived from experience, is an *a priori* condition of experience. He agrees with Hume that the idea that a certain cause is followed by a certain effect with necessity cannot be derived from experience: repeating the same experiment a hundred times does not prove that the next time the result would be the same; rather, the notion of necessity is a categorical condition for the notion of causality.

Needless to say, scientists are a long way from having a neurobiological explanation of how our brain "computes" a kind of more categorical causality. We have proposed that, at an elementary level, it may be related to the phenomenon of spike timing dependent plasticity (STDP) of synapses (Berninger and Bi 2002). STDP is a phenomenon occurring at many central synapses, for instance the so-called Schaffer collaterals in the hippocampus, which play a crucial role in the formation of episodic memories (Bi and Poo 2001). A synapse between a neuron *A* and a neuron *B* becomes strengthened when the firing of *A* precedes the firing of *B* within a narrow time window of few milliseconds. If the temporal order is reversed, i.e., neuron *B* fires before it receives input from neuron *A*, then the synapse becomes weakened. Anthropomorphically expressed, the synapse

A to *B* becomes strengthened when it contributed to the firing of *B* and weakened when it did not contribute. Thus, the synaptic modification rule appears to serve on a very elementary level as a causation detection mechanism.

Why would considering the neurobiological basis of the cognitive category of causality be relevant to the idea of neurohistory? Despite the fact that it obviously arose in adaptation to a real world, we cannot assume that a biologically implemented mechanism is limitlessly applicable to all phenomena. In fact, there are examples of situations where an appropriate description of the phenomena contradicts our commonsense understanding of causality. The unpredictability of the exact moment of decay for a single radioactive atom may be taken as an example *par excellence* of the failure of a strict causality in which every subsequent moment is entirely determined by the previous one. Likewise, our mind struggles with the view of physicists like Prigogone in the field of nonintegrable dynamical systems who suggests: "Insofar as we are unable, not only in practice, but as a matter of principle, to describe the system by a trajectory, and are forced to use a distribution function corresponding to a finite (even arbitrarily small) region, we can only predict the statistical fate of the system" (quoted in Balescu 2007, 27).

One might ask whether such reasoning can also be applied to the science of historical processes: to consider historical processes as transitions between *attractor* states, seemingly stable, but constantly destabilized by mutually interacting and interdependent factors. In a similar analogy, historical processes may be compared to the transition between brain states: they are stable within short temporal windows, but are necessarily transient and eventually result in persistent (but not necessarily permanent) modifications of the circuitry, thereby modifying the attractor landscape itself, sometimes irreversibly. If, then, we consider history to share certain structural features with nonintegrable dynamical systems, thus allowing the possibility for the emergence of complex or chaotic behaviors, it would strongly suggest that we attribute an erroneous degree of predictability to history when we try to isolate individual causal relationships between single historical *momenta* of political and ideological nature.

These considerations serve to illustrate that our thinking is often restricted by commonsense understanding, which is itself, not unsurprisingly, the result of the faculties and limitations created by the design of our brain. One important task of neurohistory may be to incorporate an awareness of these faculties and limitations into the way we think about humankind and history.

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Karin Meissner and Carlos Collado Seidel

The Power of Beliefs: The Concept of Placebo and Placebo Effects in Politics and History

Placebos and placebo effects have been studied intensively within the last decade in the field of medicine. The start of placebo research dates back at least to World War II, when Henry Beecher, an anesthesiologist, noted that severely wounded soldiers in the combat zone asked for analgesics much less frequently than patients with similar injuries in civilian hospitals (25% vs. 80%). Beecher explained this difference by a psychological factor, namely the anticipated consequences: to the soldiers, being wounded meant to have survived, to be removed from combat zone, to be treated well; whereas civilians were more worried about their social and financial situation. This observation prompted Beecher to study the psychological mechanisms of placebo analgesia more thoroughly. In 1955 he published his seminal paper "The Powerful Placebo," which can be considered the starting point of systematic placebo research.

"Placebo" has been defined as "any therapy or component of therapy that is deliberately used for its nonspecific, psychological, or psychophysiological effect, or that is used for its presumed specific effect, but is without specific activity for the condition being treated." The "placebo effect" is the "psychological or psychophysiological effect produced by placebos" (Shapiro and Morris 1978, 371).

Placebo analgesia is the best explored type of placebo effect. The biological mechanism of placebo analgesia was first discovered in 1978 by showing that placebo analgesia could be antagonized by naloxone, an opioid antagonist, which indicated an activation of the endogeneous opioid system by placebo-induced expectations (Levine et al. 1978). Several neuroimaging studies in the past ten years have confirmed this finding (Meissner et al. 2011). The placebo effect, however, is not restricted to the field of pain. Further studies have shown that motor improvements in patients with Parkinson's disease who received a placebo are mediated by the release of another neurotransmitter in the brain, namely dopamine, and placebo effects in depression work via activation of prefrontal cortices, which play a role in anticipation and expectation (Benedetti et al. 2005). Finally, placebo interventions have been shown to affect stomach movements, blood pressure, lung function, and even the coronary arteries

(Meissner 2011). Such effects can display a high degree of specificity, suggesting the involvement of specific subsystems in the brain that mediate target-specific placebo effects. Thus, placebo research has demonstrated that the expectation of receiving a potent treatment can have real physiological consequences, even if the patient receives inert treatments. Notably, in the same way as positive expectations can benefit the patient, negative expectations can have harmful effects—a phenomenon referred to as the "nocebo effect" (Colloca and Finniss 2012).

Can the concept of placebo and placebo effects be transferred to social behavior or to the process of political decision making, and could such effects have thus influenced the course of history? In the following, we will present a few examples where some of the psychological mechanisms of placebo and placebo effects apparently played a role in politics and history.

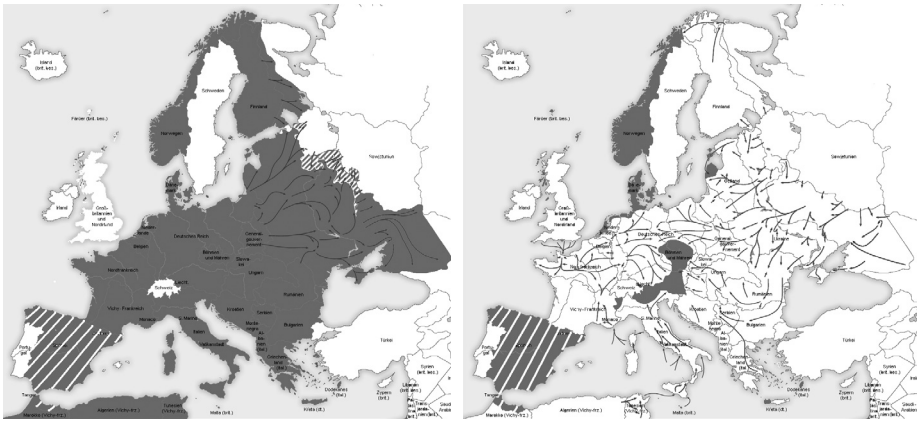
Figure 1: Visual mimicry as seen in the rear view of the beetle pachnoda sinuata. (Francois Jordaan)

Our first example concerns the use of placebos as dummies to achieve a certain psychological effect. The general usefulness of deceptive behavior is already illustrated by nature. For example, some animals make use of visual mimicry, such as the face-like markings on some insects, to appear much more powerful than they are (fig. 1).

Dummies are frequently applied in military conflicts as well. For example, the use of fake tanks as decoys to deceive the enemy is a long-standing practice in warfare that continues up to the present. Decoy tanks were first introduced during World War I and became a common appearance in World War II; the German general Rommel was especially famous for using wooden dummy tanks during the desert war in northern Africa. The US Army employed these unusual weapons, too: the so-called "ghost army," which was part of the Allied operations in Normandy in June 1944, consisted of hundreds of inflatable tanks and a collection of sound recordings which simulated advancing combat units (fig. 2). During the Kosovo War, the Serbian troops misled the reconnaissance of the NATO forces with modern inflatable, heated dummy tanks. The goal of using such dummies is clearly to achieve a certain psychological effect, namely to bluff and to impress the opponent and to prevent a counterattack.

Figure 2:
The "Ghost Army" of the US military forces in June 1944. (Work of US Government)

Our second example refers to the expectation of a specific event as one of the underlying mechanisms of placebo effects. In the case of placebo analgesia, for example, the patient has learned to expect pain relief from the intake of a drug described as a pain killer. Similarly, expectations of pain worsening can lead to an increase of pain. It has been shown that treatment expectations and related effects can be enhanced by previous relevant experience, for example, by the intake of a potent pain killer. An example showing that expectations shaped by experience also play a pivotal role in history is the attitude about the survival of the Franco regime after World War II. The Spanish dictator Franco was considered by the Allies to be an intrinsic part of the Fascist order in Europe. Therefore it was inconceivable to the British and Americans that Franco's Spain would survive as the only fascist regime after the downfall of the two main fascist powers, namely Germany and Italy and their satellites. Because of this conviction, the governments in London and Washington repeatedly refused to intervene actively in Spain, although plans to overthrow Franco were developed on several occasions during the war. However, the Franco regime did not show any signs of disintegration towards the end of the war; on the contrary, it actually seemed to become stronger internally (fig. 3 and 4). Nevertheless—and, from our point of view, this was due to persistent expectations—political observers regularly came to the conclusion that the end of the regime was a matter of days, weeks, or, at most,



Figures 3 and 4: Europe in 1941 and 1945. Franco's Spain (diagonal shading) remains stable while the rest of Europe is liberated from the domination of the Axis powers. (Courtesy of the author)

months. We think that it was mainly this false expectation that led to inaction in spite of the insistent pleas for intervention brought forward by the Spanish opposition. In terms of placebo mechanisms, the downfall of the other fascist powers made the Allies expect that the Franco regime would also soon come to an end, and this expectation obviously affected the course of history: Franco ruled until 1975.

Our last proposed link between placebo and history involves the strong appeal of therapeutic promises. Suffering patients react strongly to healing promises of any kind, even if they come from a quack. This is reminiscent of the phenomenon of "political religions," a concept used for the analysis of totalitarian regimes. It was first established by Eric Voegelin in 1938 with regard to the Hitler regime and was introduced into the historiographical debates at the beginning of the 1990s by historians and political scientists such as Hans Maier and Emilio Gentile, who applied it to other regimes as well, in particular to Stalin's Soviet Union and Mussolini's Italy (Maier 2004; Gentile 2006). Political religions are characterized by a charismatic leadership with messianic tendencies and a strong hierarchical political organization. Further characteristics are a consistent belief system which aims to impose a specific symbolic understanding on the world, as well as fatalism, i.e., the conviction that the ideology will prevail forcefully and permanently. Also implicit to the concept of political religions is a strong therapeutic promise, as is clearly reflected in contemporary artwork of "messianic leadership" (fig. 5).

In conclusion, the psychological mechanisms underlying placebo effects are not necessarily restricted to the field of medicine, but can be found in history as well. The intentional use of dummies to appear more powerful than one actually is, and thus to induce a specific psychological effect, seems deeply embedded in human behavior and resembles mimicry in animals. False expectations, such as the anticipated imminent end of the Franco regime, can create their own reality and thus influence political decisions and the course of history. The phenomenon of political religions shows that the human tendency to react to healing promises has been repeatedly instrumentalized in the field of politics. These historical aspects have been studied intensively in historiography and especially in cultural and psycho-historical studies. We think that the concept of placebo and placebo effects can be successfully transferred to these historical contexts.

Figures 5: Artwork depicting Hitler as a messianic leader. (German Federal Archives)

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Alejandro E. Gómez

From Representations to Perceptions: Towards a New "Horizon of Expectation" in Historical Theory?

In the late twentieth century, the historical discipline passed through a period of epistemological skepticism that was described as a "crisis of history" (Noiriel 1996). In a global context of major geopolitical, economic, and technological change, traditional nationalistic historiographies began to seem inadequate and alternative approaches to history emerged. Some of the most important theoretical developments that emerged from this context result from the influence of the cognitive sciences, to the point that some scholars began to speak of a "cognitive turn" that has affected most of the social sciences. Hence the emergence of new fields of research such as cognitive anthropology and cognitive sociology (Brubaker et al. 2004; Zerubavel 1999). Daniel L. Smail's (2008) concept of neurohistory, which argues that changes in the brain can shape human history, is a particularly good example of how researchers have applied insights from neuropsychology and the cognitive sciences to the study of the human past. These fields are particularly relevant for historical topics where psychological factors play an important role, such as the history of representations or the history of emotions.

The history of representations developed during the aforementioned period of crisis in the 1980s. It was presented as an alternative to the paradigm of mentalities—which at the time was much criticized for its excessive inductiveness and semantic fuzziness (Lloyd 1990)—and is concerned with the historical study of beliefs, customs, and values (Ricœur 2004; Chartier 1989). The basic framework is derived from Durkheim's (1898) notion of "collective representations" and inspired by the work of social psychologist Serge Moskovici (1961), which suggests that when a representation attains a social level, the ideas, practices, and systems of values inherent in that representation become a sort of "collective knowledge" that operates like a "cognitive filter" that influences the interpretations of reality (Gosling and Ric 1996; Jodelet 1989).

However, in spite of the influence from social psychology, the historical paradigm of representations has remained essentially unchanged since its outset. This means that—unlike the history of emotions—it has overlooked the very suggestive research carried out in the last decades within different branches of the cognitive sciences. The

aim of this essay is therefore to expose some potential advantages for the "historian's workshop" of revising the epistemological basis of the history of representations in the light of theoretical formulations issuing from recent research.

Firstly, neuropsychology has looked at the influence of "secondary" or "social" emotions on the rationality of individuals (i.e. on their actions and attitudes). Social emotions—that is, emotions that are affected by the attitudes of other people and the psycho-cultural context, such as shame and pride—produce sentiments that António Damásio (1994) defines as "somatic markers." These sentiments combine with the memories and experiences of individuals to give an "orientation" to their interpretation of a reality, which in turn affects the way they react in certain circumstances.

Secondly, research has been conducted in social psychology on the subject of social representations. The work of Jean-Claude Abric (1994) about the existence of long-lasting "central cores" and more flexible "peripheral zones" is especially interesting. He argues that social representations can be affected by personal experience, for example when individuals face a certain reality that does not correspond to what they had expected, or when they consciously assume unusual practices in order to adapt themselves to a new social environment. The modifications resulting from those situations can occur only at the peripheral level of the representation, where "social images" associated with experience seem to be generated (Moliner 1996), while its essence or "central core" remains intact for as long as it is not replaced by another representation. A representation may also disappear completely when its incompatibility with the reality it describes becomes too evident (Flament 1994; Rouquette and Rateau 1998).

And thirdly, research in biopsychology regarding the function of perceptions in the process towards individual decision-making has shown that human decisions are not based merely on rationality, but are also affected by emotional states (including secondary emotions), which have proven to have an important role in "awakening the conscience" at the outset of the perceptive process. In the initial phase of identification, the mental elements required for the process are selected, immediately organized, and, finally, interpreted. They can lead then to the desired action while, at the same time, other possibilities are ruled out or simply inhibited. The nature of some of those emotions may vary according to the cultural and psychological characteristics of each individual, which will guide, to a large extent, the perceptive process. In the words of Alain Berthoz (2003), the

emotions only establish a preparatory context for taking an action, which is comparable to what "posture is to gesture."

These three lines of research agree on giving secondary or social emotions a role in the development of certain attitudes in individuals. Furthermore, they also consider that social or cultural features, acquired mainly through *memory* and *experience*, are important in forging these emotions. These two variables have traditionally been of the utmost importance in historical theory for their usefulness in helping to explain collective behaviors in the past.

Memory is not passive and fixed, but rather something that is continually renewed and recalled. Evocations of the past, as argued in the pioneering work of the sociologist Maurice Halbwachs (1952), would not take place unless there were needs in the present that justify it (cf. Valensi 2009; Laurens and Roussiau 2002). These needs confer those memories (either collective or historical) a significance whose meaning will depend on the social framework in which they appear. This implies that the same event can be recalled at different moments and in different manners according to the community and the reasons its members have to evoke it (Ricœur 2004).

Experience, too, can influence the future behavior of individuals, and there are a number of historical theories that consider this factor. Reinhart Koselleck (1985) has underlined the importance of what he defines as "spaces of experience" to explain the future attitudes of individuals on the basis of their "horizons of expectation": a future made present, in which they express their hopes, concerns, and desires. In other words, past experiences can influence what people expect from the future, and thus also their actions and decisions. On a similar note, Jean Delumeau (1978) has postulated the existence of "climates of insecurity" to describe the collective feeling of uncertainty towards the future experienced in early modern societies. More recently, other historians have also mentioned the importance of experience in the study of emotions, by proposing more general theoretical notions such as "emotional regimes" and "emotional communities" that take into account this variable (Rosenwein 2006; Reddy 2001).

The importance given by historians to emotional climates is also shared by social psychologists, who have studied how the collective behavior of members of a group

is influenced by the underlying emotional culture and other more ephemeral emotive atmospheres (De Rivera 1992; Fischer 2003). Claude Bonnet (2003) suggests that the perceptive process can be divided into three phases: sensorial coding, gathering of information, and interpretation. In this final stage, experiences and memories seem to combine to generate social or secondary emotions that will prompt or inhibit—just as happens with basic or primary emotions—the actions of social actors in certain circumstances. In this sense, whether we describe this *predispositioning* as a conscience awakener, somatic marker, or cognitive filter, in all cases past experience is shown to play an important role in behavior that cannot be ignored by historians. Furthermore, these insights seem to substantiate the theoretical formulations made by Koselleck (particularly his notion of "horizons of expectation") by adding to them a psychological basis, and even to enrich them by granting them a cognitive dimension.

This supra-disciplinary approach could improve the analytical frameworks used by historians working on emotions, mentalities, sensitivities, and social representations by justifying the inclusion of factual situations taking place in the short term. The purpose of this would be to help identify collective patterns and individual exceptions (with or without collective impact), both in everyday life and in the course of major historical events. Accordingly, we should expect to find exceptions to prevailing perceptive patterns in individuals who had different life experiences, and who, therefore, could not have developed the same predispositions towards certain local realities as the rest of the population.

A brief example from my research (Gómez 2010) will help to demonstrate how these theories may be applied to specific historical situations. In the eighteenth and nineteenth centuries, the racial categories of white and black and the accompanying negative racial attitudes were closely connected with the societies of the Americas in which Afro-descendents (resulting from the slave trade) were numerous. However, there are examples of Europeans and Euro-descendants in the Americas who did not develop a white identity because they had not spent significant amounts of time in these multiethnic societies. They did not, therefore, share the negative racial attitudes of local whites towards Afro-descendant colored people, nor did they share the locals' chronic concerns regarding slave rebellions that characterized the "climates of insecurity" that affected those societies. Because their decision-making processes were based on a specific, atypical set of experiences and recollections, they acted in ways that

would have seemed inappropriate and even rash from the perspective of local white inhabitants.

In conclusion, there is clearly a need for updating the current episteme of the history of representations; or even for conceiving a new one based on the more inclusive notion of perceptions that includes emotions, mentalities, sensibilities, and representations. This new theoretical framework should focus on the third and interpretative phase of the perceptive process, where experiences and memory seem to come together to generate social emotions that guide or inhibit the taking of certain decisions. The resulting "predispositions" and "horizons of expectation" would then become the basis for understanding the generation of emotive climates, as well as the attitudes of those we may consider as cognitive outsiders. This methodological approach may also serve to enrich the palette of research in experimental psychology by unveiling new possibilities for the development of new protocols and experimentations through the exploration of the role of social representations and other related notions. A potentially fruitful field of research might be opened by focusing on the interaction between life experiences, the different kinds of memories (collective, historical, episodic, etc.), and specific social features or situations culturally recognizable by individuals.

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Emotions

Daniel Lord Smail

Psychotropy and the Patterns of Power in Human History

A psychotropic mechanism, if we can use a broad and capacious definition, is anything that is capable of altering perceptions, emotions, moods, and behavior. Normally, we associate the word *psychotropic* with drugs or other psychoactive substances such as alcohol, caffeine, nicotine, and other stimulants and opiates. Chemicals that make their way into the bloodstream, however, cannot pass directly to the synapses. Instead, they are "translated" into a chemical language consisting of neurotransmitters. In a sense, neurotransmitters—not drugs—are the actual psychotropic substances. Importantly, neurotransmitters are not foreign to the brain; they are always present in greater or lesser amounts. Psychoactive substances merely sensitize the neurons that are receptive to neurotransmitters such as dopamine and serotonin. In other words, users of drugs and alcohol do not experience a new chemical state; what they experience is a different or more intense version of a familiar bodily state.

The brain-body system is like a chemical sounding board that is highly responsive to inputs of all sorts, among them drugs. The most common stimuli to this system are not drugs, however. They arise instead from everyday phenotypic experiences—that is, things people do to their own bodies. Eating a good meal leads to higher dopamine levels in synapses. Sharing conversation with close friends can produce oxytocin and serotonin. Exercise elevates levels of pain-killing endorphins and enkephalins, a condition which can produce a mild state of euphoria not unlike that produced by opiates. It is true that phenotypic experiences normally do not produce the highs associated with drugs, but they typically do not produce the same lows either. Mood is an oscillating wave. Drugs may increase the amplitude of the wave, but they do not change the fundamental architecture of feeling.

The chemical language of the brain-body system, in short, is the universal idiom of mood and feeling. The existence of this idiom leads to a surprising methodological conclusion: we cannot easily make an ontological distinction between the various stimuli that trigger changes in the brain-body system. Drugs and phenotypic experiences are equally psychotropic, since they are grounded in the same array of body chemicals. The similarity between drugs and phenotypic experiences does not end there. Elements

belonging to each category (e.g., heroin, opium, gambling, and Facebook) are capable of being addictive. They can circulate as objects of exchange in human society. They can be commodified, regulated, or dressed with ritual significance. They can fall in and out of fashion. Because drugs and phenotypic experiences are cut from the same cloth, they can amplify each other, as in cases where ritual processes deploy psychoactive substances. But they can also displace each other over the course of time as a result of colonial encounters or societal transformations. For all these reasons and more, psychotropic mechanisms can be richly historicized. They constitute an important avenue of research for the neurohistorical approach.

In an earlier work, I engaged in speculations on how psychotropic mechanisms might have evolved in human societies (Smail 2008). As a working hypothesis, we can say that over the long span of human history psychotropic mechanisms have probably become more thickly imbricated in human cultures. The rapid commodification of psychotropic mechanisms such as drugs, caffeine, alcohol, leisure reading, and pornography in the eighteenth-century world system serves as a case in point.[1] But psychotropics long predate the rise of the modern world system. The process of commodification alone cannot explain why they might have become increasingly common in human societies.

One hypothesis that could explain the growing density of psychotropics springs from an observation about how power operates in human societies. One of the most important features of psychotropic mechanisms is that they induce alterations in behavior. This is the essence of power, whether it is the conventional understanding of power (one individual or group exerting control over another) or the more complex idea of "biopower," whereby individuals, in effect, unconsciously discipline their own manners or behaviors through the internalization of norms or rules (Elias 1939; Foucault 1975). At the level of the brain, this kind of power involves two neurological systems: the stress-response system and the reward system. Power, arguably, arises from the production and circulation of mechanisms that deter and reward. Significantly, we don't have to assume a kind of Machiavellian intelligence on the part of powerful individuals to explain how psychotropics may have been harnessed in the service of power in early human societies. We can offer a more organic model by using the archaeological concept of "bottlenecking."

1 The standard work on psychopharmacological substances is Courtwright 2001; see also Schivelbusch 1992; Dikötter, Laamann, and Xun 2004; Hunt 2007.

The principle of bottlenecking assumes that power coalesced at key sites in the late Neolithic system of exchange where the circulation of goods, favors, or labor value became constrained by the formation of bottlenecks (Earle 1997, 2011). In Paleolithic and early Neolithic societies, goods circulated freely. Flints, amber, and beads of various descriptions were capable of being collected or produced by many people, hindering the possibility of point-of-production bottlenecks. As a result, the webs of circulation that existed during the Upper Paleolithic were broad and diffuse. Rare exceptions, such as the bottlenecks in mammoth ivory production that may have existed at the Sungir site in Russia (ca. 22,000–25,000 years ago), prove the general rule. In late Neolithic or early Bronze Age societies, by contrast, the types of goods in circulation became increasingly subject to bottlenecks. Bronze metallurgy, for example, generates a production bottleneck; the production of bronze weapons and ornaments can be readily controlled by a single individual in a given area. Markets are examples of bottlenecks that can develop in circulation. According to complex-society archaeologists, chiefs and early states emerged by controlling these bottlenecks.

Many kinds of psychotropic mechanisms are also susceptible to bottlenecking. Psychopharmacological substances, for example, are subject to the same kinds of bottlenecks as goods. In modern societies, sin taxes and laws banning drugs are examples of bottlenecks that can develop in the circulation of psychopharmacological substances (DeGrandpre 2006; Herlinghaus 2010). Similar arguments can also work for phenotypic or cultural psychotropics. Consider two working examples drawn from medieval European society. The first, involving sermons, concerns a practice that affects the reward system. The second, involving violence and debt recovery, concerns a practice that arguably affected the stress-response system.

Sermons. Medieval observers of sermons were sensitive to the psychology of crowds. In their accounts, we occasionally find interesting descriptions of collective tears, sighs, and groans in response to sermons. Medieval authorities on the art of preaching, as Beverly Kienzle has observed, advised preachers to go carefully: if the audience is weeping too heavily, wrote Alain of Lille, “hold back a little, but not too much” (quoted in Kienzle 2002, 99). A remarkable thing about the sermons of the great mendicant preachers of the later Middle Ages is that they were held outdoors, where the audible range of a sermon, or indeed any speech, is very restricted. Yet the descriptions of audiences at medieval sermons suggest that crowds sometimes numbered in the thousands. Most of

them could not have heard the content of the sermon. The messages conveyed during a sermon were therefore as much visceral as they were intellectual. Experts on sermons agree that listeners experienced sermons as a form of theater, complete with joys and sorrows and great swings in mood. The importance of this does not lie so much in the conditioned response (although that is interesting enough) but rather in the fact that the demographic and political conditions of the later medieval cities, notably the cities on the Italian peninsula where mendicant sermons flourished, placed a high premium on cooperation. Emerging research in neuroscience has suggested that a process similar to musical entrainment (that is, synchronization in response to an external rhythm) can occur in people who share powerful emotional swings in large crowds.

Violence, Humiliation, and Debt Recovery. By the fourteenth century, cities and towns throughout southern Europe had perfected a technique for debt recovery that included the very real threat of home invasions by sergeants of the law. These agents acted on behalf of both public and private creditors (Smail 2012). During the process of seizure, the sergeants would march into houses and seize household goods of a value commensurate with the debt owed. Although the evidence is necessarily indirect, criminal court records indicate that the house invasion was often felt as a deeply humiliating, high-stress event. The practice was relatively common. In Lucca (Italy) and its district in the 1330s, for example, there were as many as 2,000 acts of debt seizure per year—and this is to say nothing of the debt claims that did not proceed as far as seizure. The practice can be interpreted from a strictly economistic perspective, but it is intriguing to consider it from a neurohistorical point of view. Among olive baboons, unpredictable violence inflicted on lower-ranking individuals can generate chronic stress, which has the effect of continuously affirming the social hierarchy and making lower-ranking individuals less competitive and more governable (Sapolsky and Share 2004; on stress more generally see Sapolsky 2004). Although the immediate cause of debt recovery may lie in economic concerns, it is possible to argue that political goals played a role in determining why a high-stress pattern of debt recovery emerged in this historical context. In particular, the deliberate violation of household space signaled the universal extension of state sovereignty.

Examples such as these suggest a hypothesis whereby power accrued as states gradually isolated and controlled bottlenecks in the circulation of psychotropic mechanisms. Sermons, promoted by civic or religious authorities, serve as an example of a range

of psychotropic mechanisms that were built on the reward system (the archetype is the "bread and circus" of ancient Rome). Prohibitions or restrictions on other reward-based activities in medieval cities and towns, such as gambling, sex, and theater, can be seen as part of a system that channeled rewards through choreographed events that heightened feelings of cooperation or solidarity and thus enhanced civic engagement. Stress-inducing practices like debt recovery, by contrast, constantly reaffirmed patterns of social hierarchy. They also served to make citizens or subjects more amenable to the payment of taxes and other dues. By offering a debt-recovery service that was cheaper and more efficient than do-it-yourself debt recovery, states exploited a small but significant bottleneck in the production and distribution of stress. Significantly, in neither of these cases is it necessary to assume that states were aware of the existence or function of the bottlenecks in question.

Bottlenecks are necessarily evanescent: since they arise naturally, they can disappear just as easily, and can also foster the emergence of forms of resistance or evasion. In light of this, one of the remarkable features of the eighteenth-century world system is the way in which the commodification of psychotropics reduced or eliminated the bottlenecks on which power had been built. In a sense, modern global capitalism has itself become an order of power, since it serves at once as a vast dopamine-delivery system (the pleasures of consumption) and, at the same time, a stress-inducing system (poverty, envy).

It goes without saying that the model sketched out above is purely hypothetical, scarcely achieving even the status of wild speculation. Any value lies in how it might enable historians interested in neuroscience to come up with new ways of thinking about the past. Neurohistory, in my view, will have gained nothing if it offers no more than a study of hardwired brain states that influence human behavior. It is far better to think of the brain as an ecological niche that is continuously being altered or manipulated even as it subtly constrains or channels behavior. Human history, in this view, is the study of the ongoing and unpredictably contingent dialectic between culture and neurology.

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Jörg Wettlaufer

Neurohistorical and Evolutionary Aspects of a History of Shame and Shaming

Neurohistory can be conceptualized in the broader context of the history of the body or, more specifically, as part of the historical interaction of the human body with the environment. The moderating mechanisms between body and environment are adaptation and behavior, with the latter also taking the complex form of human culture. From this perspective, neurohistory comes into play when the adaptive shape and the particular structure of the human brain are concerned. One major function of the brain is to "control" the body and its functions, and neurohistorical approaches might in the future help us better understand how these interactions of body, brain, and environment have shaped culture and vice versa. Bodily adaptations have been integrated into human culture in a coevolutionary process, and the cultural representations of these adaptations possess a particular importance in social interactions. One particularly interesting illustration of this coevolutionary process is the social and regulating function of the moral emotion shame.

Jaak Panksepp (1998) coined the term "affective neuroscience" to emphasize that research on emotions should be established as an important branch of the neurosciences. Recently, the social aspect of the emotional brain has been integrated in what is now called "social-affective neuroscience" or simply "social neuroscience." This approach, which is connected to the work of António Damásio, has shown the extraordinary importance of emotions for the evaluation of situations in social contexts. If we understand neurohistory as a subdiscipline of history that is especially concerned with the implications of neural states for human behavior, the social use of emotions for conflict regulation in historical societies can be described as a part of neurohistorical investigation of the interaction between the brain and social behavior.

In a research project on the cultural usage of shame and shaming in penal law, the insights of affective neuroscience into the physiological design of emotions can help provide a better understanding of emotion-triggered behavior in historical populations. Recent advances in neurophysiology and the usage of new methods of neuroimaging have boosted our knowledge about the function of different structures of the brain that

host moral emotions such as shame and guilt (see Wagner et al. 2011). We know that the limbic system interacts with the orbitofrontal cortex to store emotional memories and produce the "shame reaction," but we don't know yet how exactly this is done (Beer et al. 2006; see also Jones 2004). As these moral emotions play a crucial role in the enforcement of normative behavior in groups, they are firmly established in adaptive cultural domains like religion, law, and education.

Therefore, knowledge about the human body and brain is important for understanding past and present social behavior and regulation. Research on the neurophysiology of blushing, for instance, can help historians to understand that this visible sign of an emotional state is a hardwired function of the sympathetic system (cf. Mariauzouls 1996) and can thus be found in all humans worldwide. On the other hand, physiological markers like blushing are used in many different and sometimes even contradicting ways in specific cultures, for example in the European juridical sphere to evaluate the trustworthiness of statements or, in the context of codes of modesty, as a sign of arousal.

Shame has been used in different religions to promote cooperative behavior. Especially in the context of Christian penitential practices, shame played a major role in reforming unwanted behaviors through voluntary or involuntary (self-)punishment. Public penance in the Middle Ages and early modern times made use of public exposure and shaming of those who offended against the moral standards of the community. This strategy was adopted by secular powers from the later Middle Ages onwards; the educational and penitential character of the punishments was partly inherited from the Christian doctrine of penance. In particular, offences and misdemeanors, such as fraud, perjury, oath breaking, scolding, adultery, and other kinds of transgressions against one's community entailed shaming punishments such as the pillory, public nakedness, exposure on a tumbrel, or riding backwards on a donkey. The capacity of the human brain to feel shame has been exploited in various ways throughout human history, and complex societies have developed sophisticated means to inflict shame on group members who misbehave and transgress against their neighbors and friends. Shaming punishments rely on strong in-group relationships and seem to have been most widespread in Europe during the later Middle Ages in towns and cities where members were tied together by civic oaths and relied on mutual trust (cf. Wettlaufer 2008, 2010, 2011b).

Although shame is a universal human feature and shaming punishments are widespread and known in virtually all human societies, there are interesting cross-cultural similarities and differences in the social usage of shame. In Japanese society, for instance, which is often labeled as a shame culture, formal public exposure and shaming unconnected to capital punishment only became fashionable in penal law during the Edo Period from the early seventeenth century onwards, and the introduction of such practices seems to be related to a Neo-Confucian movement in that period (Wettlaufer 2011a; Wettlaufer and Nishimura 2012). The contrast between medieval Europe and Japan shows that the cultural expression of universal human emotions can vary dramatically in the ways they are institutionalized in the laws and customs of a society. However, the behavior ultimately has a biological basis.

In this perspective, all historical behavior that is strongly related to the human body—including social history as a whole—is a candidate for new research stimulated by neurohistory. It has been argued that the history of drug use and abuse should be considered relevant topics in neurohistory (Smail 2010). This would also create repercussions for metatheories like the civilizing process theory of Norbert Elias. If we admit a place to neuroscience as an auxiliary science to the history of the body, we should also bear in mind what connected disciplines like endocrinology can contribute (cf. Albers et al. 2002). In fact, the impact of the physiology of the human body on history has been largely underestimated in traditional historical research. Only an evolutionary approach can integrate all aspects of human physiology that appear relevant for historical behavior and patterns in cultures (cf. Russell 2011). Other especially relevant domains include the history of sexuality, reproduction, power or hierarchy, and privileges (cf. Wettlaufer 2002). Neurohistory can play a central role in understanding the interaction between people and their environment through culture. Since the brain is shaped in an adaptive manner to fit with the environment and vice versa, knowledge about its structure and function is vital for evaluating and understanding human social interaction in historical societies.

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David Matuskey

Erythroxylum Coca and Its Discontents: A Neurohistorical Case Study of Cocaine, Pleasure, and Empires

Social hierarchy is a fundamental characteristic of all civilizations. In societies with sufficient capital, this basic imperative has translated into empires that have spanned the globe and all of known history. This drive for rule and domination of people and resources has been well studied in historical and cultural dimensions, but the near ubiquitous formation of empires points to a possible biological correlate that has been decidedly less examined. Any biological intermediary that would be a good candidate for the birth of empires must be linked with rudimentary physiologic processes, a final common pathway of social hierarchy. This pathway, I postulate, is pleasure.

The magnitude and trajectory of history makes a carefully controlled experiment to investigate the biological effects of pleasure and social hierarchy on empires unattainable, but one possible way forward would be to track a known physiological agent in history with the growth of an empire in a case study. Because the biological effects would be well established, this example could provide a proxy to view the more dynamic interactions and symbiosis of the bio-socio-historical effects of empires. One of the best examples of such from history is the story of coca.

In appearance, *Erythroxylum coca* is remarkably forgettable. The leaves have an oval shape with a slightly glossy, longitudinal curve towards the tip. The bush is evergreen and grows to a height of two to five meters in the wild. If it were a plant by another name, one without the involved history of its most famous product, cocaine, it would be largely indiscernible to society.

Despite this innocuous appearance, people first became interested in the plant because of its unique physiology. Coca has hundreds of natural compounds known as alkaloids, which are employed for various functions, including protection against harmful insects that could damage the plant. One of these alkaloids is cocaine. While only one percent of the total makeup of the plant, cocaine functions as a natural pesticide (Nathanson et al. 1993). Like caffeine and nicotine, in all likelihood the effects on humans are an unintended side effect of plant evolution.

The effects of coca on humans were most likely felt for the first time on the eastern slopes of the Andes, where it grows indigenously. Due to lack of written history, the date when coca was first domesticated is a matter of speculation, but there is evidence of coca use dating back to 8000 BCE in Peru (Dillehay et al. 2010). Later, from the period 100–800 CE, there are ceramics and paintings from the pre-Incan Moche civilization depicting coca use. Other evidence of coca's widespread use can be found linguistically, with no better example available than the word coca itself. The word *khoka* in the pre-Incan language Tiwanaku is usually translated as "plant" but might well be better understood as "The Plant." Its importance was reflected in both spiritual use and the mundane: wads of leaves were used as a measure of time and distance (i.e. one wad of leaves = 45 min or 2–3 kilometers) (Streatfeild 2003).

There was a good reason for the central axis of "Mama Coca." The Andes are a difficult habitat to live in. The high altitude and rocky soil lead to fatigue and malnutrition. Coca use increases with altitude in South America and the plant is widely used for altitude sickness, probably due to its sympathomimetic effects, such as increased heart rate and dilated bronchioles for easier breathing (Hanna and Hornick 1977). Nutritionally, it has also been found to have high levels of iron, calcium, and some vitamins, possibly the highest such values in the pre-Columbian diet (Duke, Aulik, and Plowman 1975). It is the other effects, however, including mild stimulant properties and suppression of hunger, thirst, pain, and fatigue, that gathered so much interest from the empires.

The first empire to fully integrate coca was the Incan. There is some debate as to how coca was distributed amongst its citizens—one possibility theorizes the upper class had an "exclusive right to chew coca leaves" (Mortimer 1901), while others suggest the use was democratic (Karch 1997). Written history makes clear that coca use was widespread enough in South America that by the time Amerigo Vespucci arrived in northern Brazil (1504) he "discovered" coca use there. It is also clear that coca use skyrocketed after the Spanish arrived, which warrants a closer examination of bio-socio-historical interest.

Initially, the Spanish Empire did not approve of coca as the church was not in favor of its use. This changed once it was realized that much more labor could be extracted from the indigenous workforce when they used coca. This helped in the new mine of Potosí, doubly famous for having the most silver as well as being the highest city in the

empire. The coca was thus used in similar ways as when it was first cultivated for altitude sickness, fatigue, and appetite suppression. In the harsh new reality of the high mines, though, the leaf was given a purely industrial function: more leaf equaled more profit. Furthermore, the indigenous populations did not rebel against this commodification of their previously sacred substance, in some cases even demanding to be paid in coca. This reliance could be attributed to various mechanisms, including prior cultural use (perhaps the collapse of the old social order allowed the general masses to indulge in the fruit of the riches), dependence (less likely, as the low concentration of cocaine was probably not strong enough for dependence as we now define it), and an interesting neurohistorical postulate: that after the collapse of their native culture and subjugation by foreigners this was a way to extract some pleasure in life. Granted, the coca leaf is not the best vehicle for this, but in the dreary wake of the conquistadors even a one percent increase in pleasure would be welcome.

Humans, indeed all mammals, are governed to some degree by the search for pleasure. This is governed by the basic neurophysiology of the reward pathway. This pathway lies deep in the brain, in areas phylogenetically ancient and important long before consciousness. This drive for pleasure allowed for the shaping of generally productive behavior in evolution by rewarding behaviors such as sex, eating, and social bonding. In primeval habitats, however, this physiology could be quite miserly in its design, allowing only fleeting glimpses of euphoria in the gritty business of survival.

This changed when empires became industrialized in the late 1800s. Now sufficiently sophisticated, society had the technological ability to isolate compounds from the natural world. It is of little wonder that this new hunt focused on pleasure. Europe soon released cocaine from its high altitude and low concentration, and newly formed patent medicines (such as Coca-Cola) opened an avenue to the middle and lower class consumer markets (Gootenberg 2002). Popularizers such as Sigmund Freud and Pope Leo XIII soon helped cocaine become the most profitable single pharmaceutical line for companies such as Merck in Germany (Gootenberg 2009).

What had started out as a treatment for toothaches, hay fever, and other ailments (morphine addiction being of the more interesting) became a tool in the pursuit of a new and improved personal pleasure. All of this happened within the changing social structure of the modern era that was becoming more abstract and losing the tight

social cohesion of yesteryear. This new pursuit had the potential to be dangerous for all, but probably most dangerous for those on the bottom: the demoralized and those with low social status.

From this view, the "epidemic" of crack cocaine a hundred years later in the 1980s can be seen as the result of a progression of the cocktail of pleasure, chemicals, and status that had been brewing for hundreds of years—an even more potent combination of increased pharmacologic action with a tenuous social brake.

While we are left to infer this theoretical relationship between cocaine and hierarchy on historical grounds, modern animal research literature provides some possible mechanistic insight. For example, a study by Czoty et al. (2004) focused on the social order among primates given unlimited access to cocaine. Once addicted, these primates destroyed their previous social hierarchy and the new order that formed was truly egalitarian; all were subservient to cocaine with no differences amongst themselves. The dopamine reward pathway mirrored these changes. Namely: higher status animals had more dopamine, a neurochemical associated with pleasure, than their lower counterparts until they became sufficiently addicted; at that point they all had similarly low levels of dopamine.

This short essay is intended as an exploration of how seemingly divergent disciplines could unite to offer a more definitive explanation of the complex story of coca and empires. But even this brief discussion shows how neuroscience can provide a deeper understanding of historical truths through the example of coca, the pleasure pathway, and social status within empires. Convergences such as these help increase our understanding of the constellation of neurophysiology, culture, and environment that make up our history.

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Neurohistory in the Laboratory

The following abstract presents the results of an experiment conducted in conjunction with the neurohistory workshop at the Rachel Carson Center for Environment and Society on 6–7 June 2011.

Brain activity can provide important clues about how we are affected by various stimuli, because different parts of the brain will be activated in response to different emotional and cognitive demands. This study was concerned with investigating what influence environment has on our mental states. In this case, the participants were not exposed to different environments directly, but rather asked to visualize environments with particularly strong positive or negative associations for them. For example, a positive environment might be a sunny balcony in summer and a negative environment might be a crowded subway car in winter.

Insights from such studies could be useful for helping improve environments—whether in hospitals or at the workplace—so that they have a more positive effect on our well-being. Likewise, knowledge about how people respond to their surroundings may be applied in a historical context to human interaction with natural and artificial environments of the past.

This experiment used functional magnetic resonance imaging (fMRI) to record brain activity while participants visualized different environments. The technology measures changes in oxygen-rich vs. oxygen-poor blood in the brain to determine which areas are being activated. In this experiment, activated regions included the visual cortex, which processes visual information, and the supplementary motor area, which is involved with controlling movement. The left prefrontal cortex, which is involved with certain functions of language, memory, and emotion, was also important.

Evgeny Gutyrchik, Lukasz Smigielski, Janusch Blautzik, Maximilian Reiser, Yan Bao, Ernst Pöppel, Edmund Russell

Cognitive Demands on Brains Fall as Healing Properties of Environments Rise: Evidence from fMRI

There is a growing body of evidence indicating the impact of environment on restoration from stress and illness, as well as on the recovery tempo after injuries and surgeries. To maximize the healing qualities of an environment, we need to better understand its cognitive, emotional, and neural effects on people. In the present study we wanted to go beyond existing behavioral and physiological measures (such as the correlation between the type of scenery visible from a hospital patient's room and the rate of recovery from illness), creating a link between field research on optimal healing environments and brain research using fMRI technology. We based our study on a paradigm involving mental imagery. Prior to the main experiment, all participants imagined and described in writing the phenomenological characteristics of a (1) beneficial and a (2) non-beneficial environment that was part of their episodic memory. We are interested in the impact of environments on healthy people as well as those who are sick, so we asked subjects to imagine beneficial environments. (All subjects spoke German, so we used *wohltuend* and *nicht wohltuend*.) Analyses revealed common activations in the visual cortex (VC) and in the supplementary motor area (SMA) for both conditions. An additional activation of the left prefrontal cortex (LPFC) was observed for the "non-beneficial" condition. Activations in the VC and SMA probably correspond to the mental imagery processing specific to visual and motor modalities. We suggest that imagining a "non-beneficial" scenario requires additional neural processing. Additionally, since the left prefrontal cortex may play a role in inhibiting negative emotions, the observed activation in the "non-beneficial" condition may also be an indicator of emotion regulation strategy. Lack of the activation in LPFC in the "beneficial" condition could be understood as a cortical relief, suggesting that human beings may find some environments more health promoting than others because the former place fewer psychological and energetic demands on the cortex.

Keywords: optimal healing environment, mental imagery, cognition, functional magnetic resonance imaging

Philosophy and the Future of Neurohistory

C. U. M. (Chris) Smith

Neuroscience and History

Can neuroscience illuminate history? Does neurohistory constitute a useful research program? These are fundamental questions which must inform any investigation of the topic.

To begin with, there is a pressing need for historians and neuroscientists to understand each other's language and each other's basic conceptual systems.

The neuroscientist operates on both a micro- and a macroscale; the historian principally on a mesoscale. How does the brain "work"? The neuroscientist thinks of action potentials, synapses, and ion fluxes through intricately designed molecular gates. The historian thinks of outcomes: of how the whole brain influences the behavior of significant historical figures and events. How does the brain change? The neuroscientist thinks on both the meso- and macroscale: on both the developmental (or ontogenetic) scale and the evolutionary (or phylogenetic) scale. The historian is interested in changes occurring at the generational or, at most, the millennial scale. Conceivably, new neuroimaging techniques will help fill this mismatch, but then another problem emerges: the ancient mind-body problem. How do the changes in brain activation detected by neuroimaging translate into changes in subjectivity?[1]

Yet the enterprise is far from hopeless—just delicate and nuanced. There are numerous points of possible mutual interest, numerous historical topics where knowledge of neuroscience can make a contribution: from mob behavior to visual perception. The most obvious is, perhaps, the neuroscientist's understanding of the symptoms of the neurological diseases that sometimes affect the stressed lives of the often elderly individuals who hold positions of power: kings, emperors, generals, presidents and prime ministers.[2] Neuroscientific insight may help account for some of their decisions.

1 Van Orden and Paap (1997) discuss the size of the gap between neuroimages and subjectivity, as does Noë (2009, chap. 1).

2 See the publications of the former British Foreign Secretary and one-time neurologist David Owen (2006, 2007, 2008). Other publications in this area include articles by Ranum, Krueger, and Schut on Abraham Lincoln (2010), and by Peters and Beveridge on King George III (2010).

In the same context, it is worth observing that personality is strongly inherited (Penke Japp, and Miller 2007). It may be that all personality types exist in a population and certain types are more strongly selected by some cultures and social strata than others. One thinks of the Castallan chaos in the early Middle Ages, where social conditions may well have favored extremely aggressive, even paranoid personalities (Smail 2008, 168–9); conversely, the mass cultures of the early riverine civilizations of the Middle East may have favored docility in the laboring masses. Surely animals are not the only organisms to have their temperaments profoundly changed by domestication. Human societies, like those of many (but not all) primates, also show repeated movement toward dominance hierarchies—one thinks of the god-like status accorded Roman, Aztec, and Inca emperors, or of the almost superhuman status of the Roman Catholic Pope, as seen by Montaigne in the late sixteenth century (Bakewell 2010, 240).

Again, is it the case that those who hear voices summoning them to leadership (one thinks, for instance, of Joan of Arc) or are otherwise convinced that they are "men of destiny" (Charles de Gaulle in 1940) are somewhere on a spectrum whose extreme end is schizophrenia? Is the need for leaders a reason that the genes which predispose for this disabling condition are selected for and remain in the human population (Crespi, Summers, and Dorus 2007)—just as the gene which causes disabling sickle cell anemia is maintained in the population because, in the heterozygous condition, it protects against malaria?

Here, also, one might take note of the work of ethologists on supernormal releasing stimuli (Tinbergen 1951). The best-known examples are the exaggerated (delighted) responses of herring gulls to supersized eggs and the evolution of the absurdly non-adaptive peacock's tail. Do we not see the repetitive development of similar absurdities in the costumes of princes and emperors: the emperor of the Aztecs; of China; the royalty of England?

Another instance where neuroscience illuminates history is provided by the brain's demand for "meaning." Half a billion years of predator-prey "arms races" have ensured that sensory systems are designed to detect pattern and breaks in pattern (Smith 2009). The latter warn prey animals that a camouflaged predator is moving in for the kill and similarly allow the predator to detect prey camouflaged in the background. We, too, have our patterns of expectation. When these are broken, we are puzzled, anxious, and

defensive. The brain has also been evolved to detect "agency" and often detects "intentionality" in the world, even the inorganic world, where none exists (Shermer 2011). Is it too much to suggest that religious wars have been fought on these issues?

Finally, in this all-too-short essay, it is clear that recent studies of social neurobiology, especially of the mirror-neuron system, throw considerable light on the origins of mythopoeic thought in early societies (Frankfort et al. 1949). It is also clear that evolutionary neuroscience throws interesting light on the origins of universal human traits such as the aesthetic sense (Smith 2006) or cheater-detection in social exchange (Cosmides 1989), among others. These inbuilt characteristics often play significant roles in history. Lastly, turning to large-scale "universal" or "world" history, it may be that models from recent studies of animal phylogeny will prove valuable. Morris (1998), for instance, argues that from a vast assemblage of animal forms in the pre-Cambrian era only a few major designs have ultimately proved successful: arthropods, mollusks, and chordates; and, as we enter the Anthropocene, only the chordates have won out. Perhaps we should rework the largely discredited ideas of Spengler and Toynbee. Perhaps something similar to the evolutionary success of the chordates has happened in world history, ending with just two great solutions, the social systems represented by China and the West, respectively, or even, as Fukuyama (1992) once argued, just one: the West's free-market capitalism.

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Peter Becker

History and the Neurocentric Age

> *Saint Paul certainly had once an epileptoid, if not an epileptic seizure; George Fox was an hereditary degenerate; Carlyle was undoubtedly auto-intoxicated by some organ or other, no matter which,—and the rest. But now, I ask you, how can such an existential account of facts of mental history decide in one way or another upon their spiritual significance? According to the general postulate of psychology just referred to, there is not a single one of our states of mind, high or low, healthy or morbid, that has not some organic process as its condition. (William James, 1902)*

This quote is taken from the philosophical reflections of the American psychologist William James in his book *The Varieties of Religious Experience,* which was published at the beginning of the last century. It is no coincidence that references to biological reflections on the human condition from the fin de siècle reappear in today's neuro-talk. They are both indebted to an evolutionary narrative and to a strategy of reframing problems in biological terms. To William James, religious experience in the sense of transcendental states of mind had to have a neurophysiological basis. The same line of reasoning can be found in current books in the field of neuroreligion (cf. Blume 2009).

This brief look at neuroreligion is relevant for my argument as it emphasizes the reframing of key concerns in the humanities through a neuroscientific perspective. My argument is that we find a similar strategy in neurohistory as well. The fine book of Daniel Lord Smail, *On Deep History and the Brain* (2008), is a good case in point. If we leave aside the lucid reflections on the historiography of prehistory, the book leaves us with a strong impression that psychotropy acts as an interface between cultural practices and brain development. Smail focuses particularly on stress that is induced by random violent acts from superiors. There is an extensive literature on violence, politics, and trauma, which he decided not to consider (cf. Heitmeyer and Hagan 2003). Instead, he relates historical practices to evolutionary patterns based on the interaction between neurochemical brains and social environments:

> The similarity in the patterns of behavior between male castellans, male chimpanzees, and female baboons raises the question of how we explain it. Someone might

> be tempted to posit a sort of racial memory, as if castellans and spouse abusers were and are controlled by the genes of their distant primate ancestors. . . . It is more productive to explain the similarity of these behaviors as the product of convergent evolution. It is similarity of ecology, not relatedness, that often determines similarity of behavior. In societies or relationships where certain conditions are met—where resources are scarce, power is distributed asymmetrically, and the ability to form coalitions is suppressed—alpha individuals manage to reinvent the pattern of random abuse because it is a psychotropic device toward which certain politically adaptive behaviors will converge. (Smail 2008, 169)

The reframing of problems directs the analytical gaze first to the individual subject and its brain. This makes sense, as it reflects the research agenda of neuroscientists. This research agenda produces fascinating insights into the workings of the brains of rodents, primates, and humans. These insights are rather scattered, however, and thus far have failed to be integrated into a more encompassing system—a point made also by leading researchers in the field of neuroscience like Wolf Singer (2003, 40–42, 95; cf. also Bufkin and Luttrell 2005). To bridge the gap between empirical evidence on the microbiological level and general reflections on the human condition, neurosciences need to take refuge in evolutionary theory (cf. Becker 2010, 106–07).

Opening towards the neurosciences can help certain disciplines sharpen their analytical gaze at subjects and at the role of the body as a highly adaptive interface between nature, society, and individual subjects. It would be misleading, however, to herald the neurosciences as the "resurrectors" of the body as an important concept in social and cultural studies. The long tradition of gender studies, the performative turn, and, in particular, the habitus concept of Pierre Bourdieu—all have contributed to reintroducing the body as an analytical category (cf. Bourdieu 2001, 7–42). It is a different body, though, from the one featured by neuroscience. It is a body situated within its historical, social, and cultural context; it is a body whose mind is not linked to the deep history of humanity but rather to the deep history of a personal biography and its traumatizing events. It is, furthermore, a body densely connected to a wider social, cultural, and political environment, which influences the patterns of perception, thought styles, and agency.

The biographical dimension is not necessarily missing in the neuroscientific notion of subjectivity. Debra Niehoff's notion of the brain as an *organic historian* suggests that

the role of the brain is "[to keep] track of our experiences . . . through the language of chemistry. . . . These experiences get recorded as changes in the chemistry and the hormones of the nervous system and particularly the circuitry for emotion and our responses to stress" (Niehoff 1999, n.p.). However, the focus on brain chemistry as a privileged field of evidence results in a rather reductionist approach to biography and especially to trauma, as the historian Michael Hagner (1996, 278) has argued. Biographical complexity is reduced in favor of evolutionary psychology.

Daniel Smail argues strongly against the dangerous lure of evolutionary psychology. It is telling, however, that he takes up the narrative of evolutionary psychology when he expands on the implications of psychotropy for deep history. This is not his personal failure but follows from the logic of neuroscientific reasoning about social interaction and the position of individual subjects vis-a-vis society and environment. Evolutionary narratives are an important *filler* that links dispersed evidence on the neurochemical functioning of the brain and on the localization of functions in specific parts of the brain to more encompassing narratives.

I am not arguing against the use of narrative evidence. It links theory and empirical evidence in many fields of research. Narrative evidence has to answer, however, to the question of how successfully it captures social and psychological complexity. The "vulgar" Marxist assumption of a close link between class position and political identification has rightly been criticized. Do evolutionary psychological assumptions hold more potential for describing modern subjectivity? Browsing through the more recently published works in the field of neurohistory or neuroaesthetics, I cannot avoid the impression that the opening of new perspectives is currently linked to a recurrence of conjectural history (Höpfl 1978). Evolutionary projections into deep historical times are then brought back into the argument as supporting evidence.

The Discrete Charm of Reductionist Narratives

> The male part is the one synchronizing to be better heard by the females—like in the case of the American grasshopper. In primitive cultures we find social prestige and leadership linked to dancing and musical competence. The evolutionary biological relation between music and courtship can be transposed to a modern situation. We need to think only of the sex appeal of pop musicians for Fans and

> groupies. Their sweat-inducing song and dance (similar to the peacock's fan) can be understood as a sign of their fitness, which in turn explains their sex appeal. It is no coincidence that there are ten times more male than female musicians. (Schrott and Jacobs 2011, 271; translated by the author)

The Austrian writer and literary scholar Raoul Schrott has written a fine book about reading and literary writing from a neuroscientific perspective. He widely reflects on his own practice from a genuinely new angle. At times he falls into the evolutionary trap, however. The short-circuiting of grasshoppers and pop musicians in the argument of Raoul Schrott, and of male castellans, male chimpanzees, and female baboons in the reasoning of Daniel Smail is only possible by radically abstracting cultural and social practices from their wider political and social context. Only through this angle we can link the stage performance of Robbie Williams with American grasshoppers, the extractive violence strategies of castellans to dominance relations in primate groups.

Reframing research questions in the humanities based on neuroscientific concepts and narratives is highly tempting, considering the current neurocentric turn (cf. Dunagan 2010). The brief references to the study of religious practices, power relations, and cultural practices are examples of a current tendency of reframing. This can, in principle, carry substantial gains in approaching our subjects. Can we identify these gains, however, in Smail's and in Schrott's books? I tend to answer this question negatively. Putting the analytical focus on the neurochemical brain and its interaction with the social and natural environment provides no added analytical value—even if it offers a possibility to link social and cultural practices through evolutionary narratives to a deep historical past. This is not my understanding of history, however.

Brain research has made substantial and fascinating advances in our understanding of the functioning of the brain. The *bottom up* strategy was highly instrumental for this purpose. The results of this research cannot be ignored by social sciences and the humanities. This does not mean, however, that we should also uncritically take on board the reductionist evolutionary narratives embedded in neuroscientific reasoning on society and subjects.

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Kirsten Brukamp

Neurohistory: Being in Time

What is neurohistory?—The ambitious endeavors suggested by the novel term possess the potential to result in unexpected perspectives on both history and neuroscience. Neurohistory projects fall into one of three categories.

Focus on history: Neurohistory may first be history informed by neuroscience. Accordingly, neuroscience is here understood as a support for achieving historical understanding: historical events and processes are assessed in light of insights from neuroscience.

Examples for projects in this field comprise all those that would benefit from a deeper understanding of individual actions, collective intentions, and social behaviors—that is, goals that may be reached with psychology as well as social and cultural neuroscience (Adolphs 2009; Rizzolatti and Sinigaglia 2010; Martinez Mateo et al. 2011). In particular, research can unearth new perspectives on gender differences, personal factors in history, conflicts, conflict resolution, hierarchy, and power structures. In select cases, the behavior of influential individuals may be explained by disorders of the nervous system (Toole 1995). For prehistory, comparative biology and neuroscience could identify distinct stages of behavior and culture in the evolution of human ancestors (Stout et al. 2011). Moreover, insights from cognitive science could reveal more specifics about how spirituality and religious convictions have influenced history.

This first approach to neurohistory includes the history of neuroscience as a topic, containing the history of the study of the central and peripheral nervous system in neuroanatomy and neurophysiology, as well as the history of neuromedicine with its disciplines neurology, neurosurgery, and psychiatry.

Focus on neuroscience: Second, neurohistory comprises neuroscience informed by history, where history is understood as an aid to neuroscience. It deals with the history of the nervous system, either as a *collective* history through the millennia or as a *personal* history during the development of an individual. Both routes may focus on a *narrow* subject, or they may be regarded as a *broad*, interactive field.

Approaching the topic with a narrow focus, collective histories of the nervous system are concerned with the evolution (i.e. the phylogenetic history) of the nervous system up to the human brain. While this may be called classic phylogeny, a wider perspective takes into consideration the mutual influences between organism and environment: brain functions have always been shaped by the already existent human cultures. Coevolution therefore looks at the impact of the human, cultural environment on genetic material in evolutionary history.

Investigating individual histories of the central and peripheral system includes classic ontogeny, which studies the development *in utero* and as a child, as well as the changes towards the end of our lives during senescence. Transcending this narrow understanding, neurohistory also considers the correlation between brain functions and individual experiences, such as the representation of individual memories from one's personal life in the brain, for example through neuroplasticity. This is the traditional realm of developmental, biological, and clinical psychology, depending on when and in which contexts the shaping of memories takes place.

Fundamentals of neurohistory: Third, the term neurohistory points to the fundamental realities that lie at the basis of both history and neuroscience: anthropology and the philosophy of time and world history. The reflection about humanity is an element that is inherent to both disciplines.

Humans are beings existing in time and in the world, and they experience themselves as distinct and special in both regards. As creatures constituted not least by their nervous system, they construct both world history and their own personal history through narration. They find facts and artifacts in the world, put them into causal contexts, and shape their interpretations by telling stories. The prefix "neuro" in neurohistory means, at first sight, everything related to the nervous system in all animals. Nevertheless, in accordance with the philosophical perspectives of neurohistory, humans frequently are primarily interested in those compartments of the brain that likely form the material basis for higher cognitive functions. Thinking about the philosophy of time and reflecting on the state of humanity in the world provides a basis for history, neuroscience, and neurohistory alike.

In the following, a sketch of three examples illustrates the potential of neurohistorical approaches for the advancement of knowledge in different fields. In all cases, the results are intriguing for both neuroscience and history.

Contemporary functional brain imaging has been employed to demonstrate evidence for the *relevance of the motor resonance system in prehistoric learning.* In one study, three subject groups—namely technologically naïve, trained, and expert individuals—were exposed to video clips of two types of prehistoric toolmaking techniques, which differed in complexity according to their earlier or later appearance in the archaeological record (Stout et al. 2011). On the basis of modern insights into the functioning of mirror systems for motor behavior (Rizzolatti and Sinigaglia 2010), the authors concluded that the relatively younger method of toolmaking involved more extensive resonance systems in the study. In particular, the later toolmaking method activated brain areas that nowadays aid in achieving immediate action goals.

Consequently, resonance systems may be regarded as valuable elements for the foundation of human culture. Study results (Stout et al. 2011) are inconclusive as to whether humans developed new brain regions that allowed novel toolmaking or utilized the plasticity of already existent brain morphology to acquire additional skills. The conclusions of this investigation certainly rely heavily on presuppositions about the overall stability of both brain morphology and function. Nevertheless, with this approach, the researchers were able to catch a glimpse at a plausible reconstruction of the workings of *homo* species brains from deep history millions of years ago, even though the remains of these early humans have long vanished almost entirely from this earth.

Human cognitive aptitudes are adaptive and versatile, and this flexibility is rooted in a plethora of separate and partially overlapping systems and functions in the nervous system. Subsequently, a theoretical *analysis of cognitive deficits* in humans, and humans of the past in particular, can provide insights into higher brain capacities. Otherwise, these deficits, be it in behavior, perception, emotion, and thought, cannot be investigated because the results of animal studies are not to be applied unconditionally to humans, while experiments with human subjects are unacceptable because of moral concerns. Since instances of partial brain disorders are rare, scholars have scrutinized historical evidence on the basis of contemporary knowledge to reveal how prominent individuals may have been affected, an exploration that then allows novel interpretations of their historical actions and effects (Toole 1995).

The brain is usually regarded as merely a single organ among others that constitute a full human subject. In an alternative perspective, the brain itself may be regarded as

an agent, an organ with needs of its own. Here, the basic neurobiological properties of the brain come into play: biological evolution and cultural coevolution have molded the brain, and in turn, emergent features of the brain have shaped the environment and influenced history in very specific ways (Smail 2008). For example, the craving for sugary foods, likely due to the role of handy carbohydrates as an energy source for the brain, has resulted in special markets and economies with characteristic food products over the millennia. This was not only associated with weighty effects on economics, agriculture, and food production, but also on health and well-being, due to aftereffects such as the emergence of dental caries (i.e. tooth decay), obesity, and diabetes. Likewise, the modern entertainment industry relies partly on the inherent interest of humans in moving images, arousing sensations, and engaging stories. Again, this phenomenon has economic and health effects as well as social and political sequelae, because the involvement with media entertainment leads to a tendency to disengage from interaction on the personal level.

These examples provide just a sketch of the vast possibilities that research questions in neurohistory have to offer, as the history of neurohistory has not yet been written.

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THE BRAIN IN THE WEST: FROM DIVINE INSTRUMENT TO HUMAN ESSENCE

A Course of Study by Steve Fuller

This ten-week module surveys the history of Western thought from the standpoint of the brain, a locus of increasing interdisciplinary interest in the early twenty-first century. The evolution of our understanding of this organ has charted humanity's changing relationship to the divine, the natural, and the social.

The key objectives of this module are as follows:

- An appreciation of the centrality of the brain as a site of not only contemporary scientific and policy-making interests, but also of cross-disciplinary understanding—a clear case of blind men trying to make sense of an elephant.
- A grasp of the sociological contexts in which conceptions of the brain have been implicated, especially in terms of defining the evolutionary limits of humanity.
- A reciprocal grasp of how various planned and unplanned developments in human history have potentially altered the character of the brain, including the relationship to its possessor.
- An awareness of the relatively seamless way in which classic questions from theology and philosophy have been translated into the modern scientific discourses of medicine, psychology, and neuroscience.

Two of the assigned books, McGilchrist (2009) and Taylor (2004), may serve as general-purpose reference books providing cross-disciplinary overviews of the history of Western enquiries into the nature of the brain. Though both authors are trained in contemporary neuroscience, they differ in outlook: McGilchrist is more humanistic and positive, Taylor more social scientific and critical.

Students will also be required to watch at least one of the following five classic films of the past fifty years—all cheaply available on DVD—in which the brain figures prominently in the technologies of social control. The assignment may take one of two forms: (a) an academic critique of one or more aspects of the film in light of issues raised in the module; or (b) a dramatic script based on one or more aspects of the film

This syllabus is elaborated and contextualized in *Preparing for Life in Humanity 2.0* (London: Palgrave Macmillan, 2012).

in light of issues raised in the module. The five films and their general relevance to the brain are as follows:

- *The Manchurian Candidate* (1962)—programming assassins
- *A Clockwork Orange* (1971)—rehabilitating delinquents
- *Minority Report* (2002)—anticipating crime
- *The Eternal Sunshine of the Spotless Mind (2004)—erasing memories*
- *Inception* (2010)—implanting thoughts

Weekly Module Content

1. Introducing the Cult of the Brain

This session discusses how and why the brain became the defining organ of the human condition from the seventeenth to the nineteenth centuries: exploring the path from Descartes's fixation on the pineal gland at the brain's base, through Swedenborg's focus on the cerebral cortex, to the Freudian view of the self as an extension of the entire nervous system (Gross 1998). Originally treated as the meeting point between our animal and divine natures, the brain came to be regarded by an increasingly atheistic science as a secular fetish, a view which if anything contemporary neuroscience has helped to revive (Hecht 2003).

2. The Brain's Access to God

The brain was often seen as the organ for tapping into our divine natures, even if the heart or liver were regarded as more crucial for normal life functions. Two models of such tapping—both prominent in Platonic Christianity—were the "arts of memory" and the "course of study," the former drawing on our divinely inspired creativity, the latter on the prospect of our re-absorption into God's mind. Together they formed the basis for the scientific method in the seventeenth century (Yates 1966).

3. The Brain Merges with God

The "view from nowhere" to capture the divine standpoint that Newton arguably rendered humanly accessible, which brought into focus the nature of our capacity for "second-order thought"; that is, to see the world as if standing outside of it. The modern history of this prospect begins in the seventeenth century with "theodicy," which invited systematic

speculation on God's motives (Nadler 2008) and later developed into the logical and later computational puzzles associated with cybernetic models of the brain (Wiener 1950, 1964).

4. The Brain's External Relations to Mind

In the seventeenth and eighteenth centuries the two main problems of the philosophy of mind arose, both highlighting the brain as translation device: How is mind related to body, and how do minds relate to each other? The former was defined in terms of "foreign exchange" (*commercium mentis et corporis*); that is, how much of the right sort of matter is needed for the expression of intelligence? The latter was addressed by finding a basis for calibrating human similarity: Was it our common descent from God, à la Descartes, or our common life situations, à la Adam Smith?

5. The Brain's Internal Relations as Mind

The eighteenth and nineteenth centuries saw the rise of "associationism" as an account of thought based on neural conductivity, which seeded many ideas about the role of contiguity and similarity in establishing mental patterns, not least that higher (a.k.a divinely oriented) forms of thought are produced by the "synthesis" or "integration" of nervous energy. Thus, the defining human attribute of "free will" came to mean the capacity to determine the brain's focus of "attention." Post-Darwin, associationism was increasingly identified with behavioral conditioning that was neutral regarding the brain's nature, while presuming the manipulability of innate associative tendencies (Passmore 1970).

6. Composing the Brain

The two main modern views of the brain's organization emerged in the nineteenth century as offshoots of medical enquiries: (1) a "modular" view that envisaged the organ as subject to a micro-version of the social division of labor; and (2) a "holistic" view that depicted the brain as an especially sensitive self-organizing form of matter. The former tended to favor more direct, the latter less direct medical interventions, which in turn served to bifurcate the history of psychiatry in the twentieth century (McGilchrist 2009).

7. Combining Brains

Paradigms also emerged for characterizing the common or collective features of brains, especially as they adapt to changing historical circumstances. Prior to clear

empirical accounts of genetic transmission, theories of "common sense" and "collective memory" existed as alternative accounts of the acquisition and transmission of our humanity, which over the course of the nineteenth century came to be known as "culture" (Valsiner and van der Veer 2000). The recent growth of evolutionary psychology and "neurohistory" provides a new context for exploring how mass exposure to psychotropic elements in the environment (e.g., diet) have re-wired human brains, resulting in new forms of sociality and self-expression (Smail 2007).

8. The Global Brain

As the cult of the brain peaked in the twentieth century, the evolutionary prospect of a "world brain" loomed either as a single unitary entity or a parallel distributed process. The former case was described in sacred (Teilhard 1961) and secular (Wells 1938) terms, both stressing tendencies towards amplification and standardization in global communications. The latter was originally depicted as updating the classic geopolitical "balance of power" (Deutsch 1963), though Wikimedia nowadays provides a postmodern version based on the endless differentiation and democratization of knowledge production.

9. The Mass Mediated Brain

From the printing press to the Internet, the mass media have functioned—both intentionally and unintentionally—to reform the brain's powers, leaving the organ better able to cope with the ever-expanding mental ecology in which it has been embedded. This matter may be seen in positive or negative terms, as well as approached from the brain or the media side, resulting in four prospects: brain-positive (Dehaene 2009), brain-negative (Greenfield 2003), media-positive (McLuhan 1964), media-negative (Lanier 2010).

10. Conclusion: Brains Shaped, Washed, and Sold

Finally we reflect on the extent and import of humanity's attempts to control its brains. The history of this ambition recapitulates the Reformation ("evangelism") and Counter-Reformation ("propaganda") roots of modern "brainwashing," which may be seen as, respectively, a cathartic purge of unsavory associations or a reinforcement of latent virtues. The introduction of brain scanning in the field of "neuromarketing" represents a more invasive and personalized development along this trajectory (Taylor 2004).

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RCC Perspectives is an interdisciplinary series of papers and essays in environmental history, environmental studies, and related fields. The papers have their roots in the scholarly activities of the Rachel Carson Center for Environment and Society and in current debates in society. They combine thought pieces and fresh empirical research, and they are designed both to further international dialogue and to inspire new perspectives on the complex relationship between nature and culture.

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Neuroscience offers historians ideas, methods, and questions that can help us understand the past in new and deeper ways than the traditional methods of history alone provide. This issue of *RCC Perspectives* collects a number of contributions to the growing field of neurohistory. They ask questions about the role of biology and the brain in the development of human culture, a problem which is of relevance for environmental history as a whole because it can help shed light on how people interact with their surroundings.

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