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# NEUROSCIENCE CAN HELP US UNDERSTAND SOCIAL TRANSITIONS

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## Neuroscience Can Help Us Understand Social Transitions

**Abstract:** Human cultural adaptability helped our species get through several extreme environmental crises during the 200,000 year history of *Homo sapiens*. Richerson, Boyd and Henrich (2010) argue that this adaptability is a product of gene-culture coevolution. Much has been written about cultural evolution, but relatively little attention has been paid to the role human neurobiology plays in this process. I argue here that neuroscience can make important contributions to understanding human behavior within highly evolved social systems. This can help inform us as to how a transition to sustainability might be possible as we struggle to make it through the population, climate change, and resource bottlenecks of the 21st century. I argue further than the idea of *homeostasis* can serve as an organizing principle to understand individual, social and ecological sustainability.

### Introduction

A growing body of evidence indicates that the human species is unique among mammals in its degree of sociality (Henrich et al. 2004, Wilson 2007). Evidence suggests that cultural adaptation gave humans a unique advantage in managing transitions during past rapid environmental changes. The ability to adapt customs and technology to changing conditions allowed humans to more quickly adapt to a changing food resource base compared to other animals that depended on more purely genetic adaptation. For example, Richerson and Boyd (2005) argue that culture and complex brains were an evolutionary advantage for humans during the extreme climate volatility of past ice age transitions. The ability to use culture as an adaption mechanism creates another source of variety—in addition to genes—upon which natural selection can work. The ability of humans to adapt culturally-conditioned behavior to changing conditions is perhaps *the* critical factor in successfully managing social transitions. Far from leading to genetic determinism, modern evolutionary theory has shown that human behavior is a combination of genetic, developmental and cultural factors. Neither of these can be understood in isolation. Neuroscience can help us understand these links and this understanding can give insights into behavioral adjustments and policy formulation to manage societal transitions.

## Neuroscience has Confirmed the Existence of the Social Brain

Many mammals are highly social animals with a variety of behavioral attributes that evolved to facilitate social interaction, but humans seem to be unique in their degree of sociability. Two features of the human brain are particularly important to human sociality and to gene-culture coevolution: *brain plasticity* and the existence of *Von Economo neurons*.

One of the most remarkable findings from neuroscience is that most of the neurons in the human brain develop after birth and the way they are configured depends critically on how a child is socialized. It is another way that variability can be introduced into evolutionary mix. Wexler (2006, 3) writes about the evolutionary advantages of brain plasticity:

> There is an evolutionary advantage for life forms that reproduce sexually because mixing of genetic material from parents produces variety in their offspring. Thus, different individuals have different characteristics, which increases the likelihood that some members of the group will be able to function and reproduce even when the environment in which the group lives changes. In an analogous manner, the distinctive postnatal shaping of each individual's brain function through interaction with other people, and through his or her own mix of sensory inputs, creates an endless variety of individuals with different functional characteristics. This broadens the range of adaptive and problem-solving capabilities well beyond the variability achieved by sexual reproduction.

A related insight is also important for successful societal transitions. Humans alter the environment that shapes culture and brain development to an unprecedented degree.

> These human alterations in the shared social environment include physical structures, laws and other codes of behavior, food and clothes, spoken and written language, and music and other arts…It is this ability to shape the environment that in turn shapes our brains that has allowed human adaptability and capability to develop at a much faster rate than is possible through alteration of the genetic code itself. (Wexler 2006, 3)

Evolutionary biologists call this *niche construction* (Laland, Odling-Smee and Myles 2010). Most of the world's population (although certainly not all) live in a material environment almost entirely created by humans. Very little of our well-being comes directly from the natural world (although ultimately, of course, it all does). We have also adapted technologically, socially, and perhaps even neurologically in ways that shield us from the negative effects of our activities on the earth's life support systems. This is called *counteractive niche construction* (Laland, Odling-Smee and Myles 2010). The ability of humans to buffer themselves from past negative environmental change makes it difficult to get public support for policies to prevent climate change and biodiversity loss. For most people rapid environmental change is something in the distant future affecting people in distant lands, not them. But the good news is that humans have an unrivaled ability to adapt to new situations and meet new challenges. The importance of post-natal brain development in humans means that we have the innate ability to change our attitudes and ways of living both to reduce our pressure on the environment and to adapt to the inevitable changes we have set in motion.

Another remarkable finding from neuroscience is the presence in the human brain of *Von Economo* or spindle neurons that apparently evolved to enable people to make rapid decisions in social context. Sherwood, Subiaul, and Zadwidski 2008, 433) write:

> Based on the location, neurochemistry, and morphological characteristics of Von Economo neurons, it has been hypothesized that they transmit rapid outputs to subcortical regions (Allman et al. 2005). It is interesting that these specialized projection neuron types have been identified in cortical areas that are positioned at the interface between emotional and cognitive processing. Given their characteristics, it has been speculated that Von Economo neutrons are designed for quick signaling of an appropriate response in the context of social ambiguity (Allman et al. 2005). Enhancements of this ability would be particularly important in the context of fission-fusion communities, such as those of panids and possibly the LCA [last common ancestor], with complex networks of social interactions and potential uncertainties at reunions.

Allman et al. (2005, 370) argue that these neurons help humans to adjust quickly to rapidly changing social situations:

> We hypothesize that the VENs and associated circuitry enable us to reduce complex social and cultural dimensions of decision-making into a single dimension that facilitates the rapid execution of decisions. Other animals are not encumbered by such elaborate social and cultural contingencies to their decision-making and thus do not require such a system for rapid intuitive choice.

Von Economo neurons are also found (in much smaller numbers) in great apes and whales and dolphins, other highly intelligent species with complex social systems. In humans, most of these neurons are formed *after birth*, again pointing to the blurred line between heredity and socialization. Again, the latest neurological evidence suggests that human behavior is uniquely social. Understanding the social nature of decision making (the importance of reference groups, for example) is critical both to formulating successful social and environmental policies and to gaining public acceptance of these policies.

**Neuroscience has Identified the Importance of Homeostasis in Brain Structure and Function and this may be a Key to Understanding Sustainability**

Homeostasis is an important feature of living organisms as well as living systems. It is the ability (or even the goal) of living systems to maintain balance through a complex, highly evolved system of interacting processes. It can be used as a conceptual framework to link individual behavior, social stability and ecosystem resilience.

*Homeostatis and the individual* - One of the most interesting things about how the brain works is how it is intricately structured (physically, chemically, neurologically) to keep living organisms in physical and emotional balance. Traditionally, economists have seen behavior in terms of "satisfying preferences." People know what they want and rationally choose the things that will best satisfy these wants. A more accurate way to look at "wants" is to view them as one of several mechanisms to maintain homeostasis in the human mind and body. Camerer, Lowenstein and Prelec (2005, 27) write:

> As economists, we are used to thinking of preferences as the starting point for human behavior and behavior as the ending point. A neuroscience perspective, in contrast, views explicit behavior as only one of many mechanisms that the brain uses to maintain homeostasis, and preferences as transient state variables that ensure survival and reproduction. The traditional economic account of behavior, which assumes that humans act so as to maximally satisfy their preferences, starts in the middle (or perhaps even

> toward the end) of the neuroscience account. Rather than viewing pleasure as the goal of human behavior, a more realistic account would view pleasure as a homeostatic cue-an informational signal.

"Consumption" for example, is one of many kinds of behavior that may move an individual toward, or away from, emotional balance. It is a response to social and neurological signals, not an end in itself.

*Homeostasis in human societies* - It can be argued that a sustainable human society is also characterized by homeostasis. *Viability* was the term Georgescu used for a sustainable economy. An economy was viable if (1) it uses technologies that do not draw down irreplaceable stocks, and (2) it does not impair the ability of *fund* factors (labor, capital, and land) to maintain themselves through time. Human labor power, for example, must be maintained through adequate nutrition, support of family and friends and other healthy social relationships.

*Homeostasis and ecosystems* - Homeostasis is related to the concept of "resilience" in ecosystems (Hollings 1973). Maintaining diversity and evolutionary potential is essential to preserving ecosystem integrity. The unsustainability of the current path of ecosystem use by humans is apparent from the catastrophic loss of biodiversity and the destabilization of the earth's climate regime—both a direct result of pursuing one goal, namely, exponential economic growth.

These hierarchies of homeostasis--individual, social and ecosystem—are closely intertwined. Identifying feedback mechanisms leading to, or away from, homeostasis (balance) within and among these three hierarchies is a rich research area for understanding the transition to a sustainable society. The evolutionary context of homeostasis is critical. Evolutionary processes often result in traits that are maladaptive when conditions change. For example, nutritional adaptations such as a craving for fat and sugar among hunters and gatherers were once adaptive but are now mismatched to current sedentary societies. Cultural traits that for a time worked to create prosperous, unified societies sometimes led to disastrous long-term consequences as in the Maoi (human statue) cult of Easter Islanders. But cultural evolution, like biological evolution, is also subject to the problem of "mismatch." Traits that were successful under one set of environmental circumstances may prove to be maladaptive as conditions change.

**Conclusion**

Neuroscience has confirmed the fact that human behavior is a complex outcome of the interactions between "nature" and "nurture". There is no hard and fast separation between the two. Behavior and the neurological structure of the brain have co-evolved over eons to solve some basic survival problems. Generalized Darwinian selection (Hodgson 2010) of cultural behavioral traits gave humans an evolutionary advantage over other species in the fact of rapid environmental change. Our understanding how cultural traits are generated, propagated, and selected can be greatly enhanced by current advances in neuroscience. This understanding may be crucial in surviving the inevitable rapid environmental and cultural changes of this century.

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