Navigating the Molecular Reduction of Human Nature

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This short, impressionistic paper is meant to shed some light on the tension between reductionist natural science and normative human nature. Since the mid 20th century and the discovery of DNA, our understanding of human biological nature and has amplified exponentially. The molecular revolution in biology has pushed the subject to an unapologetically reductive and quantitative corner from which groundbreaking discoveries about human traits and disease have been made with molecular biology. Such discoveries are made possible by a reductive perspective—that is, the boiling down of biological phenomena to molecular logic and mechanisms.

Behavior is also a biological phenomenon, and much work is also being done to reduce behavioral phenomena to neuroendocrine pathways and other mechanisms in hopes for better explanations. These kinds of investigations have and will continue to illuminate important details about the chemical basis of behavior, however, they leave something to be desired or, at worst, dehumanize human phenomena. The same goes for the reduction of various aspects of human nature to molecular genetics. What happens to a musical performance when you see it as a series of electrochemical happenings? Or a patient as having a particular genetic abnormality? Reduction in biology, a science that sits between the harder facts of physics and the systematic claims of psychology, needs to be welcomed with caution, for it has the potential to disrupt our fundamental interpretation of human nature and sense of identity, both of which are inherently biological.

Due to its high level of resolution and usefulness, molecular reasoning and computation tend to displace higher order reasoning in biological contexts such that statements like, "this patient has cancer" have been replaced by statements like "this patient has KRAS mutated lung adenocarcinoma." The problem with this trend I want to emphasize is that we ought not reduce, or strive to reduce identity statements to molecular or other levels before careful consideration. For instance, when I say "I am Italian-American," I could also say, "I have the genetic makeup of a history of individuals who trace back to Italy and the United States," or some shorter iteration of that thought. However, what's lost in the translation is a slew of individual and cultural components of my identity that cannot be supplanted by molecular details. From my cultural identity comes a bouquet of traditions, sensibilities, concepts, ideals and stories that have no molecular content, yet have an impact on my nature and that of the world. Likewise, my molecular identity carries information that my cultural identity does not, such as my susceptibility or resistance to disease, blood type, and triglyceride levels. Both senses of identity are valuable, but for different reasons depending on the context of inquiry.

If my molecular and cultural identities carry different content, no description of an individual, or of human nature generally, is sufficient if these descriptions are not integrated with other levels of organization. To add another layer of complexity, my environment and behavior also frame and inform my experience, which is in turn tied to my biology through epigenetics. Furthermore, there are developmental, psychological and sociological variables that exist interdependently with all the above. Thus, human nature is multifactorial and spreads across multiple levels of organization. How then are we to systematically understand the interplay of several kinds of interdependent variables—molecular, developmental, environmental, behavioral, cultural and experiential—and their collective significance as the framework of human nature?

Rubenstein and Hoffman (2015) are behavioral scientists that provide a view for the integrated study of animal behavior that simultaneously acknowledges the significance of the multiple levels of organization at which the organism emerges and avoids nearsighted reduction. In my view, Rubenstein and Hoffman's model for the integrative study of animal behavior is expressly compatible with the study of human nature, as it pins sociality—"the pinnacle of biological complexity,"—as its target for study. (Rubenstein 2015, 154) The authors state that social interactions are pivotal to understanding the integrative decision making processes that animals use to act based on information from internal (eg, physiological, psychological) and external (eg, environmental, social) influences. Importantly, they observe that social behavior crosses spatial and temporal scales and all levels of biological organization. This is exactly the case with the concept of human nature—it is biological, yet crosses several levels of organization, and is simultaneously equivalent to and greater than the sum of its parts. The integrated view of behavior then, may also be used as a logical framework for understanding human nature not only mechanistically, but also philosophically.

Rubenstein and Hoffman assert that understanding the mechanisms underlying social behaviors, what they call the "behavioral ecologists' black box," requires the integration of five "non-mutually exclusive proximate pathways." (ibid.) Through this perspective their objective is to uncover details about the evolution of adaptive social behaviors in vertebrates, and the model can also be specifically applied to the study of human nature in a way that that is both sufficiently reductive and cautiously conservative.

The integrative approach allows us to frame a perspective on human nature as a complex sociality with molecular, environmental psychological, and cultural influences and contexts. The five proximate pathways according to the authors are: neural circuits, neuroendocrine regulation, gene expression, epigenetic regulation and genome structure. They consider these pathways as crucial

links between the environment and social phenotypes. That is, they believe that in order to shed light on the "black box" of social behavior mechanisms, these phenomena must be considered together. For instance, under their view, understanding mating tactics and dominance hierarchies requires content from all five pathways to be understood mechanistically. That is, there will be neurological, genetic, epigenetic, genomic and neuroendocrine stories to tell and a social and ecological context to consider when explaining mating or dominance behavior. This approach extends to the study of all animal behavior for Rubenstein and Hoffman, and I want to suggest how the same approach can be applied to human nature.

If the integration of proximate pathways proposed by Rubenstein and Hoffman is crucial for understanding social phenotypes, then it is also crucial for understanding human nature. In part, human nature is a subset of social phenotypes unique or particular to our species. Our "social phenotypes" encompass the whole of interactive human behavior, capturing phenomena such as family life, education, group activity, government, dating, the arts, science and countless other behaviors that entail interactions and shape our nature. If we accept that all human behaviors, including self-reflective behavior and the having of mental states necessarily involve the five proximate pathways, then an integrative concept of human nature emerges. That is, we can understand human nature in a systematic way if we apply the integrative approach of Rubenstein and Hoffman to the philosophical, psychological and biological question of what it means to be human.

Human nature can be understood reductively, and we can say many things about our molecular nature, but these observations cannot be taken out environmental, social, or other contexts at different levels of organization. Once we take up such a perspective, we're lead down an interesting path of inquiry that can examine the properties, plasticity and dynamics of human nature through philosophical, psychological, behavioral, sociological and biological lenses. The value of an

integrated perspective on human nature is that it creates a pool of information ripe for cross-disciplinary studies and hypothesis generation.

For instance, we may want to understand more about the nature of musicality and its psychosocial effects. Traditionally, we would create two groups of musical and non-musical individuals, then start comparing the two groups through psychological questionnaires, trials of musical ability, and perhaps brain imaging. We'd then use the results data to uncover various trends and associations based on specific research questions. Under the integrative approach, the studies could have less depth in any particular domain, but more breadth. Perhaps we'd also collect DNA and blood samples from the individuals, take social histories of their upbringing and family life, probe the dynamics of their past experiences with music, and record personal anecdotes, all in addition to traditional sampling strategies. This approach steps outside the bounds of a particular one-dimensional approach to ask intriguing questions such as: Is there a combination of epigenetics and musical fostering that produces virtuoso musicians? Do highly trained musicians have different neural firing patterns than amateurs? How does musical ability affect biology and subsequent behavior? The integrative approach makes meaningful answers to questions like these possible to uncover.

The integrative approach is therefore not only a tool for generating novel research questions, but also a conceptual compass for thinking about human nature. Its pluralism suggests that questions about human nature may have reductive components, but stresses that one must not loose sight of the larger picture. The approach is equally as useful in a question about the etiology of disease as it is in a question about the dynamics of mental states or the behavior of individuals with mental illness because it starts from the outset with consideration of different levels of organization and how they may harmonize with one another. This way, we not only can systematically investigate

human nature from different and equally valuable perspectives, and we can discover new perspectives by considering its different aspects together.

The philosopher Wilfred Sellars says at the outset of his *Philosophy and the Scientific Image of Man* that "The aim of philosophy, abstractly formulated, is to understand how things in the broadest possible sense of the term hang together in the broadest possible sense of the term." I offer that philosophy need not be the only discipline in which understanding how a plurality of variables integrate and create the conditions for the possibility of complex phenomena hang together. In fact, all sciences and humanities should aim to harmonize with one another such that divergent and cross disciplinary thinking are the norm and not the exception, for this pluralism and divergence is a hallmark of human nature itself. We could say that to be human is to be integrative, and therefore that we ought to implement the integrative approach in all that we do.

References

Rubenstein DR and Hoffman HA. Proximate pathways underlying social behavior. *Current Opinion in Behavioral Sciences.* 2015(6):154–159.

Sellars, Wilfred. *Philosophy and the Scientific Image of Man.* http://selfpace.uconn.edu/class/percep/SellarsPhilSciImage.pdf. Accessed 4/2016.