Taking Evolution Seriously

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Abstract

This paper examines evolutionary theories developed in the life sciences and explores the ways in which specific concepts and/or insights from these theories can be profitably applied to social and political institutions. First, we highlight Darwin's fundamental insight that evolutionary change depends on the uniqueness of every individual within a population or species. Because all individuals are different, they will respond to or adapt to different environmental stimuli in unique ways. Secondly, evolutionary theories begin with an understanding of change as being a *simultaneously* endogenous and exogenous process. Instead of seeing the process as one of fundamental stability (what political scientists and economists would call 'equilibrium') evolutionary theorists understand the world as a *'complex adaptive system.'*

In the second part of the paper we attempt to use some of the insights drawn from evolutionary theory to help offer insights on two current issues in political science theory: a) Where do preferences come from and b) how can we explain institutional change.

Finally, we attempt to push an analogy between genes (which are rules governing cell reproduction and behavior) and political institutions (which are also rules governing reproduction and behavior). This is the most speculative section of the paper were we essentially offer a set of propositions and some comparisons. This section – even more than the rest of this essay – is presented more as 'food for thought' than as an attempt to offer a synthetic argument.

Taking evolution seriously

> What we lack is a dynamic theory, one that endogenizes the mechanisms of transformation.
>
> (Levi 2006)

Recently, Kathleen Thelen, titled her award winning book, *How Institutions Evolve.* Yet nowhere in this book is the reader offered a definition of the terms 'evolve', or 'evolution'.[1] The point here is not to criticize Thelen's work. She is certainly not alone in invoking - but not defining – evolution. The term evolution is repeatedly used across the subfields of political science.[2] When political scientists use the term 'evolution', the reader is often left wondering as to the precise meaning of the phrase. Perhaps it is simply that the term is used rather casually – i.e. to invoke the concept of change. In most cases there is no attempt to understand the theoretical mechanisms underlying the change.

Alternatively, it could be that 'evolution' is meant metaphorically –suggesting a connected pattern of historical events. John Campbell, a sociologist, is more precise in his definition: He describes "an evolutionary pattern" as "characterized by the gradual accumulation of small, incremental changes over long periods of time" (Campbell, 2004: 5). In this case what is meant is simply that events follow one another in a connected historical pattern. In this version of 'evolution' the central idea is path dependency in that events are in fact connected to each other over time. We believe that this is what is most commonly meant when this term is invoked.

[1] Indeed, Thelen titles each of her substantive chapters of this book with the term 'evolution' (eg. "The Evolution of Skill Formation in Germany"). In her 2003 essay, *How Institutions Evolve* (43 manuscript pages) she invokes the terms 'evolve' or 'evolution' 34 times – still with no definition of the term or reference to the large body of literature which explicitly presents and/or examines various evolutionary theories (Thelen 2003).

[2] A quick search of J-store journals reveals that 134 of the catalogued political science articles in their data base used the word 'evolution' in their title or abstract between 1990 and 2006.

Finally, it is also possible that the term 'evolution' is used intentionally. In this case, when scholars write "the evolution of x or y" they actually mean to invoke *evolutionary theory* as *an explanation for* the patterns of historical and institutional change which they wish to describe or analyze.

Given the variation in the use of the term 'evolution', this essay calls for conceptual clarity and an attempt to think more systematically about the possible applicability of evolutionary theory for explaining institutional change.[3] Clearly we know that institutions change, but do they *evolve?* This essay takes this question seriously. We argue that doing so offers significant insights into the mechanisms of change. Finally, a serious look at evolutionary theory also suggests a fascinating challenge to our very understanding of the 'science' of political science.

This analysis is divided into two main parts. In part I, we present the basic ideas in evolutionary theory.[4] We show that evolutionary biologists agree on a number of Darwin's basic propositions which point to biological variation and environmental selection as the key mechanism for change. Secondly, we highlight the fact that evolutionary biology relies on somewhat different set of ontological and epistemological assumptions than are typically found in political science. Ontologically, evolutionary biologists are much more attuned to complexity and interaction, which diminishes the efficacy of reductionism. In this view, it is impossible to reduce outcomes to their constituent parts because complex

[3] We focus on institutions because these are the units of analysis of most interest to political scientists. While historians may be interested in the individuals and their influence over historical events, political scientists are typically more interested in the positions these individuals occupy and the power they thereby can exert.

[4] We are not interested here in the *political* debates surrounding evolutionary theory and whether evolution should be taught in public schools, etc.. Instead we focus on the main currents in scientific thinking within evolutionary theory.

interactions create emergent characteristics.[5] Indeed, this is a scientific framework that embraces diversity as the key driver of change. As we show, this perspective stands in contrast to scientific theories that assume homogeneous characteristics across cases and explain change exogenously.

In order to see if we can gain critical leverage on issues of concern to political scientists, part II applies this evolutionary framework to two key questions of interest to political scientists. First, we examine whether an evolutionary framework informs us about the sources of human preferences. We contend that this framework holds out the possibility of synthesizing micro-level approaches, rooted in assumptions about 'human nature', as well as macro-level structural accounts that argue preferences are constrained by institutions. Secondly, we consider whether evolutionary theory provides added insight to the study institutional change. In this section we present an analogy likening genes, which are rules governing cell behavior, to political institutions, which are rules governing political behavior. We conclude with our observations on the utility of this exercise.

Part I: What is 'evolution'?

Many social scientists incorrectly assume that there is *a single* theory of evolution. In fact, there are many theoretical components to evolutionary theory. One should note that this is not an attempt to offer a complete survey of evolutionary theory. Instead of presenting a comprehensive summary of evolutionary theor*ies,* this section focuses on specific aspects of evolutionary theory. Our goal is to highlight the most important ideas in evolutionary thought that may be relevant to the study of institutional and political change.

[5] Emergence is a concept borrowed from evolutionary biology, which captures the fact that aggregate outcomes cannot be reduced to their constituent elements. Thus certain qualities "emerge" from the complex interaction of many different factors.

A brief introduction to evolutionary theory

Charles Darwin remains the father of modern evolutionary theory. Writing in the mid-19th century, Darwin was one of many biologists interested in explaining the wide variety of species found on earth. Darwin, like several of his contemporaries, questioned the essentialist doctrine of Christian theology, which argued that there were a set number of species on earth and that species had always been fundamentally distinct from one another.[6] On the Galapagos, Darwin found many animals, which were very similar to those found elsewhere, yet also different.[7] His observations on the islands brought him to the revolutionary idea of the non-constancy of species.[8] In other words, rather than seeing life on earth divided into distinct categories (species), in which all members of a species were alike, Darwin saw phenomenal *variation* within species. This insight brought him to the conclusion that evolution was a gradual process in which different species *developed over time*. Thus, his major scientific innovation was to conceptualize variation as a key component of change. This required a rejection of equilibrium assumptions about biological life.

How did this change happen? Here, Darwin argued that the key mechanism was 'natural selection'. Since he understood that populations were composed of unique

[6] Darwin's published his theory in his *Origin of the Species* in 1858 (Darwin 1968).

[7] It is interesting to note that much political science today (particularly comparative politics) is spend typologizing. This it seems to me is analogous to the biologists' attempts to distinguish species and subspecies. Also similar is the apparent fact that no sooner is one typological set established (say, for example "Three Worlds of the Welfare State" or "Varieties of Capitalism" than other scholars rush to these typologies to find variation within them. This eventually leads others to question the viability of the category to begin with. This entire process reminds me, at least, of the pursuit of 'essential' categories for analysis. A futile effort in the natural world – no less in the political world. Again, Darwin's key insight should prepare us to *expect variation*. This does not mean that categorization or typologies are useless. On the contrary they are extremely useful and helpful. But one should not expect unit homogeneity within categories.

[8] Much of the following discussion of Darwin's ideas are drawn from Ernst Mayr's outstanding introduction to evolutionary theory, *What Evolution Is* (Mayr 2001: 83-90).

individuals,[9] he came to recognize that some individuals possessed traits that gave them an advantage in their environment. Over time individuals with advantageous traits would have greater success in the competition for food and mates. Consequently they would have more offspring than others and ultimately increase those traits within the population. In evolutionary terms, certain traits are *selected* because they are more successful in a given environment. In this way, species evolved to have different traits over time. In some cases this would mean that the entire population would change. In other cases, especially when there was geographic isolation (allopatry) populations would diverge to such an extent that new species ultimately emerged.

The problem for his theory was that he had no explanation for the source of variability. While it was clear that variation was the driver of evolution, the source of biological variation remained unexplained. According to evolutionary biologist, Ernst Mayer, "[t]his is what puzzled Darwin all of his life, but in spite of his efforts he never found the answer" (Mayr 2001: 26). Of course one has to remember that Darwin was writing in the mid 1800s, more than a half century before modern understanding of molecular biology and genetics. Thus, it was much later—in what became known as the 'modern synthesis' of genetic and evolutionary theory—that scientists came to understand that *gene mutation* was a key to this process.

Gene theory helped scientists realize that genes govern cell reproduction. Our genes tell each cell in the body how it should develop and act and pass down the historical record of all the evolutionary changes that have taken place so far within the species. In this way, genes represented the codes of biological life. (Just as a constitution represents the rules by which a political system is reproduced over time, genes encoded the historical record of the organism, enabling it to reproduce itself.)

[9] This was called "population thinking."

Genetics also helped explain individual variation within populations. Through the study of molecular biology and then genetics, scientists came to understand first how the enormous complexity of genes in an individual creates unique combinations, and secondly, that the process by which genes are reproduced (recombination) is imperfect.[10] Thus genetics provided evolutionary biologists with empirical proof of – and an explanation for - the enormous variation in individuals. Genetics can be seen as the study of the 'micro-foundations' of evolutionary theory.

Micro and macro processes of change

One of the most well known disputes between evolutionary theorists is the sometimes bitter debate between Richard Dawkins and Steven J. Gould.[11] In 1976 Dawkins published his seminal, *The Selfish Gene,* which argues that the gene is the basic "unit of selection" in the process of natural selection. He argues that the history of evolution is best understood as a competitive struggle between genes to reproduce. Dawkins does not suggest that genes are somehow sentient beings who consciously 'decide' to act in their reproductive self-interest, but rather that they behave as if they were 'self-interested' reproducers. Of course he also recognizes that genes must also cooperate with one another to create organisms, because cooperation is the most effective way genes can pass on their own genetic information to the next generation.[12] He believes that the massive complexity of life is simply and purely the product of competition between gene alliances in their

[10] Richard Lewontin puts it this way: "Any computer that did as poor a job of computation as an organism does from its genetic 'program' would be immediately thrown into the trash and its manufacturer would be sued by the purchaser" (Lewontin 2000: 17).

[11] For Dawkins' original statement and defense, see Dawkins 1976, 1982. Gould (new deceased) has published an enormous number of books and articles both critiquing Dawkins and defending his own perspectives, see Gould 1976, 1978, 1989, 1997. For an excellent and highly readable overview of this debate, see Sterelny 2001.

[12] Dawkins has subsequently lamented that he could just as accurately titled his book *The Cooperative Gene*.

struggle for survival. "In short, for Dawkins, the history of life is a history of a mostly invisible war between gene lineages" (Sterelny 2001: 9).

Gould, on the other hand, is skeptical of what he sees as the 'fundamentalism' and 'reductionism' of this theory. He believes that the individual—not only the gene—is the unit of selection. In this view, genes are simply replicators. They are the code that stores the historical memory passed on from generation to generation, but *selection* is based on the individual organisms. It is the whole organism that dies out or adapts in the evolutionary process.

Today there is fairly widespread agreement among evolutionary theorists that there are *multiple levels of selection*. Of course, scientists with different backgrounds will have different emphases, but today, few reject the idea that there selection at the gene, organism, population and (more controversially) species level.

Exogenous and endogenous change

Another point of divergence between these two theorists focuses on the relative weight given to environmental factors as the key mechanism of change. Gould and his followers place much greater weight on exogenously-driven environmental change as the major evolutionary mechanism than Dawkins. In contrast, Dawkins' is mostly a story of endogenous change.

This debate is familiar to political scientists accustomed to the concept of 'punctuated equilibrium', which was introduced by Gould in 1972. In this view one should look for large scale environmental shocks, when trying to explain large scale changes in the historical record. While these scientists do not doubt Darwin's basic insights or disagree that evolution is the product of small adaptation, but in their

view, the BIG changes in history (e.g. the extinction of entire species – as opposed to longer and shorter beaks on finches) are the product of huge cataclysmic events.

Today essentially all biologists agree with Darwin's basic propositions regarding the non-constancy of species and the fact that individual variation is the key to the evolutionary puzzle. Additionally, there is now broad agreement that genes, behavior, and environment interact in massively complex ways to produce evolutionary outcomes. From an evolutionary perspective, these variables are always interacting, thereby make evolutionary change possible. The central insight here is that one cannot understand evolutionary outcomes without examining the *interaction* between genetic inheritance and environmental influences. Evolutionary theory views both of these variables as in motion at all times. Genes are the foundational rules that govern individual development, BUT do not completely determine the development of the individual. For example, the genes of a bush direct the organism to grow branches, but the genes do not and cannot direct the specific shape or direction of these branches, instead the shape of the tree is the product of the interaction of genetic factors and the amount of wind, rain, sun, heat, cold, phosphate in the soil, loggers, and kids with pocket knives and tens of thousands of other factors. Again, this is why each individual is unique. "In fact," as sociobiologist John Alcock observes, "genes do not do anything by themselves because the information they contain cannot be expressed in the absence of many other chemicals, all of which are environmentally supplied" (Alcock 2001: 43).

Finally, because of the perpetual set of hugely complex interactions between genes, environment and behavior, it is difficult to reduce biological outcomes to their constituent components. In other words, we cannot understand each piece of the evolutionary process in isolation from one another. This is what biologists call 'emergence' — the concept that a series of unguided interactions at the micro-level

creates emergent properties at the higher levels of analysis. Just as genes at the micro-level interact to form a unique individual, individuals interact with one another within a population. These myriad interactions create a process of constant gradual change. Therefore, there is no natural static equilibrium in nature. Instead, we find a system in constant flux.

Chance

Darwin and many of his followers assumed that evolution was in some ways progressive. In other words, more 'fit' individuals, populations and species would be better able to compete with others in their local ecology. Today, it is widely understood that selection is not always purposeful or progressive. This is sometimes called *neutral selection*. In addition to adaptive changes resulting from natural selection, neutral selection views environmental change as the primary factor that advantages specific traits that previously offered none. The reverse is equally possible, where traits that had an advantage at time A could lead to extinction at time B. In other words, rather than constantly evolving in a stepwise or hierarchical pattern, random chance can and will have significant evolutionary consequences.[13]

Biology and behavior

Perhaps one of the most interesting and controversial schools of thought within evolutionary theory is in the field of 'sociobiology.' Sociobiology was defined by E. O. Wilson, one of the central figures in this school of thought as, "the systematic study of the biological basis of all social behavior" (Wilson 1975). Wilson's *Sociobiology: A New Synthesis,* builds on a large body of scientifically accepted work

[13] In point of fact, adaptationists agree with this point. The key point of disagreement here is how great the role of chance has played in evolutionary history. Adaptationists think it is there, but not central to their explanations, others like Gould, see it as an essential part of the evolutionary story.

in behavioral ecology, which attempts to show that all social behaviors can be explained as products of an evolutionary adaptation. It is obvious that many behaviors in many animal species are inherited. For example, some dog will point at birds and others will chase cats without ever having been taught these behaviors. Yet, Wilson and others began to argue that many human behaviors, motivations and preferences could be derived from basic evolutionary adaptations – both religious leaders and many social scientists began to object.

For biologists, geneticists (or for that matter evolutionary psychologists) there is no controversy over whether genes influence *human social behavior.* The real question is how much of social behavior can biology explain? Even the most committed sociobiologist accepts the view that environment and genes both affect behavior. According to James Wittenberger, "[s]ociobiology is not built on the premise that behavior is genetically determined or inflexible. It depends only on the premise that genetics *influences* behavior."[14] Given this perspective, the scientist's task is to tease out the relationship between genetically derived predispositions, on the one hand, and the environmental causes of behavior on the other.[15]

Some critics have argued that sociobiological explanations are, at best, reductionist and scientifically flawed, or, at worst, politically dangerous. These critics argue that not only do they risk excessive focus on evolutionary arguments, at the expense of other factors such as sociological learning, but such arguments could also be used to justify behaviors that are socially unacceptable. For example, some sociobiologists attempt to explain human beings' universal practice of creating 'in groups' and 'out

[14] Wittenberger, J. (1981) *Animal Social Behavior*, Boston: Duxbury Press, p. 10, cited in Alcock (2001: 43), emphasis in original. For a discussion of the subtleties here, see Alcock 2001: 46-52.

[15] This approach then pushes scientists towards the *most difficult* cases for their analyses. In other words, they will look for cases which appear contrary to their theory in order to test their theory. For a similar logic see, Tsbelis 1990.

groups' in evolutionary terms (Diamond 1992; Hartung 1995). Yet, critics fear that this research could be used to justify in-group mentality and even ultimately racism or ethnic cleansing.[16] Indeed, the perverse use of 'social Darwinism' was responsible for some of the worst atrocities of the twentieth century, and has in many respects prevented social scientists from accepting insights from evolutionary biology.

If one looks beyond the vitriol that this debate has sometimes evoked, it is now clear that there is far more agreement between evolutionary scientists than disagreement on this score. Put simply, the distinction that social scientists sometimes make between *nature* and *nurture* is false. John Ehrlich put it this way: "The nature-nurture dichotomy, which has dominated discussions of behavior for decades, is largely a false one – all characteristics of all organisms are truly a result of the simultaneous influences of both" (Ehrlich 2000: 10).

Very recently debates about evolutionary science and genetics have reemerged in the popular press. The mapping of the human genome and the enormous potential to better understand the genetic/evolutionary sources of disease, birth defects and even potentially intelligence has led some scientists to believe that we will one day be able to truly "understand" the human creature. Indeed, molecular biologist, Walter Gilbert declared that once the human genome sequence was completed "we will know what it is to be human" (cited in Lewontin 2000: 11). Others, most notably, Richard Lewontin, have argued that the reductionism implied with idea that organisms can be computed from their DNA sequence is simply hubris. He argues, "a reductionist approach to the study of living organisms can lead us to

[16] The research scientist has two basic responses to this criticism: First, they argue that finding the root causes of a behavior does not justify such behavior. Secondly, they are not genetic determinists, therefore noting a human predilection for association with people who the feel are "like us" does not necessarily translate into racism (or genocide), since what is "like us" can be strongly influenced by environmental/cultural factors.

formulate incomplete answers to questions about biology or to miss the essential feature of biological processes or ask the wrong questions in the first place" (Lewontin 2000: 109). The argument here is that, while it is certainly possible to fully dissect the human genome, humans are not simply the sum of their genes—they have emergent qualities as well. In other words, understanding genes alone will not explain how they interaction with an organism's environment. To be sure, dissecting the genome can teach us a great deal about human physiology, psychology, preferences and diseases, but it does not provide the whole picture. This implies that, when dealing with macro-level phenomena, social scientists should be circumspect about what they can predict.

The point here is *not* simply that life is too complex to be fully understood (even with ever larger and more sophisticated data sets and computers). Rather, complex systems have *emergent* qualities. What this means is that the *interaction* between constituent units in a system creates unique properties which cannot be subdivided into or derived from the specific parts.[17] This of course does not imply that reductionism is a bad scientific methodology, and/or it is useless to try to understand the parts that make up the whole. Certainly, most of the advances in physics, chemistry, medicine, engineering and biology have come from just such a strategy. The point made by Lewontin and many other evolutionary theorists is that a system is different than the sum of the parts – no matter how elaborate the algorithm.[18]

[17] An interesting and very simple example of this is water tension. Thermodynamics has shown that nothing about hydrogen and oxygen atoms could lead you to predict the water tension we observe when these atoms are combined into water. I thank Michael Grant for this observation.
[18] See Jervis 1997 for similar arguments applied to political outcomes.

Ontological and epistemological assumptions in evolutionary theory

The previous discussion of evolutionary theory implies a different scientific ontology than that commonly found in the hard sciences. At the root of evolutionary biology is the assumption that the objects of analysis—living organisms—are fundamentally different than inanimate matter. Thus, as Ernst Mayer points out, the development of biology as a science has required an investigation of "additional principles" that applied only to living organisms. He argues, "[t]his required a restructuring of the conceptual world of science that was far more fundamental than anyone had imagined at the time" (Mayr 2004a: 26). To the extent that social systems—the object of analysis in political science—are rooted in biology, then this framework requires one to evaluate an alternative scientific ontology.

First, evolutionary theory relies on the concept of *dual causation*. This means that behavior is a function of both environmental constraints and its genetic code. Indeed, this duality is also evident in the institutionalist literature, as seen in debates about the relative importance mico-level motivations and macro-level structure. Consequently, an evolutionary framework would fully support the notion that agents interact and evolve with their environment.

Secondly, evolutionary theory is the study of "complex adaptive systems" (Holland 1992). This notion accepts the importance of *emergence*, as noted above, and specifically attempts to understand the ways in which the interactions of genes, behavior and environment shape one another in a dynamic process. As we have argued, perpetual interactions between genes, environment and behavior make it difficult to reduce outcomes to their constituent components. In short, we cannot understand each piece of the evolutionary puzzle by isolating its constituent

components, due to the fact that a series of unguided interactions at the micro-level creates emergent properties at the higher levels of analysis. Just as genes at the micro-level interact to form a unique individual, individuals within a social system interact with one another within a population. The character of the whole population, then, is distinct from a simple aggregation of the constituent units. Thus, interaction is the key aspect of an emergent system, which implies that isolating factors as 'independent variables' may be an ontological fallacy.

This interactionist model of science clearly suggests a very different scientific epistemology. Similar to political science, most of the truly experimental research in biology deals with proximate causation. That is, how the genetic code causes different characteristics or behaviors. Similarly, experimental research in political psychology and rational choice scholarship focuses on how decisions are made at the individual level. In contrast, evolutionary biology focuses on ultimate causation — how the environment and history have exerted an influence on the way that individuals adapt and change over time. Indeed, we argue it is in the latter field, that the epistemological differences between biology and the physical sciences are most distinct.

This leads to a third major difference between the physical and natural sciences — *prediction*. Physicists, operating in a world of laws, are able to construct fully deterministic models that can accurately predict outcomes once the underlying components are known. In contrast, biologists focus much more on probabilistic assessment. While biologists create typologies, the greater role ascribed to chance makes it very difficult to construct a fully deterministic model.[19]

[19] Keiser, E., and Welser, T. (unpublished).

Finally, the important role of chance and geographic scope conditions, make evolutionary biology a historical science. Evolutionary biologists often research unique phenomenon, which cannot be explained by reference to laws, nor can their causes necessarily be discovered by experimentation (Mayr 2004b: 32). Consequently, the primary method of analysis is that of a *historical narrative*, which describes the influence of historical contingency and environmental factors on outcomes.

Ernst Mayer defends scientific merit of this approach in the following way:

> When asked whether or not the adaptationist program is a legitimate scientific approach, one must realize that the method of evolutionary biology is in some ways quite different from that of the physical sciences. Although evolutionary phenomena are subject to universal laws, as are most phenomena in the physical sciences, the explanation of a particular evolutionary phenomenon can be given only as a 'historical narrative.' Consequently, when one attempts to explain the features of something that is the product of evolution, one must attempt to reconstruct the evolutionary history of this feature.
>
> (Mayr 1988)

Rather than predict the future, the goal of the evolutionary biologist is to better understand the forces and dynamics that have shaped the world as we know it. Specifically they are interested in understanding how and why species adapt, prosper and sometimes die out. In other words, why is there variation across time and space? They do this inductively rather than deductively. The evolutionary biologist does not have the goal of being able to predict future evolutionary adaptations. This is not because they do not have enough data, nor because their computers are not powerful enough, but because evolutionary theory assumes that random variation can set development along totally new, and unpredictable, paths.[20] Also, some adaptations that work in one setting can be disastrous in others, which implies

[20] There is a huge literature dealing with these puzzles. Some interesting examples include: Futuyma and Slatkin 1983; Hoffman and Riley 1999; Holland 1992; Jervis 1997; Kerr 2002; Mayr 1988; Pierson 2000; Ridley 2003; Zimmer 2001.

different equilibrium. For example, some continents might have lots of marsupials, and other none. In some sense, then, the evolutionary scientist is necessarily engaged in path analysis. They are interested in understanding both why different adaptations happen in different places and the consequences of those adaptations.

Certainly, this epistemological framework might raise a number of objections from social scientists accustomed to standards of science derived from physics. For example, if explanations are constructed post-hoc and cannot be verified with experimentation, then how can they be falsified? While falsification is a worthy goal, the simple fact is that some research questions defy these standard models of scientific study. Once again, given a macro-level emphasis on the interaction of complex systems it is impossible to reduce these events to basic covering laws.[21] This perhaps explains why Popper himself began to question the utility of reductionism. Popper argues, "as a philosophy, reductionism is a failure. . .we live in a universe of emergent novelty; of a novelty which, as a rule, is not completely reducible to any of the preceding stages."[22]

Consequently theory construction in evolutionary biology resembles a process of comparative historical analysis, rather than experimentation and falsification.[23] While "just so" stories can certainly be problematic, they can be "tested" against the historical record and the probability that any particular theory is correct is constantly updated against new evidence. Indeed, within our pluralistic concept–driven field, one can already discern trends in this direction.

[21] Reductionism may be applied to functional biology that focuses on proximate causes.
[22] Quoted in, Mayer (2004: 79).
[23] Indeed, political scientists are increasingly turning to Bayesian frameworks for assessing the validity of competing theories. Thus this method may in fact be quite consistent with the overall direction of the field.

Part II: Evolutionary theory and political science

In the following section we explore the extent to which evolutionary theory has anything to offer to political science. As the reader has undoubtedly already surmised, we are sympathetic to the view that there are many insights to be gleaned from evolutionary theory. We begin the issue of human preferences. We argue that the origins of human preferences are very poorly understood by political scientists. Secondly, we contend the blanket assumptions that humans are *self*-interested utility maximizers do not sufficiently explain human preference structures. Moreover, evolutionary biology offers a more logical explanation for the origins of human preferences that is consistent with empirical evidence on human behavior and cognition.

A second line of analysis addresses one of the most common critiques leveled at dominant political science approaches–that they cannot explain change. In this section we highlight a number of insights drawn from evolutionary theories of change. We suggest that political institutions are analogous to genetic codes (they are both sets of rules) we then attempt to draw specific parallels between theories of genetic change and institutional change.

Before we enter these discussions, however, we want to address up front some of the most obvious critiques and limitations of such an analysis. As an exploratory essay, we do not suggest that biological evolution and political, institutional or historical change are exactly the same. Instead we are interested in exploring the extent to which we may be able to apply some of the insights from evolutionary theory to see if they can help us understand political behavior and change.

Does 'evolution' apply to human society and institutions?

The most obvious and significant difference between politics and biology is that human beings are sentient beings. We can *intentionally* change our own history. Of course, as Marx pointed out, Man makes his own history, but not necessarily the way he wants it. Yet the fact remains that no other organism can *decide* to change their environment. All creatures effect the environment that they live in, but none – that we are aware of – can consciously decide to change the way they affect their world. Elephants, for example, can't have a meeting and decide to stop destroying the savanna on which they forage, they must simply move on (or die) once it is depleted. Chimpanzees can't gather an assembly and appoint a leader or build a bridge. Humans can. Therefore human history is necessarily different from the history of any other creature.[24] In this view, human evolution is *qualitatively distinct* from the evolution of any other creature. Human beings are a fundamentally unique species. If this is the case, then evolutionary theories and/or insights should have no relevance or applicability to the human experience.

At perhaps the other extreme, one can argue that human's are simply the most evolved creatures on this planet. Humans are unique, to be sure, but so are gorillas, honey bees, and e-coli. The key difference between humans and other living creatures is that humans have developed the most powerful cognitive capacities, sophisticated systems of communication, and consequentially, the most complex social organizations.[25] In this view, the basic evolutionary patterns of human societies are obviously more complex than those of other creatures but logically many of the same evolutionary processes should be at work. If one accepts this

[24] Human history is even more different from the 'history' of physical objects (star clusters, molecules, atoms, or neutrons (actually, it is worth questioning whether physical objects have *history* - they certainly do not evolve in any meaningful sense of the word).

[25] Dunbar (1996) and others have suggested that this is because humans have developed the most complex societies (which is itself a product of the evolution of language).

logic, then it should at least be reasonable to suggest that human society, politics and institutions are themselves the products of evolutionary processes.

What is the 'unit' of selection?

Another key issue for political scientists interested in evolutionary theory is what is sometimes called 'the unit of selection.' This was once a major issue amongst evolutionary biologists as well. As noted above, Dawkins and other 'gradualists' argue that it is the gene (or more precisely, gene lineages) that are the central key unit that compete with one another in the evolutionary struggle to survive and reproduce. Mayr and many others have argued that this view is too narrow, because a gene lineage is not able to reproduce without the 'host' organism. In this view, it is the individual organism and/or the population in which it lives that is selected for in the evolutionary process. Finally, Eldredge (1971) and later Gould argued that in fact it is entire species that are selected in or out in the evolutionary process.[26] These controversies continue today with some scientists holding on to their favorite 'unit' as being the most important.[27] In recent years, however, there has been somewhat of a rapprochement around the idea that there are different "levels" of selection. In other words, instead of saying that *either* genes, populations, or species are subjected to evolutionary processes it is most likely that all of them are.

Similarly we suggest that that there are multiple levels of selection in the political world. Therefore, there should be multiple levels of analysis. In other words, there is clear evidence that *homo sapiens* have evolved over the past 200 thousand years

[26] See Stanley 1998 for a recent and forceful statement of these argument.

[27] It is interesting to note that (at least from the outsider's point of view) it appears that these are also disciplinary controversies. Geneticists tend to argue that genes are the key to evolution, biologists seem to argue that it is the organism and/or population that is central, and paleontologists seem to argue that the species is where the most important evolutionary processes (which in their case is extinction) takes place.

and that both physiological and behavioral evolution is continuing apace. Equally, it seems clear that there is significant competition between populations (societies/political systems), which can be seen as an evolutionary process (war is the most obvious example of this competition, but populations compete for resources in many ways). Finally, humans as a species are clearly in a competitive (and maybe losing) struggle for survival on this planet. In sum, we argue that the question "what is the unit of selection?" for an evolutionary theory of human societies and politics is a red herring. Instead, we can and should understand that there are multiple levels of selection.

Importantly, the insight that there may be different levels of selection suggests that there may be different methodological tools that are appropriate for the study of these different levels.

Genes, history and environment: Where do preferences come from?

> The dynamic nature of history implies that the centrality of beliefs – how humans form their beliefs and how they learn – is fundamental to a new social science. This in turn leads us to two inquiries: first, how the mind and brain work to understand their environment; second, how humans learn from one another, for example through culture. We also need to understand that studying the mind is not like studying the physical sciences – "it's all in your head" as they say. This makes all knowledge, at least at the first step subjective.
>
> (North 2005, 2006: 1005)

In their important volume, *Preferences and Situations*, Ira Katznelson and Barry Weingast bring together an impressive list of Rational Choice and Historical Institutionalist scholars in an attempt to see where bridges can be built and where genuine disagreements between these different schools of thought remain. They focus the book around the question of preferences arguing, "[p]references are foundational for any theory that relies on agency," and that, "[w]e know too little

about preferences, where they come from, or how they are generated" (Katznelson and Weingast 2005: 2). Interestingly, however, neither this chapter nor any of the subsequent chapters actually sheds much light on these two fundamental questions. Instead, the authors admit, "*we can derive* a form of preference based on the compelling logic of institutions embedded in particular historical situations; or at least come to understand how a given institutional *milieu both constrains and shapes* the repertoire of available preferences" (Katznelson and Weingast 2005: 2, emphasis added). However, what they do *not* do is give the reader much insight into where preferences actually come from, except to suggest (following Hall's insight) "historical developments cause a particular set of preferences held by a given actor" (Katznelson and Weingast 2005: 2, 3). In short, one of the most authoritative recent works in political science specifically focused on the formation and origins of preferences ends up arguing rather blandly that human preferences are "caused" by history.

Nowhere in this volume, however, do we see this assertion defended. Instead, each of the constituent chapters shows how preferences are constrained and perhaps shaped by the institutional, historical or strategic context facing the actors. Clearly, as argued most forcefully by Weingast in this volume, as well as many other rational choice scholars, sophisticated rationalists have backed off the narrow assumption that human motivations can be reduced to simple *homo economicus*.[28]

It is not enough, as both Sheri Berman and Mark Blyth have separately argued, to say that 'ideas' (read preferences in this instance) matter (Berman 2001; Blyth 1997). We need a better theory for explaining *where these preferences come from*. We submit that evolutionary theory offers us just this: Biology has a simple, empirically tested and ultimately reasonable explanation: All living things – including humans – want

[28] See Elster 1998, 2000; Levi 1997; North 1992; Weingast 2005.

to reproduce (to pass on their genes). This does not mean, of course, that all living organisms simply want to have sex (or divide) as much as possible. Rather, successful organisms, populations and species develop quite complicated and highly regulated behavioral strategies (rules), which facilitate their reproductive success in the context in which they live. Moreover, there is now overwhelming evidence that all living creatures *inherit* the desire to follow these rules. Whether we speak of ants, bee colonies, elephants or humans, there is no doubt that specific behavioral patterns and the impulse to follow these patterns is inherited from generation to generation (for the best early statement of this see: Wilson 1975).

Why 'reproduce' rather than 'survive' or 'maximize our *individual* self interest?' This is due to the overwhelming evidence collected by biologists that individuals (at least in all social species) simply do not consistently act in their individual self interest. In fact, all social creatures invest enormous personal resources in reproduction and the protection and future success of those who share their genes.[29]

All social beings adapt social or cooperative strategies as the best way to reproduce. Remember, one of the great insights of modern evolutionary theory was "population thinking". As Dawkins argues quite forcefully, the best way for individuals to pass on their genes is to cooperate with other individuals. Therefore, for an evolutionist there can be no clear and arbitrary distinction between the desire/need for an individual to protect itself and the need to protect its kin, family, or clan.[30] The simple and obvious fact is that social creatures do *both*. Seen in this

[29] This invites an additional discussion of how individuals will sacrifice their individual self-interest in the interest of their children, family, community, and so on. The degree of commitment/investment appears to be closely linked to the closeness of the familial/genetic connection for most social species see, Alcock 2001. We do not have space here to discuss this interesting finding at length here.

[30] There is a growing body of evidence suggesting that the more complex the brain, the larger the social group that the individual may be willing to protect. Moreover, there is good evidence that individuals are more likely to risk their individual short term self interest for those whom they are likely to share a

light, the social science battle over whether humans are "individually self-interested and rational" or are really "satisficers" motivated by "norms, rules and culture" is rather silly. Of course both sets of motivations are necessary for the survival of the species (but they can be found in different degrees in different individuals and across different societies – see the next point).

Secondly, evolutionary theory reminds us that *variety* is necessary for all reproductive strategies. The prediction from an evolutionary point of view, then, would be that there would be an enormous diversity of *individual* preferences even while the whole species is motivated by a shared preference for reproduction. Third, the current structure of our preferences is the product of *both* evolutionary adaptations to previous environmental contexts *and* our individual development. Once again, nature and nurture fundamentally shape the preference structure of every individual.[31] As Paul Ehrlich notes in *Human Natures*,

> [g]enes do not shout out commands to us about our behavior. At the very most, they whisper suggestions, and the nature of those whispers is shaped by our internal environments (those within and between our cells) during early development and later, and usually also by the external environments in which we mature and find ourselves as adults… genetic evolution and cultural evolution are not independent. They are important 'co evolutionary' interactions between them.
>
> (Ehrlich 2000: 5, 7)

The implication of this point is especially important: Since preferences grow from personal experience and species history, we should expect the following propositions to hold: 1) different populations would develop different preference clusters; 2) there would be significant variation within populations; and, 3) most people to have multiple and often conflicting preferences. If our prime motivation

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genetic bond than for those who with whom they do not share a bond (mother's to children is the most obvious case here, but the logic evidence extends much further).

[31] For example, as Alford and Hibbing show in their study, identical twins separated at birth appear to share some predilections, but it is impossible to predict their personalities.

(i.e. the origin of our preferences) is to pass on our genes and reproduce, then there are many different behaviors that may result. A society made up of purely selfish individualists could not last long. Fortunately, real human societies are made up of individuals possessing a variety of preferences and motivations, ranging from extreme selfishness to inspiring altruism.[32]

There is very strong empirical support both for the proposition that human being are both cooperators and individualist self-interest maximizers as well as for the proposition that there is significant variety in these traits within a community. Indeed, recent work even shows that there are specific parts of the human brain that influence these basic preferences (Knoch et al. 2006). Equally interestingly, these sections in the brain also seem to be related to the specific parts of the brain that stimulate preferences for reciprocity and fairness in individuals (Fehr 2006). A full discussion of this interesting research goes beyond the scope of this paper, but the point we would draw here is that evolutionary biology and experimental research are coming together on precisely the point that the human brain has evolved to advantage cooperation as well as individualism (cf. Fehr and Fischbacher 2004). In the end, this is of course highly reasonable. But it turns the rationist's fundamental dilemma (how is it possible that human's ever got together and built social institutions in the first place?) into a non-problem (Gintis et al. 2006).

Thus, this approach may be able to help resolve long-standing debates in the institutionalist literature about where preferences come from. Whether they are hardwired or structured by institutions? A balanced evolutionary approach would argue that both genetics and social structure matter. This view is expressed by Masters, who contends that "contemporary life sciences reject simple dualities and

[32] Interestingly, an iterated prisoner's dilemma game with multiple players who are all purely self-seeking rational cannot be sustained. The existence of just some players who consistently punish defectors – even when it is not in their individual rational 'self interest' – can sustain the game.

stand four-square in support of an interact ional view of human behavior" (Blank 2001: 23). Thus it is the interaction between genes and social structure that determines behavior, which, once again, implies that these phenomena should be viewed from different levels of analysis.

Along these lines, Alford and Hibbing offer an especially insightful discussion of the *interaction* of genetic and behavioral variables in explaining human behavior. They point to the fact that, while we often talk about different types of individuals, the reality is that individuals often fall along a spectrum. They illustrate this point through careful examination of twin studies and a fascinating discussion of what might be called 'types of intelligence.' Clearly, some individuals may be highly developed rational thinkers yet have very limited abilities to understand subtle messages and non-verbal clues that are necessary for normal conversation. Other individuals can be hugely empathetic and/or acutely aware of other's emotions, yet quite poor at systematic calculative reasoning. In other words, there is huge variation between individuals within any population. Now, let's think about this in an institutional and evolutionary context. Individuals grow up, live and mate within a political institutional context (or as biologists might say, an ecological context). We suggest that political institutional contexts, just like environmental contexts, are fundamental to both the behavioral actions of individuals and *also* to their reproductive strategies and success. In other words, different institutional systems should even affect the reproductive strategies of individuals.

We would push Alford and Hibbing a step further drawing from the new institutionalism on the one hand and the bio-politics literature on the other. Taken together these analyses suggest that different institutional contexts could encourage and advantage certain types of individuals and particular types of behaviors, perhaps privileging a certain set of preferences. In some institutional contexts, egoistic self-

interested behavior could be advantaged and ultimately selected for, while 'wary cooperators' would be advantaged in other institutional contexts. Over time, this could develop into something that looks suspiciously like what many would call differing political cultures.

If certain types of political institutions advantage or favor particular types of behaviors and attitudes (and we think that we can empirically show that they do) then there may be a more long run evolutionary consequence of these institutional differences than the simple fact that certain political strategies are chosen in one context over another, as rational choice scholars suggest. To be more specific, it is quite possible that James Madison et. al.'s system of check and balances which is premised on and *encourages* self-interested individuals and behaviors by explicitly pitting interests against interest, faction against faction and individual against individual actually encourages a culture of self-interested egoists.[33]

One should note that so far this has little to do with evolution per se. Sociologists who have no interest in evolution would easily agree with many of the statements above. So where is the *evolutionary* contribution? First, remember, we are talking about a spectrum of genetic and behavioral traits - where most people are really closer toward the middle than towards the ends. In addition, no matter what the ecological or institutional context, it is highly unlikely that Mother Theresa would come to behave like Karl Rove or visa versa. However, the interesting questions

[33] Just as growing up in a violent household encourages low MAOA individuals to become more violent. Just as violence prone individual may become more violent if they grow up in a violent environment, more self-centered or rationalist individual may be more self-centered if they grow up on an environment in which they see much self-centered behavior (perhaps especially if they see this behavior rewarded). Alford and Hibbing similarly suggest, "[a]cting alone, MAOA deficiencies or violent childhood have little predictive power, but the *interaction of genetic and environmental* forces is disconcertingly powerful" (p. 717, my emphasis).

arise when we put these observations into motion.... or as Paul Pierson might say, put politics into *time* (Pierson 2004).

Remember, again, that we are referring to an *interactive* process *over time*. Both experience and genes matter. Remember also that we are talking here about human beings who make conscious choices and can learn attitudes and behaviors. Consider then, even in the event that an extreme altruist and an extreme egoist should and have children. These children are most likely to inherit some parts of each parent's genetic makeup. Like most individuals they will probably be found somewhat closer to the middle of the systemizer/empath spectrum than either of their parents. As they grow up, they will learn which behaviors and attitudes are likely to be rewarded and which behaviors are discouraged in their particular institutional context. In short, if these children are raised in a country in which the institutions reward cooperation, consensus building and contextual thinking, they are likely to reinforce this aspect of their genetic predisposition and de-emphasize the more egoistic/systematic predispositions. If they are raised in a more self-seeking institutional context then the reverse would likely apply. Moreover, to come back the earlier point, as these children grow up they are also more likely to *prefer*, marry and have children with individuals who are more likely to succeed in their respective environments. This could well be like the noted phenomena that children who are abused often repeatedly seek out abusive relationships as adults. And then, of course, they are likely to exhibit violence towards their children... and the cycle continues.

NONE of this suggests any kind of genetic determinacy. Instead it should focus our attention on the *interdependence* of attitudes, behaviors, and genes over time. Moreover, this (albeit thinly drafted) logic emphasizes the role of political institutions in this story.

Co-evolution

Political institutions are created and they evolve. Institutions are created and changed by individuals who have preferences and have basic suppositions about how other people behave. If these preferences are a product of both their genetic inheritance and their individual experience then it makes a great deal of sense to consider *who* created (and/or changed) specific institutions in order to consider *why* they constructed the institutions they did. The point here is that institutions are intentionally constructed by individuals who have expectations and understandings of other people's behavior and motivations and who mean to use institutional rules to shape that behavior.

Almost every constitution begins with broad statements about human nature, but these statements could in fact be based in really quite different assumptions about human *natures*.[34] The evolutionary point is that these different institutional designs may ultimately structure or shape these different human natures. If so, they have far more important implications than the obvious fact that they help structure strategic behavior. If they advantage certain types of individuals over others (rationalist vs. contextualists, or systemizers vs. empaths) then they may also have the evolutionary effects of shaping who wins, who loses, who reproduces and who does not, and then, what we prefer.

Explaining change

Many political scientists today are groping for a better understanding of origins and mechanisms of political change. At one level this must seem surprising. What's the problem? Change happens, we all know this. The problem analytically, is that most political science models are in fact static. For the behavioralist, variable X, affects

[34] See Ehrlich 2000.

variable Y causing outcome Z. This kind of analysis can be extremely useful to explain the proximate outcome Z, but it is necessarily limited in its ability to explain change in Z other than to demonstrate that it must be related to a change in X or Y. What behavioral approaches cannot do (and perhaps are not interested in) is explain *why* there is a change in X or Y.

Rational Choice theory suffers a different problem. Clearly, RC scholars are interested in political change, but unfortunately the foundational assumptions underlying their theory lead them to predict 'no change.' This is because, Rational Choice assumes that actors will maximize their interests (and that they can know their interests) in any given institutional setting. Thus, in any given institutional framework an 'equilibrium' will be established where, "no one has the incentive to change his or her choice" (Levi 1997: 27). Consequentially the only source of change comes from outside the theory. As Levi argues, "it is obvious that choices change regularly and constantly. […] To understand these changes requires a set of hypotheses concerning what exogenous shocks or alterations to the independent variables will have what effects on the actions of the individuals under study" (Levi, 1997: 28).[35]

For rational choice, then, political change is simply produced by the fickle finger of fate. Obviously, this is not a very satisfactory theory. Still, given the foundational assumptions and logic of rational choice, "[e]ndogenous institutional change appears," as Hall and Taylor observe, "to be a contradiction in terms," quoted in (Greif and Laitin 2004).

[35] The recent 'historical' turn in rational choice is an example of this. The key point for these scholars is to show that the theorized relationship between actors holds in a wide variety of places and times. See, for example, Margaret Levi's (1998) *On Rule and Revenue,* or the widely read volume, *Analytic Narratives* (Bates et al. 1998). Morris Fiorina (1996) explores the underlying logic of this scientific enterprise. See also Lichbach 1995. For an insightful and frank discussion of the epistemological issues dividing political science see Wallerstein 2001.

Historical institutionalists have had the most success in exploring the mechanisms of political change.[36] Today the importance of time and concepts such as 'path dependence,' 'increasing returns' and 'institutional layering,' are widely accepted as central to a better understanding of political change.[37] A recent book edited by Wolfgang Streeck and Kathy Thelen, *Beyond Continuity,* pushes the agenda of understanding institutional change further than any other work to date. This excellent book brings together a group policy experts from around the world and asks them to examine cases of policy change and specifically explore the endogenous sources of this change. "A general problem in contemporary institutional analysis" they correctly note, is that it has "always emphasized structural constraints and continuity". Institutions, effectively are seen as "frozen residues, or 'crystallizations', of previous political conflict" (Streeck and Thelen 2005: 6).[38]

Streeck and Thelen thus provide a healthy anti-dote to institutionalists' reliance on 'punctuated equilibrium' models to explain institutional change making a case for what they call "gradual transformational change". Curiously, in our view at least, they argue that theirs' is not a model of 'adaptive change'. "We ask how we may distinguish 'real' change from 'superficial', merely adaptive change, and how to detect change in the absence of disruptive events leading to institutional breakdown" (2005: 2).

[36] The most important of these are Pierson 2000, 2004; Steinmo, Thelen, and Longstreth 1992; Streeck and Thelen 2005; Thelen 2004.

[37] Paul Pierson has probably been the most important single scholar pushing this agenda. Many of these concepts have been introduced to political science (though often drawn from elsewhere) by Pierson. See Pierson 1993, 2000, 2004.

[38] Going even further toward an explicitly evolutionary theory as here, Streeck and Thelen (2005: 16) tell the reader that institutions are defined by the continuous interaction between rule makers and rule takers during which new interpretations (mutations?) of the rule will be discovered, invented, rejected and maybe adopted. As a graduate student reading this paper recently commented in seminar "[t]his sounds to me like constant 0 trial and error".

We have no interest in bickering over terminology. Nor is it important that institutionalists use terminology drawn from other disciplines in the same ways that they are used in other disciplines. Still, a careful reading of Streeck and Thelen's excellent volume suggest that they *are* proposing a model of evolutionary change and it is precisely what evolutionists would call 'adaptive change'.[39] In fact we are reminded here of the somewhat tired argument between Steven J. Gould and the 'adaptationists' (noted above). But in the case of political scientists it appears that the arguments have been reversed. Evolutionary theory since Darwin has argued that the major changes in life's history have been the product of small adaptations and that the cumulative effects of these small adaptations have been immense. Gould's (1989) central argument was that life is more conservative than the adaptationists assumed and that the really big changes in life's history (which have mostly been extinctions) are the products of massive environmental shocks which "punctuate" the "equilibrium" of life.

The standard model in political science, curiously, has been closer to Gould's. We have even borrowed his terminology of "punctuated equilibrium" (see, for example, Krasner 1984; Steinmo, Thelen, and Longstreth 1992). Having adopted this 'conservative' view, political scientists end up being stuck with static models of life – only to be 'saved' from the outside. But increasingly, theorists such as Streeck and Thelen, Levi, Lieberman, Grief and Laitin, Blyth, and many others argue that 'exogenous' models of change are insufficient. Curiously, so do most evolutionary theorists. Today, as we noted above, it is widely accepted that *both* adaptation and punctuation are important parts of the evolutionary story (Mayr 2001).[40]

[39] Note that Kathy Thelen's award winning book is titled: *How Institutions Evolve*. Additionally, the substantive chapters examine changes in the 'skill formation' in four different countries. Each of the four chapters is titled, "The Evolution of….."

[40] Even Gould seems to have moved in this direction in the last years of his life (2002a, 2002b). It is the term "equilibrium" that still gives many pause. We do not know Gould's position on this term, but we

The key here is to see that there is no perfectly static state in the history of life. Change is the norm. Sometimes change can occur quite rapidly (eg. when an asteroid's impact blots out the sun for several days), but this of course is very rare. Most change is in fact slow change. But saying it is 'adaptive' does not mean that it should be understood as 'exogenous.' This is because there is an *interactive and dynamic* relationship between organisms and their environment. One may for heuristic purposes speak of independent and dependent variables. But in reality such distinctions make little analytic sense. An organism and its environment are not independent.

We think this is exactly true for institutions as well: *It is misleading to think of institutions as independent of their environment.* Consequentially, to make a clear distinction between endogenous and exogenous institutional change is also misleading. Our environment is constantly changing – and we are constantly changing our environment. The most obvious case of this today is of course, Global Warming. But this same phenomenon is ongoing all around us. Consider, for example, the relationship between the media, elections, and technology. Are any of these 'variables' independent of the others? We think not.[41]

Evolutionary theory's emphasis on the dynamic and interactive relationships between the genes, organisms and populations and environments (or institutions, individuals, and populations) presents ontological problems for political scientists if they hold onto traditional (and largely outdated) notions of what science is. We will return to this in the last section of this paper. But considering politics in this way,

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argue that it should be used only as a very general metaphor indicating that slow change. But we see few 'equilibriums' in the economic or rational choice sense in the living world.

[41] We also believe that Streeck and Thelen are in fact very close to making just the kind of argument we suggest here. For example, they tell us "[m]oreover, rather than emanating on the outside, change is often endogenous and in some cases is produced by very behavior an institution itself generates" (2005: 19).

we believe, allows us to see political history as it is – a complex adaptive system. Rather than as an idealized model divorced from reality.

In sum, we suggest that evolutionary theory offers a framework for understanding sources of endogenous *and* exogenous changes. Moreover, it also provides an explicit theoretical framework for understanding how these sources of change interact in an incremental process. First, evolutionary theorists point to replication as the primary means of endogenous change. This occurs because of the imperfections in how institutions are replicated. Formal institutional rules, like genes, do not determine how institutions are reproduced. The turnover of individuals in formal positions will inherently cause institutions to change incrementally. If genes cannot be replicated perfectly, then one would expect political institutions to be even less precise in how they are replicated over time.

Based on an understanding of evolutionary theory, we put forward a number of hypotheses regarding institutional replication. In the following section we offer a number of suggestions attempting to suggest how insights from evolutionary theory might be profitably adopted and/or used in political science.

Are institutions the genes of politics?

In this section of this paper we attempt to push a metaphor. The readers will hopefully see these ideas as more 'food for thought' than as a worked out argument that we stand behind and are willing to defend. But in the spirit of seeing how far the metaphor of evolution can stretch into politics we offer the following: *Biologists understand an organism's genetic code is a set of rules that structure the development and*

behavior of particular cells in an organism.[42] We suggest that political institutions perform very similar functions in the body politic. If so, perhaps examining the ways in which genes reproduce and change that can offer insights into both institutional stability and change.

Genes rarely act alone. Therefore change is typically quite slow. Most physical and behavioral attributes are directed by many genes and these genes interact in massively complex ways. Consequentially, changes in one gene rarely have an effect on others. But when multiple changes coincide, there can be very important long term consequences. Similarly, political institutions rarely 'act alone.' (For example, no single institution controls tax policy.) Instead dozens (or hundreds) of different institutions interact in massively complex ways to shape a country's political system.

The massive complexity of gene interaction combined with the fact that the interaction between genetic rules and environmental context leads to *variation* across individuals. Not even clones are perfectly alike. Similarly, the massive complexity of the interaction between institutions results in significant variation across similar political systems. Even when specific institutions have been cloned (eg. Westminster Democracy in Africa) the political systems that result are very different.

Certainly there are important differences between genes and institutions – even if both can be understood as rules that are inherited, are imperfectly replicated, and must be understood as part of the environment in which they live. Recalling a discussion above, we note that a key difference that is immediately apparent is that institutional innovations/mutations can be intentionally adopted in other institutions. A gene (or for that matter an organism) cannot look over at another

[42] The on-line encyclopedia *Wikipedia,* offers the following definition for 'genetic code': "The **genetic code** is a set of rules that maps DNA sequences to proteins in the living cell, and is employed in the process of protein synthesis".

gene/organism and say, 'hey, that's a good way of doing that' and then attempt to copy the innovation. Human's can – imperfectly, to be sure.

This last point brings us to the question of the role of "ideas" in politics. Most political scientists are dissatisfied with an understanding of politics and political change that excludes the role of ideas. Only hard bitten materialist truly believe ideas do not matter. Still, there can be no gainsaying that ideational variables have had a hard time finding a place in traditional political science theory. While this may stretch the readers' tolerance one step to far, we suggest that even "ideas" can be understood in evolutionary terms: If institutions are the genes (rules) in a political system, then perhaps "ideas" can perhaps be seen as mutations. Most actors, most of the time, follow the rules. But occasionally (generally because there has been some kind of environmental change) individuals can decide to *not* follow the normal patter or rules. As Blyth suggests, this is most likely to occur in periods of "Knightian uncertainty" (eg. where it is difficult to really know what is in your interest or which rules one should follow) that results in an opening in the environment which can allow for space for the new ideas to 'fit' the new reality (Blyth 2002). At any rate, we see a politically actionable idea as a decision not to behave in the prescribed pattern. It is, at minimum an innovation and deviation from the rule.

Gene reproduction is a highly imperfect process. However, most "mutations" are screened out by the organism. Sometimes, however, a mutation is reproduced – eg. when it finds itself in favorable environment. These mutations can sometimes prove beneficial to the host organism, at other times they can literally kill the host organism. Similarly, most ideas are selected out, destroyed and/or ignored. But rarely – when the environment is conducive to change - an idea (or a mutation) can

offer the institution some advantage. Others may even come to accept and perhaps even adopt this idea.

If a genetic innovation/mutation yields advantages to the individual in his or her competition for resources or mates, this trait is likely to grow slowly over time within the population. Similarly, if institutional innovations/mutations offer the institution advantages in its competition for resources (budgets, personnel, policy domain?) the institution is likely to grow (be reproduced?) within the body politic. (For example, innovations are constantly being measured by whether they perform in a given environment. In essence those policies do not perform will be disregarded for new policy ideas that hold out the possibility of better performance.)[43]

To be sure, this framework requires scholars to adopt a different ontological position. Rationalists must recognize that preferences and behaviors are not as homogenous as they often assume. Historicists must accept that history and exogenous structures are not as stable as they assume. In short, both preferences and situations vary, and it is the interplay between these gradual sources of change that drives evolution.

Conclusion: Political science and physics envy

> I was equally disappointed by the traditional philosophy of science, which was all based on logic, mathematics, and the physical sciences, and had adopted Descartes' conclusion that an organism was nothing but a machine. This Cartesianism left me completely dissatisfied. […] Where else could I turn?
>
> (Mayer 2004b)

[43] Performance is based on preferences of that political system. Usually we assume performance to be based on economic growth or the expansion of power; however, it could also be based on other preferences, such as social equity or stability.

Mainstream of political science has adopted a model of science based in large part on the hard sciences of physics and chemistry. As Alan Zuckerman has said, "[positivists] envision a world composed of linear relationships among variables, parity in the size of cause and effect, recurrent patterns over time, and the fundamental insignificance of chance happenings (Zuckerman 1997). According to James Farr, political science's move in this direction was the outgrowth of a much broader intellectual movement in the social sciences, which began much earlier in the 20th century. The intellectual thrust of this movement was to "[s]tudy political behavior according to the canons of scientific methodology" (Farr 1995: 201). 'Scientific methodology' meant adopting reductionist and deterministic models that characterize Newtonian physics. Causal processes are to be reduced to their constituent variables, which could then be examined according to deterministic mathematical relationships. In so doing, it was hoped that models would be developed that would uncover the general laws of politics. Farr summarizes, "the very aim of science, it was argued, was to discover laws or law like generalizations that organized and explained the facts" (Farr 1995: 203). Zuckerman agrees, "the established goals of comparative politics reflect these standards. As comparativists propose cross-national generalizations, they posit covering laws" (Zuckerman 1997: 279).

We submit that this commitment to a scientific ontology drawn from the physical sciences misleads political scientists. The Laws of physics are based on the constancy of the physical world.[44] Unfortunately, the conditions upon which these sciences are built do not exist in politics. The study of politics (like biology) is by definition the study of unique events. We suggest that a model of science rooted in the natural

[44] We are aware that modern physics has also moved from these stable assumptions. Not only does Quantum Physics challenge many of Newton's basic assumptions, 'String Theory' goes even further arguing that it is theoretically not falsifiable.

sciences is a more appropriate framework for political science.[45] From a natural science perspective, efforts to create deductive models of political activity are inadequate both because context and time matter (Pierson 2004) and mechanical models do not help us to understand iterative and dynamic relationship between preferences, behavior and outcomes.

Evolutionary theory thus provides a more appropriate framework for understanding political outcomes because it offers a dynamic theory of politics. Evolution assumes change, not equilibrium. Secondly, evolution's focus on dual causality offers the chance to account for both micro and macro-level dynamics and therefore even holds out the possibility of reconciling some of the longstanding debates within the field, because it can explain why humans can behave egoistically in some settings and altruistically in others. Thus, following several others, we contend that evolutionary frameworks hold out the possibility of uniting different subfields as well as different social sciences under a natural science framework.[46]

In conclusion, in this paper we have tried to take a look at evolutionary theory in the biological sciences with an eye toward the relevance of these theories for the study of politics. In the end, we find the metaphor interesting and useful. While we do not suggest that human institutions and history evolve in exactly the same ways as biological evolution, we do believe that there are many insights that can be gleaned from evolutionary theory that *are* appropriate for the study of politics. It is interesting to note, finally, that in a wide variety of fields, from economics, to psychology, to anthropology, and sociology cutting edge theorists are taking evolution seriously. We submit that political scientists should too.

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[45] For a similar argument in Sociology, see Liberson and Lynn (2002) *Barking Up the Wrong Branch*.

[46] See, for example, Alford, J. R., and Hibbing, J. R., (2004) "The Origin of Politics: An Evolutionary Theory of Political Behavior", *Perspectives on Politics*, 2 (4), and Blank, R. H., & Hines, Samuel M., (2001). *Biology and Political Science*, London: Routledge.

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