Taking Evolution Seriously:
Institutional Analysis and Evolutionary Theory

Orion Lewis and Sven Steinmo

"What we lack is a dynamic theory, one that endogenizes the mechanisms of transformation."

-Margaret Levi, American Political Science Association, Presidential Address, 2006.

In recent years there has been an explosion of interest in evolutionary theory in wide variety of scientific domains. In fields as diverse as computer science, philosophy, economics, sociology, psychology, biology, and anthropology "evolutionary thinking" (Dennett 1995) has come to the forefront of the discipline. Political scientists use the term "evolution" quite often as well, but generally they use it rather casually – i.e. to invoke the concept of change – without really understand the theoretical mechanisms underlying evolutionary change. For most political scientists, "evolution" is generally meant to infer some basic type of the historical path in which events are connected to each other over time.

We argue in the following essay that political science generally, and new institutionalists in particular, should take evolutionary theory more seriously. While some social scientist have long been interested in applying evolutionary theories to social systems,[1] there are a relatively small number of political scientists who have examined these theories' implications for political and institutional development.[2] We suggest that this lacuna grows out of the fact that evolutionary theory operates from an ontological position quite different from the Newtonian physics based ontology commonly adopted in traditional political science. While many political scientists are clearly dissatisfied with the physics based ontology, they have not generally explored the alternative theories originally developed in the life sciences. In this essay we offer a modest introduction into evolutionary theories and suggest that in doing so we gain substantial insights into some of the most confounding problems facing institutionalist scholars today.

The analysis is divided into three main parts. In part I, we present a basic overview of some of the key concepts in evolutionary theory. We focus largely on evolutionary theories originally developed in the biological sciences. We show how evolutionary has built on and developed

[1] See Veblen 1898, Schumpeter 1934, Spencer and Peel 1972, Boulding 1981.
[2] There is growing interest in applying evolutionary theories in political science as well. See Axelrod 1984, Masters 1989, Hodgson 2002, Alford and Hibbing 2004, Thayer 2004, McDermott 2004, Alford, Funk, and Hibbing 2005, Modelski 2007a, Fowler et al. 2008.

Darwin's key propositions that point to biological variation and environmental selection as the key mechanism for change. In part II, we highlight the distinctive ontological and epistemological positions necessary for evolutionary theories.[3] Whereas much political science assumes "equilibrium," evolutionary theory is explicitly dynamic and is specifically interested in interdependent relationships and the emergent characteristics of complex interactions.[4] In part III, we apply this evolutionary framework to two key questions of interest to political scientists. First, we explore the implications of evolutionary theory for our understandings of human preferences. We contend that evolutionary theory 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 shaped and constrained by institutions. Secondly, we consider the implications of evolutionary theory for the study of institutional change. We argue that this framework builds on recent innovations in the literature on endogenous institutional change, because it provides a meta-theory that helps to explain as well as tie together many of the mechanisms of change outlined by new institutionalists. In this section we present an analogy likening genes, which are rules governing cell behavior, to political institutions, which are rules governing political behavior.

Part I: An Introduction to Evolutionary Thought

This essay does not attempt to offer a complete survey of evolutionary theory. Our goal is to highlight the most important ideas in evolutionary thought that are relevant to the study of institutional and political change. We begin with a brief introduction to the history of evolutionary thought in order to orient and provide background to ideas that are already vaguely understood by the educated reader. We specifically explore some of the most prominent recent debates in evolutionary theory focusing on those that have explicit implications for the study of politics. We conclude this section by outlining some of the most recent writings in "evolutionary thinking" specifically directed towards explaining human social evolution.

Variation: The Key to Evolutionary Change

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

[3] Geoffrey Hodgson argues that evolutionary thinking evokes a "movement from analogy to ontology" (Hodgson 2002).
[4] Emergence refers to the concept that aggregate outcomes cannot be reduced to their constituent elements. Thus certain qualities "emerge" from the complex interaction of many different factors.

had always been fundamentally distinct from one another. On the Galapagos, Darwin found many animals that were very similar to those found elsewhere, yet also different. His observations brought him to the revolutionary idea of the non-constancy of species. In other words, rather than seeing life on earth divided into distinct categories (species), in which all members of a population were alike, Darwin saw phenomenal variation within species.[5] This insight brought him to the conclusion that evolution was a gradual process in which different species changed over time. Thus, his major scientific innovation was to conceptualize variation as a key component of gradual change. This required a rejection of previously held equilibrium assumptions about biological life.

How did this change happen? Darwin argued that the key mechanism was "natural selection." Because he understood that populations were composed of unique individuals,[6] 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 resources and mates. Consequently, they would have more offspring than others and ultimately increase those traits within the population. Thus, 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 in instances of geographic isolation (allopatry) populations would diverge to such an extent that new species and categories ultimately emerged.[7]

The problem for Darwin's theory was that he had no explanation for the source of variability. Although it was clear that variation was the driver of evolution, the source of biological variation remained unexplained. According to evolutionary biologist Ernst Mayer, "This is what puzzled Darwin all of his life, but in spite of his efforts he never found the answer" (see, Mayr 2001: 26). Of course 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

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[5] It is interesting to note that much effort in political science today (particularly comparative politics) is spent typologizing. This is analogous to the biologist's early attempts to distinguish species and subspecies. Also similar is the apparent fact that no sooner is one typological set established, for example "Three Worlds of the Welfare State" or "Varieties of Capitalism," then other scholars rush to criticize these typologies because they don't accurately describe a particular case. This eventually leads others to question the viability of the category to begin with. This entire process reminds one of the pursuit of essential categories of analysis—a futile effort in the natural world, much less in the political world. Once again, Darwin's key insight should prepare us to *expect variation*. This does not mean that categorization or typologies are useless—indeed they are extremely useful--however one should not expect unit homogeneity within categories. For an excellent discussion of these issues in the biological world see (Goodwin 1994).

[6] This was called "population thinking."

[7] It is interesting to note that it was 19th century sociologist Herbert Spencer who coined the term "survival of the fittest" and *not* Charles Darwin.

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 provide the rules that tell each cell in the body how it should develop and act, and they pass down the historical record of all the evolutionary changes that have taken place so far within the species. In this way, genes represent the codes of biological life. Genetics also helped explain individual variation within populations. Through the study of molecular biology and then genetics, scientists came to understand, first, that the enormous complexity of genes in an individual creates unique combinations, and secondly, that the process by which genes are reproduced (recombination) is imperfect.[8] Thus genetics provided evolutionary biologists with empirical proof of—and an explanation for—the enormous variation across individuals. Genetics, then, is the study of the "micro-foundations" of evolutionary theory.

Evolution Operates at Multiple Levels

In 1976 Richard Dawkins published his seminal work, *The Selfish Gene,* in which argued that the gene is the basic "unit of selection" in the process of natural selection. As Dawkins saw it, the history of evolution is best understood as a competitive struggle between genes to reproduce. This argument has evoked enormous controversy and misunderstanding in the three decades since it was written. Dawkins did 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. Indeed, Dawkins explicitly recognized that genes must 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.[9] He held that the significant complexity of life is the product of competition between gene alliances in their 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).

In contrast, another prominent evolutionary biologist, Steven Jay Gould argued extensively against Dawkins' views.[10] Gould contended that the individual—not the gene—is the unit of

[8] 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).

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

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

selection. In this view, genes are simply replicators. They are the codes that store the historical memory passed on from generation to generation, but selection takes place at the level of the organism. It is the whole organism that dies out or adapts in the evolutionary process.

The great evolutionary theorist, Ernst Mayr, along with many others reminded researchers that a keystone of Darwinian evolution, what he called "population thinking," rejected the dualism implied in the debate between Gould and Dawkins. He argued that not only genes and individuals subjected to the competitive pressures that drive evolutionary change, but groups and entire populations as well (Mayr, 2001: 75-770). Even Dawkins (1982) later embraced multi-level theories of selection. Today there is fairly widespread agreement among evolutionary theorists that there are *multiple* levels of selection. Of course, scientists have different emphases, but few reject the idea that selection operates at the levels of genes, organisms, populations and, more controversially, species. Thus, we find a trend against reducing the evolutionary process, towards embracing ontological complexity, as analysts such as Plotkin (1994) have embraced a "hierarchically structured" evolutionary theory (101).

An Interactionist Paradigm

Today essentially all biologists agree with Darwin's basic proposition regarding the non-constancy of species and key role individual variation plays in the evolutionary puzzle. Additionally, there is now broad agreement that genes, behavior, and environment interact in extremely complex ways to produce evolutionary outcomes. From an evolutionary perspective, these factors are always interacting, thereby making gradual evolutionary change possible. The central insight is that one cannot understand evolutionary outcomes without examining the *interaction* between genetic inheritance and environmental influences. Evolutionary theory views each as being in motion at all times. Genes are the foundational rules that govern individual development, but they are not completely deterministic. For example, the genes of a bush direct the organism to grow branches, but the genes 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 with environmental ones such as the amount of wind, rain, sun, temperature, phosphates, and thousands of other factors. "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).

In addition, due to perpetual complex interactions among genes, behavior and environment, it is difficult to reduce biological outcomes to their constituent components. This leads to what biologists call "emergence"— the notion that a series of unguided interactions at the micro-level creates emergent properties at the higher levels of analysis. These emergent qualities are a product of complex systems, and cannot be reduced to an understanding of foundational variables. These myriad interactions are the drivers of constant gradual change. Therefore there is no natural static equilibrium in nature. Instead, we see a system in constant flux.

Biology and Behavior

Perhaps one of the most interesting and controversial schools of thought within evolutionary theory is in the field of "sociobiology," which was defined by E. O. Wilson, a central figure 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 in behavioral ecology, which attempts to show that all human social behaviors can be explained as products of evolutionary adaptation. It is obvious that many behaviors in animal species are inherited. For example, some dogs point at birds and others chase cats, each without ever having been taught these behaviors. However, when Wilson and others argued that many human behaviors, motivations, and preferences could be derived from basic evolutionary adaptations, religious leaders and many social scientists began to object to what they saw as biological determinism.

Some critics have argued that socio-biological 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 genetic programming, 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 socio-biologists attempt to explain human's universal practice of creating in groups and out groups in evolutionary terms (Diamond 1992; Hartung 1995). Yet, critics fear that this research could be used to justify an in-group mentality and even ultimately racism or ethnic cleansing.[11] 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.

[11] 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 factors and is a social construction.

This vitriolic debate centered on a false duality and misconceptions about evolutionary processes. For biologists, geneticists, or 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 that environment and genes both affect behavior. According to James Wittenberger, "Sociobiology is not built on the premise that behavior is genetically determined or inflexible. It depends only on the premise that genetics *influences* behavior."[12] 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.[13]

If one looks beyond the vitriol that this debate has sometimes evoked, it becomes clear that there is far more agreement between evolutionary scientists than disagreement. Put simply, the distinction that social scientists sometimes make between *nature* and *nurture* is false. "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). In fact, this more moderate perspective has generated a burgeoning research agenda on the genetic foundations of human behavior. Advances in genetics and neuroscience techniques have facilitated research into these ongoing questions, including their application to political phenomena (Alford et al. 2005, Fowler, Baker and Dawes 2008).

[12] James Wittenberger, *Animal Social Behavior*, 1981, Boston: Duxbury Press, p. 10, cited in (Alcock 2001: 43) emphasis in original. For a discussion of the subtleties here see Alcock, pp. 46-52.
[13] 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).

Part II: Key Ontological and Epistemological Assumptions in Evolutionary Theory

"[A] substantial gap has opened up between the methodologies popular in comparative politics and the ontologies the field embraces" (Hall 2003:374).

The previous discussion of evolutionary thought necessarily broaches the issue of ontology, because a less reductionist approach is required for explaining gradual change. At the root of evolutionary theory is the ontological assumption that the objects of analysis—living organisms—are fundamentally different than inanimate matter. As Ernst Mayr points out, the development of biology as a science has required an investigation of "additional principles" that apply only to living organisms argues, "This 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, or even follows similar processes of selection and replication, then one must consider this 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.[14] Consequently, an evolutionary framework would fully support the notion that agents interact and co-evolve with their environment.

Secondly, evolutionary theory is the study of "complex adaptive systems" (Holland 1992). This notion accepts the importance of interaction and emergence, as noted above, and specifically attempts to understand the ways in which interactions of genes, behavior, and environment shape one another in a dynamic process. In short, we cannot completely understand 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 population interact to replicate institutions. The character of the whole institution, 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 suggests a very different scientific epistemology. In biology, most of the truly experimental research deals with proximate causation—i.e. how the

[14] For similar arguments in social history see (Sewell 1992).

genetic code causes different characteristics or behaviors. Similarly, experimental research in political science often focuses on how decisions are made at the individual level. In contrast, evolutionary theory focuses on ultimate causation—how the environment and history have exerted an influence on the way that individuals adapt and change over time. It is the macro-level causal explanation that is supplemented with auxiliary theories at lower levels of analysis.

This leads to a third major difference between the physical and natural sciences—*prediction*. Many believe that physicists, operating in a world of constant laws and are therefore able to construct fully deterministic models that can accurately predict outcomes once the underlying components are known.[15] In contrast, biologists focus much more on probabilistic assessment. Although biologists create typologies, the greater role ascribed to chance and emergence makes it very difficult to construct a fully deterministic model (Kiser and Welser 2006).

Finally, the important roles ascribed to chance and geographic scope conditions make evolutionary biology a historical science. Evolutionary biologists often research unique phenomena that 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 *historical narrative* that 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).

Instead of accurately predicting the future, the goal of evolutionary biologists is to 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.

[15] The reality of modern physics is substantially more complex than this. The Newtonian/Cartesian vision of the th phycisal world as being as finite set of fixed and stable constants governed by universally applicable laws has been abandoned by physicists since Einstein. The fact that so many economists and political scientist have assumed a model of science no longer used by physical scientists is an ironical story in itself. For an excellent history of how economists took this turn, see Eric Beinhocker, 2006.

Evolutionary biologists do not have the goal of being able to predict future evolutionary adaptations, not because they do not have enough data, nor because their computer models are not powerful enough, but because evolutionary theory assumes that random variation within complex systems can set development along totally new and unpredictable paths.[16] Moreover, some adaptations that work in one setting can be disastrous in others. For example, marsupials may thrive on one continent but not in another. For these reasons, evolutionary scientists are necessarily engaged in path analysis. They are interested in both explaining adaptations and understanding the consequences of those adaptations.

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 one cannot use experimentation, then how can they be falsified? Although falsification is a worthy goal, the simple fact is that some macro-level research questions defy these standard models of scientific study. Given a macro-level emphasis on the interaction of complex systems, it is impossible to reduce these events to basic covering laws.[17] This may explain why Popper himself came to question the utility of reductionism arguing that "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."[18] Consequently theory construction in evolutionary biology resembles a process of comparative historical analysis, rather than experimentation and falsification.[19] While "just so" stories can be problematic, they can be "tested" against the historical record and the probability that any particular theory is correct can constantly be updated against new evidence.

In the following section we argue that this ontological shift towards complexity is a foundational element of the emerging literature on institutional change, albeit one that has not been stated explicitly. For example Streeck and Thelen (2005) argue for a definition of institutions as "regimes" of layered rules, norms and behaviors. Similarly Hall and Thelen (forth) assert that there are often multiple agents of change at various levels of analysis. Both of these moves towards less reductionism indicate an implicit ontological view of institutions that comes much closer to that of

[16] 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).
[17] Reductionism may be applied to functional biology that focuses on proximate causes.
[18] Quoted in, Mayer, Ernst (2004). p79.
[19] 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.

complex adaptive systems. In the following section we argue why a deeper discussion of evolutionary theory provides a value-added to the study of gradual institutional change.

Part III: Evolutionary Theory and Institutional Analysis

What does evolutionary theory have to offer political science? We argue that it provides insight into both micro and macro level institutional dynamics. First, it is widely acknowledged that human preferences are poorly understood by political scientists. We argue that evolutionary biology offers an explanation for the origins of human preferences that is consistent with empirical evidence on human behavior and cognition. Secondly, we argue that evolutionary theory provides a meta-theoretical framework that helps researchers understand the mechanisms of gradual change. We suggest that political institutions are analogous to genetic codes—they are both sets of rules—drawing specific parallels between theories of genetic change and institutional change.

Is Evolution a General Theory?

Richard Dawkins is credited with coining the phrase "Universal Darwinism" which refers to the idea that evolutionary processes can be reduced to a very simple algorithm: variation, selection, retention. In this view the evolutionary algorithm does not just apply to biological phenomenon, but is instead a universal phenomenon that applies to a wide variety of systems. "Modern evolutionary theorists," Eric Beinhocker summarizes, "believe that, like gravity, evolution is a universal phenomenon meaning that no matter whether the algorithm is running in the substrate of biological DNA, a computer program, the economy, or the substrate of an alien biology on a distant planet, evolution will follow certain general laws in its behavior" (Beinhocker 2006: 12).

Philosopher Daniel Dennett builds on Dawkins notion of a Universal Darwinism arguing natural selection can be seen as a simple algorithm that can be used to explain evolutionary change *writ large* (Dennett 1995).[20] Noting Darwin's insight that the core evolutionary mechanism is *variation* he suggests that for evolution to occur in any substrate there must be a mechanism generating variation. As we saw above, in biology this mechanism is random genetic variation. Dennett suggests, however, that this need not be the only generator. Next there must be a mechanism for *selection*. In the biological world, mutations variations are repeatedly tested within the environment. It is through the repeated tests of the environment on the genetic mutation that natural selection occurs. Darwin never used the term, "survival of the fittest,"[21] what he meant by

[20] For a cautionary note in this regard see (Nelson 2007). But also see Gary Cziko, *Without Miracles,*

[21] It was sociologist Herbert Spencer who coined this phrase.

natural selection was that some behavioral or physical traits, for example the ability to swim or better eyesight, might give some competitive advantage to individuals or populations in the universal competition for resources. Individuals or populations that possessed these favorable traits are more likely to succeed in their environment than those that do not. In other words, random variation would not create *evolutionary* changes unless some of those variations gave some advantage to the carriers of the trait. Finally, these new traits must be *retained* or passed down to subsequent generations. It is not enough that an individual or group possess an advantageous trait, they must also be able to pass this trait down to subsequent generations.

Evolutionary economist Geoffrey Hodgson (2002) summarizes these ideas by arguing that the key element of an evolutionary system is "imperfect inheritance." As long as the object of analysis, whether it is an organism or institution, displays this mechanism, then one should expect evolutionary processes to take place (272). Inheritance means that successful adaptations will be replicated, but the imperfect nature of that replication ensures that there will continue to be variation. In sum, in it simplest form evolution can be presented seen as a universally applicable algorithm: variation, selection, retention, and whenever the process of retention is imperfect, then we should expect evolutionary dynamics at work.

Universal Darwinism has raised objections from critics who contend that humans are uniquely intentional in their behavior and as such "biological analogies" do not apply to human socio-economic development. Clearly one of the unique features of socio-economic evolution is that humans have highly developed cognitive capacities. We are self-conscious, capable of building and sustaining highly complex social organizations and able to quickly learn and copy behaviors from others. Many animal species learn and can even copy behaviors of others, but humans have the most developed capacities for learning from one another.

However, none of these factors prove that the general evolutionary algorithm does not apply to human societies. As Hodgson (2002) argues the existence of the basic evolutionary elements in human societies means that all social systems are subject to these processes (272). The key research question is: how does human socio-economic evolution differ from other species? Indeed it is clear that the specific process of evolution in human societies are very different than in other species due to our capacity for building complex structures and the speed by which new ideas and behaviors are learned. Some institutions provide members with competitive advantages, the most obvious

examples being wealth and military strength, and these institutions can be copied by other groups.[22] This means that we must develop auxiliary theories that help to fill in the picture of how these processes work in human societies. For example Hodgson points out that the mechanisms of socio-economic replication—routines, norms and institutions—are very imperfect when compared to DNA (272). Secondly, selection may not involve the death of a particular organism but can in fact take place during the life of social institutions based on their relative success in a given time period. Finally when combined with the human capacity for learning and copying successful behaviors, we, along with many others argue that human evolution may in fact be much more rapid than in other species because some of the mechanisms by which it takes place—e.g. the transfer of ideas—are different.

Understanding Institutional Evolution

We argue that gradual institutional change can be understood as the product of fundamental evolutionary algorithm outlined above. Over the past 30,000 years as humans moved from hunter-gatherer societies to more complex social structures, there have been a huge number of innovations that have been tested and tried. The vast majority of these were unsuccessful and never repeated or copied. Some, however, have been selected and copied by individuals who could calculate the advantages of the new "idea." Occasionally an innovation provided a population with an advantage in their competition with other groups for resources. Sometimes those groups that adopted these innovations literally conquered other groups and imposed their institutions on them. At other times, other groups simply copied the successful innovations of the more successful groups and adapted them to their local environment. Darwin described the process this way: "A tribe including many members who, from possessing a high degree the spirit of patriotism, fidelity, obedience, courage and sympathy, were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection" (Darwin 1874).

It is easy to see such processes working in the areas of national security and international relations, but it may be less obvious how this basic process applies to domestic institutions which have more subtle implications for a society's search for power and wealth in competitive environment.

[22] For example, Gureck et al. have shown that humans adapt their institutions and behaviors when they see other groups which use strategies or institutions that yield higher payoffs (Gureck, Irlenbusch, and Rockenbach 2006).

As stated earlier, the key to understanding how evolutionary processes change domestic social institutions requires making an ontological shift that views them as complex adaptive systems. Institutions are defined as layered and sometimes overlapping sets of rules and norms that determine behavior. Many are interdependent with one another. In this sense, a political system is analogous to a biological system.[23] Thus a particular political system is actually a complex of interdependent rules. In this regard political systems are phenotypes—they are reified concepts that denote a more complex structure. Social scientists discuss "capitalism," "France" or "Congress" as if they were actual objects or actors. However, everyone understands that these are actually complex sets of rules that imperfectly fit together as a whole—leading to variation—and are imperfectly replicated over time.

In recent years 'new institutionalists' have gradually revised their conception of institutions from one that viewed institutions as independent, self-reinforcing and essentially stable constraints on behavior to one that views institutions as embedded within the broader institutional milieu of a polity. First, scholars increasingly adopt the view outlined above, where institutions are defined as sets of rules norms and beliefs that themselves are embedded within a broader institutional context. For example Grief and Laitin (2004) argue, "Within any organization, or around any set of rules, there are subsets of coordinated elements that are themselves institutions. Institutions can be identified therefore at different levels of aggregation." (640). Similarly, Streeck and Thelen (2005) define institutions as a "social regime" which is constituted by a set of rules that clarify desired behavior and that which is unacceptable (12). By defining institutions new institutionalists have made an ontological shift that mirrors the one outlined in evolutionary theory.

Biological systems-even the human body–are not perfectly designed organisms but are constantly adapting and evolving. Evolutionary theory's emphasis on the dynamic and interactive relationships among genes, organisms, populations and environments, or in political science terms, institutions, individuals, and populations, focuses attention on the imperfect replication that is inherent in this process. However this broad meta-theoretical framework does not explain variation

[23] Phenotype: "the observable characteristics of an individual (or system) resulting from the interaction between the genotype (rules) and the environment" (Oxford American Dictionary). For example, a zoologist might describe a particular animal but they are in fact examining an enormously complex biological system. No zoologist could hope to explain every genetic and behavioral detail of a complex organism. Instead they simplify and reify the concept as a phenotype that can be compared with other phenotypes.[23] The zoologist or biologist never forgets, of course, that the organism is in fact a massively complex system of interdependent and often imperfect genetic rules.

in the mechanisms and pace of that evolution can across species and over time. This is equally true for cultural systems and social institutions as well.

In sum, we suggest that evolutionary theory offers a framework for understanding sources of gradual endogenous institutional change. It also provides an explicit theoretical framework for understanding how various sources of change interact in an incremental process. Evolutionary theorists point to replication as the primary means of endogenous change due to the imperfections in how institutions are replicated. Building on this understanding of evolutionary theory, the following section puts forward a number of preliminary hypotheses and outlines the remaining research agenda for understanding institutional replication and endogenous institutional change.

Preferences, Culture and Institutions

"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." (North 2005)

"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 2006: 1005).

The search for a better understanding of human preferences is one of the most pressing issues in political science. More than 15 years ago, Peter Katzenstein noted that one of the key differences between rational choice (RC) and historical institutionalism (HI) is that rational choice scholars assume humans possess a constant and universal set of basic preferences[24] whereas historical institutionalists are critically interested in explaining why preferences vary across time and space (Steinmo, Thelen, and Longstreth 1992). The reason that it is important to understand preferences is that policy-makers must consider both their own preferences as well as those of the rule takers when they build institutions. We know that institutional design itself constrains behavior, because as historical institutionalists have long argued, the rules themselves shape peoples subsequent references (Hall 1997). However, beyond the basic point that "history" shapes preferences, political scientists have had little no offer as a basic explanation for what humans want.

Evolutionary theory offers a clear and empirically tested explanation for the origins of human preferences: all living things—including humans—want to pass on their genes. This does not mean, of course, that humans simply want to physically reproduce as much as possible. Nor, as population biology has shown, the desire to pass on genes does not necessarily imply that each individual in a

[24] Clearly, sophisticated rationalists have backed off the narrow assumption that human motivations can be reduced to simple *homo economicus*. See (Elster 1998; Elster 2000; Levi 1997; North 1992; Weingast 2005).

community, group or population must individually pass on her genes.[25] Nor does evolutionary theory suggest that all developed behaviors lead to reproductive success.[26] What we do know, however, is that all social creatures inherit powerful instincts to follow social rules. Whether we speak of ants, bees, elephants or humans, there is no doubt that specific behavioral patterns and the impulse to follow these patterns is inherited from generation to generation (see Wilson 1975).[27] In complex societies these rules can become quite complicated and highly regulated.

Social beings have evolved these social or cooperative strategies as the best way to reproduce and replicate. As Dawkins argued 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 to protect oneself and the need to protect one's kin, family, or clan.[28] Social creatures do *both*. Seen in this 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 silly. Both sets of motivations are necessary for the survival of the species, although they can be found in different degrees in different individuals and across different societies. This implies that the environment and conditions of cultural and institutional evolution determine how and to what extent socially cooperative strategies proliferate in a society. For example, in their agent-based model of the evolution of social preferences, Bowles et al argue "the evolutionary success of individually costly but group-beneficial behaviors . . .may have been a consequence of distinctive human capacities in social institution building." (135).

Secondly, evolutionary theory reminds us that variety is necessary for all replication strategies. The prediction from an evolutionary point of view is enormous variation in individual second-order preferences and behaviors even while the whole species is motivated by a shared first-order preference for replication. Third, the current structure of preferences is the product of both evolutionary adaptations to previous environmental contexts and our individual development. Once

[25] In some animal populations, for example many types of bees, most individuals do not reproduce individually at all. Population theory also argues that individuals can satisfy this basic drive by supporting the survival of their group.
[26] It is well known, for example, that births are below the replacement rate in several wealthy societies.
[27] 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/ and 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.
[28] 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 (Dunbar 1996). 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 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).

again, nature and nurture fundamentally shape the preference structure of every individual.[29] As Paul Ehrlich notes in *Human Natures*,

> Genes 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).

Today there is very strong empirical support for the propositions that human beings are *both* cooperators and individualist interest maximizers and that there is significant variety in these traits within and between communities.[30] 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). While a full discussion of this interesting research goes beyond the scope of this paper, there are booming literatures in evolutionary biology, psychology, anthropology and economics that are converging on the argument that the human brain has evolved to advantage cooperation.[31] The human mind is neither a "blank slate" nor a purely strategic calculative computer.[32] This insight turns the rationalist's dilemma—how is it possible that human's ever built social institutions in the first place—into a non-problem. The primates from which homo-sapiens evolved were already a social species, replete with social rules, norms and behaviors. Indeed, human's likely thrived precisely because their genetic abilities and preferences for cooperation advantaged them over their competitors.[33]

Thus, this approach helps resolve long-standing debates in the institutionalist literature about the origin and nature of human preferences—whether they are hardwired or structured by institutions. A balanced evolutionary approach would argue that both genetics and social structure

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[29] For example, as Alford and Hibbings (2004) show in their study, identical twins separated at birth appear to share some predilections, but it is impossible to predict their personalities.

[30] For a similar argument see (Thayer 2004).

[31] See for example, (Barkow, Cosmides, and Tooby 1992; D'Andrade 1993; D'Andrade and Strauss 1992; Dawkins 1982; Fehr and Fischbacher 2004; Gureck, Irlenbusch, and Rockenbach 2006; Hartung 1995; Knoch et al. 2006; Lakoff and Johnson 1999; Nelson 2007; Nelson and Winter 2002; Shore 1996; Ziman et al. 2002).

[32] For an excellent summary of evolutionary psychology and its implications for social science see: (Cosmides and Tooby 1997). Anthropologists have their own debates over the origins of cooperation, individual self-interest and preferences for sociality. See, (Boyd and Richerson 2005b; Richerson and Boyd 2005) (Boyd and Richerson 2005a) as well as (Sperber and `ere 2006).

[33] Evolutionary game theory has made significant advances demonstrating how cooperative institutions can develop and why they can prove more efficient even for self-interested individuals. The games become more interesting, though far more complex when they begin with cooperatively inclined individuals. For the classic statement see (Axelrod 1984). See also (Axelrod and ebrary Inc 1997; Gintis 2000; Maynard Smith 1982).

matter. This view is expressed by Masters, who contends that "contemporary life sciences reject simple dualities and stand four-square in support of an interactional view of human behavior" (Blank and Hines 2001: 23).

Along these lines, Alford and Hibbing (2005), and more recently Fowler et al (2008), offer an especially insightful discussion of the interaction of genetic and behavioral variables in explaining human behavior. Alford and Hibbing point out that, while we often talk about different types of individuals, the reality is that individuals often fall along a spectrum.[34] They illustrate this point through careful examination of twin studies and an intriguing discussion of what might be called "types of intelligence." 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 extremely empathetic and acutely aware of others' emotions, yet poor at systematic calculative reasoning. In short, there is great variation among individuals within any population: Yet these individuals grow up, live, and replicate within a political institutional context, which, 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 do not only encourage certain behaviors, but also affect the reproductive strategies of individuals.

The implications of this analysis are especially important. Since preferences grow from personal experience and species history, we should expect the following propositions to hold: 1) different populations will develop different preference clusters where a certain type of behavior "predominates" 2) despite the proliferation of certain preferences, there will continue to be significant variation within populations3) individuals have multiple and sometimes conflicting preferences. If our first-order preference is to replicate our preferences, then many different behaviors may result. A society made up of purely selfish individualists could not last long. Fortunately, real human societies are composed of individuals possessing a variety of preferences and motivations, ranging from extreme selfishness to inspiring altruism.[35]

Cultural Evolution

[34] Alford and Hibbing 2004.

[35] 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.

Evolutionary anthropologist have embraced these views by arguing that different institutional contexts encourage and advantage certain types of individuals, particular types of behaviors, and a certain set of preferences. For example Richerson and Boyd (2000) state that "Given that decision rules derive from the action of selection on genes and hence are adaptive, on average at least, a system that responds both directly to natural selection and to adaptive decision making forces will be able to adapt to varying environments more quickly than can organisms that adapt by genes and non-transmitted learning" (4). They suggest that human cultural evolution may be faster than biological evolution because the replication of ideas and beliefs change more rapidly than genetics. Moreover, these genetic and cultural systems may come into conflict over time. Cultural inheritance and genetic inheritance co-evolve over time and consequentially represent a layering of different instincts that may conflict or lead to institutional friction. According to Richerson and Boyd, "These ancient social instincts conflict with the tribal. We are simultaneously committed to tribes, family, and self, even though conflicting demands very often cause us great anguish" (8).

Therefore, if certain types of political institutions favor particular types of behaviors and beliefs then institutional differences may have more long-run evolutionary consequences than the simple fact that certain political strategies are chosen in one context over another.[36] More specifically, it is possible that a Madisonian system of check and balances which is premised on and *encourages* self-interested individuals and behaviors by explicitly pitting interest against interest, encourages a culture of self-interested egoists [37]

If many non-evolutionary social scientists would easily agree with many of the statements above, then what is the evolutionary contribution? First, evolution points to a less-reductionist view of preferences—as social scientists we investigate societies that contain a spectrum of genetic and behavioral traits. But while it is probably trure that most individuals are positioned closer toward the middle than towards extremes – as Darwin pointed out, it is those outside the norm that can make the most difference in evolutionary history.

[36] For an interesting argument along these lines see (Sardemov 2007).

[37] Similarly, 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 (2004) similarly suggest, "Acting alone, MAOA deficiencies or violent childhood have little predictive power, but the *interaction of genetic and environmental* forces is disconcertingly powerful," (p. 717, our emphasis).

An evolutionary approach also focuses on the interactive processes over time. In the event that a more altruistically inclined and an egoistically individual should and have children, their children would inherit some parts of each parent's genetic makeup. 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 setting where the social rules and institutions reward cooperation, consensus building, and contextual thinking, this aspect of their genetic predisposition is likely to be reinforced and their more egoistic predispositions de-emphasized. If one is raised in a more self-seeking institutional context, then the reverse would apply. Moreover, 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. For example, researchers have noted phenomena, where people tend to marry those of a similar social status.[38] Once again, none of this suggests genetic determinacy. Instead it should focus our attention on the interdependence of genes, attitudes, behaviors, and institutions over time.

This perspective implies a greater attention to scope conditions and helps us better explain variation in cultural patterns across geographic space and over time. In this regard, it is important to recognize that evolution *is not efficient*. This is partially because there are many preferences both cultural and genetic that continue to exist far beyond the time that they were adapted. This in part helps us explain why human preferences are not consistent coherent and cogent. Like institutions, preferences can be layered and complex. Real human beings—not the *homo-economicus* hypothesized in some research—have conflicting preferences drawn from both their personal histories and their genetic past. This leads to two important points with respect to cultural attitudes: first, one should expect significant variation within cultures and between them, and, secondly, different environmental contexts and political institutions shape how individuals within a population to develop different aspects of their motivations. Some societies may champion cooperation and equity and other might emphasize conflict or competition. Each of these could be quite "natural" or "rational" response to environmental stimuli that genuinely mirrors an individual's preferences.

Institutional Change

Many political scientists today are searching for a better understanding of the mechanisms of political change. The problem analytically, is that most political science models are static. For rational choice, this is due to the theoretical argument that any given institutional setting will

[38] Kalmijn 1998.

eventually reach an equilibrium in which "no one has the incentive to change his or her choice" (Levi 1997: 27). Consequently the only source of change is exogenous. 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).[39] Given the foundational assumptions and logic of rational choice, "endogenous institutional change appears," as Hall and Taylor observe, "to be a contradiction in terms."[40]

Historical institutionalists have had somewhat more success in exploring the mechanisms of political change.[41] 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.[42] However, the political science debate over the important mechanisms change—adaptive change or punctuated equilibrium—is reminiscent of the debate in evolutionary biology outlined previously. However the political science emphasis on "punctuated change" mirrors the minority view in evolutionary biology articulated by Gould, who argued that life is essentially conservative and the really big changes in life's history are the products of massive environmental shocks which "punctuate" the "equilibrium" of life (for example, Krasner 1984; Steinmo, Thelen, and Longstreth 1992).[43] In contrast, evolutionary theory since Darwin has argued that the major changes in history have been the product of small adaptations, the cumulative effects of which have been immense. Having adopted the equilibrium view, political scientists end up being stuck with static models of life—only to be saved from the outside by unpredictable exogenous change. Increasingly though, new instititionalists such as Streeck and Thelen, Levi, Lieberman, Grief and Laitin, Blyth, and many others argue that "exogenous" models of change are insufficient. Similar to trends in evolutionary biology, it is now widely accepted that *both* gradual endogenous

[39] 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, *On Rule and Revenue,* (Levi 1988) or the widely read volume, *Analytic Narratives* (Bates et al. 1998). Morris Fiorina (1996) explores the underlying logic of this scientific enterprise in, see also (Lichbach 1995). For an insightful and frank discussion of the epistemological issues dividing political science see (Wallerstein 2001).
[40] Quoted in Greif and Laitin 2004
[41] The most important of these are (Pierson 2000; Pierson 2004; Steinmo, Thelen, and Longstreth 1992; Streeck and Thelen 2005; Thelen 2004).
[42] 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; Pierson 2000; Pierson 2004).
[43] Gould 1989.

change (i.e., adaptive change) and punctuation are important parts of the evolutionary account (Mayr 2001).[44]

A recent book edited by Streeck and Thelen (2005), *Beyond Continuity,* addresses the research agenda of understanding institutional change more than any other work to date. This book asks policy experts from around the world to examine cases of policy change and specifically explore the endogenous sources of this change. "A general problem in contemporary institutional analysis" they note, is that it has "always emphasized structural constraints and continuity." Institutions, have been viewed as "frozen residues, or 'crystallizations', of previous political conflict."[45] (Streeck and Thelen 2005: 6). While Streeck and Thelen move researchers away from a reliance on "punctuated equilibrium" models to explain institutional change, they argue that theirs' is not a model of "adaptive change." They state, "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" (2).

While this work provides an excellent typology of different forms and mechanisms of institutional change, this research agenda lacks the over-arching theoretical framework that explains this process of change. As we have already shown, many of the ontological shifts in this literature mirror those proposed in this analysis, so a careful reading of their work suggests that they are in fact pointing towards a model of evolutionary "adaptive" change without embracing the broader theoretical framework.[46]

We argue that literature on endogenous institutional change can benefit from greater attention to the insights provided by the meta-theoretical framework of evolutionary theory. This framework allows us to posit the following sources of gradual institutional change: first, rules are never perfect replicatiors of behavior because they rely on the adherence of rule takers. As institutional systems become more complex inevitable conflicts arise between various institutional orders within the system (Lieberman 2002). Thus a major source of endogenous evolutionary change is a result of the imperfect rules. These rules can be either behavioral or genetic (Mayr 1991). Rule imperfection

[44] Even Gould seems to have moved in this direction in the last years of his life (Gould 2002a; Gould 2002b).
[45]. Going even further toward an explicitly evolutionary theory, Streeck and Thelen tell the reader that institutions are defined by the continuous interaction between rule makers and rule takers during which new interpretations of the rule will be discovered, invented, rejected and maybe adopted. Streeck and Thelen 2005, 16. As a graduate student recently commented in seminar "This sounds to me like constant trial and error."
[46] In Thelen's award winning book, *How Institutions Evolve*, she uses the term 'evolution' 34 times in the first chapter and titles each substantive chapter at titled "The Evolution of…" but she never actually defines 'evolution.'

occurs because they are imperfectly transmitted from one generation to another due to individual variation or random mutation.

Secondly, the process of selection may lead to a variety of successful institutional change processes at the micro-level that may exist simultaneously. Richerson and Boyd (2000) point out that evolution is not "system optimizing" because natural selection is myopic (21). In other words selection at lower levels of analysis may point to multiple behaviors that prove to be successful. As societies grow more complex it is difficult to *a priori* determine which strategy has the best fit in a particular institutional context, so the constant trial and error that natural selection entails may show that multiple mechanisms of change can exist simultaneously.[47]

A third source of evolutionary change results from conflicts between institutional orders within a system. This is called "institutional friction" (Lieberman 2002). Recalling our definition of institutions as regimes or complexes of rules, norms and behaviors, the more complex a system becomes then greater likelihood conflict between orders arises. All systems can be understood as compromises between different elements, and this applies to both biological and social systems. For example, if faster animals capture more prey, why do we not find all animals get faster over time? The answer is that such systemic change requires the coordination of an entire set of changes at he micro-level. Thus growing stronger arms and legs might improve speed, but unless the heart also grows stronger simultaneously, a stronger body could easily undermine the long-term health and reproductive capacity of a particular species. Similarly, participatory democratic forums might increase the popular legitimacy, but increased democratic participation could also lead to gridlock, making it difficult to reach final decisions and ultimately undermining the efficacy of the organization. In other words, increased complexity alone does not necessarily yield competitive advantages, because complexity also requires greater coordination among the constituent parts.

In sum, we identify three sources of evolutionary change that are directly relevant to human social institutions: first, the rules that govern behavioral replication are imperfect. There is always opportunity for new mutations—or ideas—to improve the fitness of the institution within its broader environment. Secondly, natural selection is myopic, which means that it does not necessarily lead to one particular type of adaptation, but in fact may generate multiple "model" of institutional change that exist simultaneously. Thirdly, all institutions are in fact complex systems which contain a

[47] For example, Lewis (forth) finds that both self-reinforcing and self-undermining institutional processes are taking place within the Chinese news media.

number of interdependent subsystems most of which have evolved myopically at specific times to fit different functions. Systems do not evolve as a whole and are therefore often compromises between different subsystems. In some case this can cause conflict or friction between the subsystems within the whole and this in turn can itself be a source of evolutionary adaptation and change.

To summarize, the constant interaction of adaptive agent strategies and institutional and environmental selection is what generates gradual change. There is not a perfectly static state or equilibrium in socio-economic institutions. Gradual evolutionary change is the norm. In the following section, we expand on the research agenda of understanding how these processes work within political institutions via a thought experiment that analogize institutional rules and genes.

Institutions as Genes, Ideas as Mutations

Biologists understand an organism's genetic code to be a set of rules that structure the development and behavior of particular cells in an organism. Political institutions perform very similar functions in the body politic. If so, examining the ways in which genes reproduce and change that can offer insights into institutional replication and questions of stability and change.

First, it is important to note that genes rarely act alone. Therefore change is typically quite slow. Most physical and behavioral attributes are influenced by multiple genes and these genes interact in extremely complex ways. Consequently, 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 if not hundreds of different institutions interact in extremely complex ways to shape a political system.

The complexity of gene interaction, the interaction between genetic rules and environmental context and the imperfect replication of these rules all lead to *variation* across individuals. Not even clones are perfectly alike. Similarly, the complexity of the interaction between institutions results in significant variation across similar political systems. Even when specific institutions have been copied, for example efforts to build Westminster Democracy in Africa, the political results are very different.

However, there are clearly limits to the biological analogy. Certainly there are important differences between genes and human social institutions—even if both can be understood as rules that are passed from one generation to the next, are imperfectly replicated, and must be understood as part of the environment in which they live. As indicated, we contend that a key difference is that

institutional innovations (i.e., mutations) can be intentionally copied and replicated by others. Genes cannot consciously copy innovation, but humans often do, which has important implications for the mechanisms and speed of institutional change.

This 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. Still, it is clear that ideational variables have had a hard time finding a place in traditional political science theory. We suggest that even "ideas" can also be understood in evolutionary terms.[48]

If institutions are the genes (rules) in a political system, then "ideas" should be seen as mutations. Most actors, most of the time, follow the rules. Yet occasionally, usually because of environmental change or individual predisposition, individuals can decide to *not* follow the normal patterns and rules and become ideational entreprenuers. As Blyth (2002) suggests, this is most likely to occur in periods of "Knightian uncertainty" where events have caused a fundamental questioning of conventional wisdom and new ideas have the opportunity to fit a new reality. Under these conditions politically-actionable ideas are innovations that deviate from the rules, and they may or may not offer the opportunity for greater future success.

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[48] **The Evolution of the Human Brain**

Recent research has made significant progress in our understanding of the evolution of the human brain. We know, for example, that we share most features of the brain with other far less advanced creatures. In other words humanoid brain developed new physical characteristics that are in some senses layered on top of the brains of our animal ancestors. This means not only that the human brain is quite like the brain of chimpanzees and orangutans, but in fact we share many physical brain features with quite basic animals (dogs, cats, rats, etc.). One of the most notable difference between the humanoid brain and brains of other social creatures is the highly developed frontal cortex(Dunbar 1996). This is the area of the brain that is most closely responsible for rational calculation and communication. It is very important to remember, however, that calculation (or reasoning) and communication are not exclusively controlled in the cortex. Quite the contrary, even very simply 'rational' calculations (such as deciding which road to take or which ground beef is a better buy) involve a complex mix of brain functions (Gintis et al. 2006). It is simply not the case that one part of the brain controls rational thought and other parts control emotions, or memory, or bodily functions. The brain has evolved has a hugely integrated organic machine in which new capacities and abilities (Hirschfeld and Gelman 1994; Westen 1997).

The particular evolution of the human brain yields at least three specific advantages to homo sapiens that are relevant to institutional change: Humans have a unique capacity to innovate. We are the most innovative or creative creatures on this planet. Innovation requires the ability to rules or established patterns of behavior or thought. Other social creatures can innovate as well, but humans innovate to a far greater extent than any other social creature. Secondly, homo sapiens have evolved an advanced capacity reason. Reasoning is the ability to view alternative processes or actions and select the strategies that best fit the situation or context and then apply this action/strategy similar situations. Finally, homo sapiens have remarkable abilities to imitate the actions or behaviors of others. Once again, all social creatures have this capacity to some extent. As Richerson and Boyd observe, "The existence of a fancy capacity for high fidelity imitation is one of the most important derived characters (sic) distinguishing us from our primate relatives" (Richerson and Boyd 2000).

For human institutions, these evolutionary mechanisms are found in human's own cognitive capacities. Innovation → Reasoning → Imitation

As noted previously, gene reproduction is a highly imperfect process, and most "mutations" are screened out by the organism. Sometimes, however, a mutation is selected and reproduced when it finds itself in a favorable environment and proves to be successful. Whereas mutations can sometimes prove beneficial to the host organism, at other times they can literally kill it. Similarly, most ideas are selected out, destroyed, or ignored. Yet once in a while –when the environment is conducive to change or an idea proves to be a better innovation—such ideas offers the institution some advantage. This success may lead others to acknowledge and even copy these ideas.

Therefore, if a genetic 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 ideational innovations offer an institution advantages in its competition for resources (e.g., budgets or personnel) the institution is likely to prove more successful and be selected and reproduced within the body politic. In other words policy innovations are constantly being measured by whether they perform in a given environment.[49]

In our view, much of the most interesting work in the new institutionalist tradition today is found precisely amongst those who are trying to better understand the ways in which ideas, values and beliefs affect political history, and who are specifically applying these insights to understanding institutional change (Berman 1998; McNamara 1998; Marcussen 2000; Berman 2001; Lieberman 2002; Katznelson and Weingast 2005). In this literature institutional change is the product of changes in policy ideas held by actors. In this case "ideas" are defined as *creative solutions to collective action problems*. Seen in this way, institutional change comes about when powerful actors have the will and ability to change institutions in favour of new ideas. A group or collective may agree that a particular idea is a "good idea" or a "good fit" if they agree that there is a problem that needs solving, *and* they agree that this solution might actually solve the problem. Seen in this way, ideas are not "irrational," but instead are best understood as creative adaptations.[50]

To illustrate our points here, let's consider the examples of basic welfare state institutions of the 20th century: unemployment insurance, public pensions, banking regulations, etc. At first these proposals were simply untested ideas—creative problem solutions—whose promise was to help solve some of the social and economic problems created mid-twentieth century capitalist economy,

[49] 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.

[50] There has been an unfortunate and unnecessary tendency to pit 'ideational' analysis against 'rational' choice in a way that *appears* to argue that either on bases decisions on ideas OR rational calculations. This is an absurd distinction.

such as economic dislocation, unemployment, and increased poverty. As the economically vulnerable in society gained more and more power through the ballot box in western democracies, and as the economic failures of unregulated capitalism became increasingly apparent, elites ideas changed in response to these environmental conditions. The economic experiences of the 1920s and 30s focused public attention on these problems. Additionally, the performance of the governments in WWII with respect to economic management, regulation of production and massive war mobilization efforts led many to believe that governments could in fact do a good job managing new tasks. Over time, environmental conditions (i.e. selection pressures) cause a re-evaluation of existing institutions and allowed for a broad consensus to converge around the idea that capitalism should be regulated and government had an appropriate role in managing the economy. Thus the specific tax, welfare and regulatory policies that were implemented over the next 30 or 40 years cannot be understood as anything less than policies ideas that were eventually selected and institutionalized.

However, modern democratic capitalism did not stand still: It continued to evolve. Along with rising standards of living and increased equality, expectations also changed. Especially after the oil shocks of the early 1970s and the stagflation that followed, people increasingly came to believe that governments regulated too heavily, taxed some citizens unfairly and in general were less capable than it promised to be.[51] The neo-liberal ideas proliferated in the later decades of the 20th century because more and more people came to accept the idea that "government was not the answer, but the problem." This occurred because the interaction of agents with the broader policy environment. Neo-liberal policy entrepreneurs actively persuaded others of the logic of their argument, but they were successful only after the changes in environmental conditions—e.g. stagflation—caused the re-assessment of existing institutions. It is important to understand that there was no "proof" that neo-liberal policies would address these problems. The new policies were simply "ideas" that seemed to address environmental changes, as they promised to dampen inflationary tendencies of the Keynsian era, put more money into the hands of capitalists who could reinvest and constrain "wasteful" government spending. Those who accepted these "ideas" shared a sense of the problems facing capitalist democracies, because environmental selection clarified them, and subsequently agreed that neo-liberal policy solutions would help solve them.

To be sure, the proliferation of ideas surrounding both the establishment of welfare state

[51] Interestingly, there was significant variation in this regard. Quite obviously, some governments were more capable of delivering on their promises efficiently and fairly than others (compare, for example, Sweden and the US). The best explanation for these variations is, of course, differing institutional structures.

institutions and neo-liberal policies could be seen as purely rational interest-based arguments. However this assumes that we have an objective and precise understanding an actor's preferences and "self-interest" as well as a clear conception of exactly how the complex capitalist economy works. We argue that social scientists have neither. First, the modern capitalist economy is a far more complex and contingent than even the most sophisticated mathematical tools can model accurately. Second, the very foundation of an individual's or group's interest is fundamentally rooted in their beliefs about how the world works, their values about what constitutes good outcomes and ideas about how to best achieve these outcome. For example, consider the following question: did the tax cuts of the 1980s stimulate growth and increase government revenue as was promised, or did they simply create the largest budget deficits in history? The answer to this question depends on who you ask. If, you ask an economist how believes in neo-liberal economic theory, they will almost certainly tell you that the tax cuts worked and may be able to draw on data to demonstrate this fact. If you asked an economist who does not believe in neo-liberal economics they could just as convincingly argue that the tax cuts did not work as promised and it was the tax increases of the 1990s that returned the economy to balance. In the absence of clear evidence, the economist you choose to believe is based on their ability to frame complex information in a convincing way. Thus, if economists cannot agree at the most basic level on the effects of economic rules or institutions in the past, then it is clear that prospective policy ideas are less certain, so their proliferation is based on the interaction of individual agency and the environmental conditions that support or undermine them. Secondly, if we cannot know the effects of past ideas, then this also implies that it is difficult if not impossible to rationally calculate one's self-interest.

Bringing ideas into our understanding of institutional change, then, bring agents back into institutional analysis. One could argue that a key weakness of institutionalism in the past has been that it was overly-structural—actors were more or less hostages of the institutions that they inhabit. Integrating ideas into the analysis addresses this problem by making institutions both a constraint on behaviour at the same time it is the object of political contestation. Bringing ideas specifically into institutional analysis thus allows for a better understanding of mechanisms of institutional evolution. A growing group of new institutionalists and evolutionary social scientists are in fact moving in this direction by specifically attempting to bring evolutionary theories and ideas to the study of

institutional change.[52] The common denominator is the basic ontological view that institutions, ideas and the environment change in a co-evolutionary process. This perspective sees history and politics as dynamic processes that are constantly evolving, rather than seeing history as a lurching from one equilibrium to another. This view provides a broad theoretical framework for understanding the specific mechanisms of endogenous institutional change. Moreover, the evolutionary approach views outcomes as contingent and unpredictable rather than linear and predictable. Finally, the evolutionary approach specifically integrates auxiliary theories of agency.

This framework requires scholars to adopt a different ontological position, albeit one that the field is already implicitly moving toward. Rationalists have recognized that preferences and behaviors are not as homogenous as they often assume, and historicists have accepted 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. However, to say that evolutionary process applies to institutional change does mean that it provides a comprehensive explanation for all of the mechanisms and specific types of changes found by researchers. As Geoffrey Hodgson argues, evolutionary theory "provides an encompassing framework within which particular theories can be placed" (272). Thus the future research agenda for political scientists using this framework includes the development of auxiliary theories of variation, selection and replication that fully explain this overall process.

[52] For recent work pointing in these directions, see North 2006.

Conclusion: History as an Evolutionary Process

"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?" --Ernst Mayer[53]

Mainstream 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 "study political behavior according to the canons of scientific methodology" (Farr 1995: 201). Scientific methodology meant adopting reductionist and deterministic models that characterize Newtonian physics.

There can be no doubt that there many interesting and important correlations and relationships that can be understood through these methodologies and approaches.[54] However, as we have outlined, evolutionary biology outlines a scientific framework that is well suited to the study of complex macro-level systems. Many a historical institutionalist has been confronted with questions about falsifiablity and prediction, implying that the lacking clear and quantifiable answers to these questions relegates ones work outside of the realm of "science." These critiques miss the point of historical and case based analysis precisely because they assume a world that is stable, and a world in which causal variables are somehow "independent" of one another. We suggest that such a world does not exist.

Whereas the laws of Newtonian physics are based on the constancy of the physical world evolution assume contingency, inconstancy and emergence.[55] This is first because the study of politics is in many cases the study of complex unique events. Secondly, a science based on static and fixed relationships between independent variables cannot capture the realities of the living world where context and history determine outcomes. Finally, mechanical models do not help us to understand iterative and dynamic relationship between preferences, behavior and outcomes.

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[53] (Mayr 2004b)

[54] For a broad and thoughtful critique along similar lines as those suggested here see(Blyth 2006).

[55] 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.

In sum, evolutionary theory provides an appropriate framework for understanding many aggregate political outcomes because it offers a dynamic theory of politics. Evolution assumes change, not equilibrium. Moreover, 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 longstanding debates within the field about human motivations and the relative importance of structure and agency. 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.[56]

These insights have important implications for what we study and how we study it. For evolutionary theorists and historical institutionalists alike, history is not simply a chain of independent events. Historical institutionalists study history because it shapes later outcomes not merely to increase the reference points for analysis as is done in time series analysis. Taking evolution seriously ultimately means that the scholar is sceptical of the very notion of variable independence. Instead, acknowledging the importance of history suggests an explicit awareness that historical changes have important long-term evolutionary consequences. More than some other disciplines, historical institutionalists are explicitly interested in the interactive effects of multiple causal variables.

Indeed we argue that historical institutionalists are like the environmental biologist who believes that in order to understand the specific fate of a particular organism or behaviour, one must explicitly examine that organism or behaviour in the ecology or context in which it lives. This implies a different scientific ontology than that commonly found in the hard sciences of physics and chemistry. While objects in the physical world often adhere to constant 'laws' of nature, biological organisms often defy attempts to reduce them to their essential components because of their complexity. Historical institutionalism is rooted in a similar ontological shift in social science. In order to understand historically specific events and long-term political outcomes, one could not strictly apply methods and epistemologies drawn from the study of invariant variables that have fixed relationships across space and time. This, of courses, does not mean that it is not science – unless one's definition of science would exclude biology as well; rather, it implies that the scientific methods applied should fit the subject being studied.

[56] See for example: Alford, John R., & Hibbing, John R., (2004) and Blank, et. al. (2001).

We have examined evolutionary theory in the biological sciences in order to determine their applicability to the study of political institutions. In the end, we believe that evolutionary theory offers more than an interesting metaphor. While we do not suggest that human institutions and history evolve in exactly the same ways as biological evolution, but human social institutions—just like humans themselves—are products of evolutionary forces and processes. Virtually every other discipline in the social sciences today has begun to take evolution seriously. We submit that political scientists, should too.

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