

Toward Generalized Evolutionism: Beyond “Generalized Darwinism” and Its Critics

Shiping Tang

Abstract: This article seeks to transcend the debate regarding “generalized Darwinism” or “universal Darwinism” for the social sciences. Highlighting recent discoveries in evolutionary biology, the article argues that it is no longer tenable to insist that (neo-)Darwinism is the only proper doctrine for understanding biological evolution. Moreover, social evolution is much more than purely (neo-)Darwinian or (neo-)Lamarckian. As such, the debate on whether we deploy only (neo-)Darwinism or (neo-)Lamarckism – generalized or not – to understand social evolution is a red herring. Instead, social scientists should embrace “generalized evolutionism,” a more accommodating and versatile doctrine that subsumes “(generalized) Darwinism” or “(generalized) Lamarckism.” Empirical inquiries that deploy “generalized evolutionism” have shed important new light on some critical puzzles in human society: from institutional change to the foundation of economic development before 1500 AD, through the coming of the industrial revolution, to the evolution of the international system. More empirical efforts along this line of theorizing are needed.

Keywords: generalized Darwinism, generalized evolutionism, extended synthesis, modern synthesis, (neo-)Darwinism, (neo-)Lamarckism, social evolution

JEL Classification Codes: B00, B25, B52

Among recent efforts that generalize evolutionary theorizing, or “evolutionism,” to social sciences (e.g., Blute 2010; Brinkworth and Weinert 2012; Mesoudi 2011; Runciman 2009; Sanderson 2001), Geoffrey M. Hodgson and Thorbjørn Knudsen’s *Darwin’s Conjecture: The Search for General Principles of Social and Economic Evolution* stands out as a key contribution. Building upon their earlier works in evolutionary economics, Hodgson and Knudsen (2010) make a fundamental contribution to

Shiping Tang is the Fudan distinguished professor and the Dr. Seaker Chan chair professor in the School of International Relations and Public Affairs (SIRPA) at Fudan University, Shanghai (China). He also holds a Cheung-Kong/Changjiang distinguished professorship of China’s Ministry of Education. He is grateful to Marion Blute, Geoffrey M. Hodgson, Richard Nelson, Pavel Pelikan, Ulrich Witt, the editor of this journal and two anonymous reviewers of this article, and the late David Hull for their critical comments and discussions.

evolutionary social sciences. Their book (Hodgson and Knudsen 2010) has generated a lively debate. Overshadowing their more specific arguments, however, it has been Hodgson and Knudsen's insistence on generalized Darwinism that has received the most scrutiny.¹ On one hand, Hodgson and Knudsen's supporters insist that generalized Darwinism is the only proper approach for understanding social evolution (e.g., Aldrich et al. 2008). On the other hand, their critics contend that generalized Darwinism is too dogmatic and hence improper for understanding social evolution (e.g., Buenstorf 2006; Cordes 2006, 2007; Levit, Hossfeld and Witt 2011; Nelson 2006, 2007a, 2007b; Pelikan 2011, 2012; Vromen 2008, 2010, 2012; Witt 2004, 2008).

I seek to transcend the debate regarding Hodgson and Knudsen's (2010) generalized Darwinism stand by advancing three principal arguments. First, in light of many recent discoveries in biological evolution, it is no longer tenable to insist that (neo-)Darwinism is the only proper doctrine for understanding biological evolution. Hodgson and Knudsen's insistence on a generalized Darwinism is thus based on a dated understanding of biological evolution.² Second and immediately following from the first, Hodgson and Knudsen's (2010) insistence that only generalized Darwinism is deployed for understanding social evolution is tenuous at best and misleading at worst. Third, social scientists should instead embrace the more accommodating and versatile doctrine of "generalized evolutionism," which subsumes "(generalized) Darwinism" and "(generalized) Lamarckism" and makes them specific cases of "generalized evolutionism." Indeed, empirical inquiries based on "generalized evolutionism" have shed important new light on some of the most critical puzzles of human history: from institutional change to the foundation of economic development before 1500 AD, through the coming of the industrial revolution, to the evolution of the international system (e.g., see Diamond 1997; Elias [1939] 1994; for my own effort, see Tang 2011, 2013, 2016; Tang and Long 2012; and Tang, Hu and Li 2016).

Three caveats are in order here. First and foremost, although I criticize some of Hodgson and Knudsen's views, I share their conviction (and that of many other social scientists) that a properly constructed evolutionary approach is applicable to the whole human society. The key issue here is: What should we generalize: Darwinism, Lamarckism, Spencerism, or evolutionism? Second, I readily acknowledge that there

¹ See the exchanges in the *Journal of Evolutionary Economics* (2006, 2008, 2012), the *Journal of Economic Issues* (March 2007), and entries in "Papers on Economics and Evolution" of the Evolutionary Economics Study at the Max Planck Institute of Economics (www.econ.mpg.de/english/research/EVO/discuss.php). There is no doubt that Hodgson and Knudsen choose the term "generalized Darwinism" to distinguish their doctrine from Dawkins's (1983) widely known concept of "universal Darwinism." Not surprisingly, most critics of Hodgson and Knudsen have taken "universal Darwinism" and "generalized Darwinism" as equivalent (e.g., Nelson 2006, 2007a). I do concur with Hodgson and Knudsen (2010), as well as Howard E. Aldrich et al. (2008), that "generalized Darwinism" is preferable to "universal Darwinism."

² Hence, critics of Hodgson and Knudsen's generalized Darwinism stand could also benefit from a firmer grasping of the recent advancements in evolutionary biology. As I make it clear below, recent advancements in evolutionary biology make the possibility of moving from generalized Darwinism to "generalized evolutionism" not only possible, but also far more attractive and valid.

has been much discussion of Hodgson and Knudsen's generalized Darwinism project, and many insights have been gained from these exchanges. Indeed, many have argued that generalized Darwinism is unnecessarily restrictive for understanding social evolution (see citations above). My critique of Hodgson and Knudsen's enterprise, however, goes much deeper. Moreover, I am using my engagement with their book (2010) as a springboard to advance a set of new arguments, although I can only offer a more systematic statement of only some of the issues broached here (as well as elsewhere) due to the enormous complexity of social evolution. As such, I will not repeat or critically engage these criticisms against Hodgson and Knudsen, although I do draw from these studies whenever appropriate. Third, I am fully aware that "evolution" has many meanings, including Darwinian, Lamarckian, and Spencerian meanings, at the very least. My arguments, however, are foremost concerned with evolution of the biotic system and human society in the real world. My critique of Hodgson and Knudsen's generalized Darwinism is thus ontological first and label-related second. I argue that, because the evolution of the biotic system and human society in the real world is not merely Darwinian, Lamarckian, or Spencerian, that we should move beyond the unproductive debate on label and wording — labels like Darwinian, Lamarckian, or Spencerian are of only rhetorical utilities.³

I structure the article as follows. In the next section, I briefly recap the history of generalizing Darwinism, Lamarckism, and evolutionism from biological to social evolution. After delineating Hodgson and Knudsen's several key contributions, I introduce their four rationales for insisting on a generalized Darwinism stand, and then show that two of their rationales are easily refutable. In the third and fourth sections, I challenge Hodgson and Knudsen's other two rationales for clinging to generalized Darwinism. In section three, I explain why it is no longer tenable to insist that (neo-)Darwinism is the only proper doctrine for understanding biological evolution in light of several key discoveries in evolutionary biology. In the same section, I also critique one of generalized Darwinism's pillars: namely, its insistence on the duality of replicator vs. interactor in evolution. Building on the preceding discussion, in the fourth section, I argue that Hodgson and Knudsen's defense of generalized Darwinism for social sciences is shaky at best and invalid at worst because social evolution is more than (neo-)Darwinian or (neo-)Lamarckian. I conclude my argument in the final section by contending that the proper evolutionary approach toward human society is a rigorously formulated, but more accommodating "generalized evolutionism."

Generalizing Darwinism or Evolutionism?

The idea of generalizing "evolutionism" (or "evolutionary theorizing") from biology to human society — of which "generalized/universal Darwinism" is a form — has a long

³ I do not discuss Herbert Spencer's work here because his understanding of evolution is not really about evolution per se, but mostly about embryogenesis and development (for an earlier discussion, see Haines 1988), although I am fully aware that many of Spencer's key ideas (e.g., evolution is design-unfolding toward higher complexity and morality) have remained influential in some fields of social sciences (e.g., structural functionalism in sociology).

and distinguished pedigree (Hodgson and Knudsen 2010, 8-13). Alfred R. Wallace (1864), Charles Darwin (1871), David Ritchie (1891, 1896), and Thorstein Veblen (1899) were the earlier pioneers. Then, in a series of groundbreaking articles, Donald Campbell (1960, [1965] 1998, 1974a, 1974b) articulated an idea that most social (or sociocultural) changes can be understood as an evolutionary process of *blind variation–natural selection–selective retention*, thereby advancing the first systematic statement for a *generalized* (Darwinian) *evolutionism*.⁴ Since Richard Dawkins (1983) coined the term “universal Darwinism,” efforts to generalize Darwinism or evolutionism have only accelerated. Today, one finds evolutionary theorizing of some sort or another in almost all major fields of social sciences.

Among recent contributions, Hodgson and Knudsen’s (2010) work stands out on several grounds. They (2010) not only forge a vigorous defense of a more evolutionary approach to human society from seemingly critical challenges, but also tackle some key conceptual issues for understanding social evolution. For example, they explicitly state that human intentionality (i.e., non-blind variation or artificial selection) does not jeopardize the application of evolutionary theorizing to social changes. Hodgson and Knudsen (2010) also usefully address the relationship between generative replication and complexity. The authors (2010) further identify six major information transitions in social evolution, and then link these transitions with a multi-level social evolution (cf. Maynard Smith and Szathmari 1997; Vromen 2012, 79-80). Finally, by insisting that theorizing social evolution requires more than the mechanism of variation–selection–inheritance, Hodgson and Knudsen rightly expand the scope of evolutionary social sciences beyond the narrow focuses of sociobiology, evolutionary psychology, and gene-culture coevolution. Overall, Hodgson and Knudsen (2010) advance a very sophisticated and systematic framework for evolutionary social sciences. Their more specific contributions, however, have received far less attention than their insisting upon a fairly rigid Darwinian framework (i.e., generalized Darwinism) for understanding social evolution. In Hodgson and Knudsen’s words (2010, vii, emphasis added), “*Darwinism is not simply an option. We hold that there is no known alternative to Darwinism as a general framework with which to analyze the evolution of social and economic systems.*”

Because many social scientists believe that social evolution is at least partly Lamarckian, Hodgson and Knudsen (2010) explicitly set out to “dismantle” Lamarckism (Hodgson and Knudsen 2006a). Hodgson (2011) puts it most forcefully: “The claim by many social scientists that social evolution is Lamarckian is a

⁴ Note that Donald Campbell’s (1965) concept of “retention” is far more accommodating than “inheritance” (for a similar interpretation, see Pelikan 2011, 343, fn. 1). Strictly speaking, inheritance can only mean the passing of information from one generation to the next via replication. By contrast, retention can mean (i) inheritance via replication from one generation to the next and (ii) retention from one round to the next by a single organism in its development and life cycle that does not require replication. Transmission is even broader. It can mean (i) horizontal transmission via DNA jumping (e.g., transposons) and insertion, (ii) horizontal transmission via imitation and learning (in both human and non-human animals), and (iii) vertical transmission from offspring to parents. Thus, I use these terms precisely (see Table 1 for details). Campbell banked on “blind variation” and “natural selection” too much, as both Karl Popper ([1974] 1987, 117-119) and Robert J. Richards (1977) have pointed out.

distraction from the compelling conclusion that it is Darwinian, and that Darwinian ideas can be helpful in understanding the processes. Lamarckism does not provide an adequate evolutionary framework and it is a red herring." Although Hodgson (2011) admitted that "the possibility of processes where the acquired characters of an interactor (social phenotype) can affect its replicators (social genotypes)," he insists that "it is misleading to describe this [possibility] as Lamarckian."⁵ Thus, although Hodgson and Knudsen (2010, 65) note that "Lamarckism and Darwinism are not mutually exclusive" (and they do not always state their stands absolutely), most commentators have interpreted their stance as very (if not strictly) Darwinian, which leaves little space for Lamarckian and other non-Darwinian elements (Aldrich et al. 2008; Hodgson and Knudsen 2012, 14; Mesoudi 2011, 44; Nelson 2006, 2007a, 2007b; Pelikan 2011, 351).

Hodgson and Knudsen (2010, 32-37, chs. 3 and 4) insist that social evolution is (mostly) Darwinian, hence generalized Darwinism should be preferred based on four rationales. First, evolutionism is an ambiguous term, whereas Darwinism is precise. Second, all other explanations of evolution (e.g., a Lamarckian explanation of cultural evolution) require some kind of Darwinian component or element, hence do not nullify a Darwinian process (2010, ch. 4). Thus, although "Lamarckism and Darwinism are not mutually exclusive" (2010, 65), only a generalized Darwinism stand is valid. Third, the three principles – namely, variation, selection, and inheritance – are Darwinian. Fourth, even in social evolution, selection and inheritance must be Darwinian. Therefore, social evolution is also Darwinian (see also Aldrich et al. 2008, 583-586).

Scientific concepts and labels are mostly about ontology, and whether one concept (or label) is better than another depends most critically on whether the phenomenon contains the core properties that the concept conveys. In light of this, one can see that Hodgson and Knudsen's first and second rationales are easily refutable. First, evolutionism is an ambiguous term largely due to misunderstandings about evolution. When this is the case, the researcher's job is to clean up – rather than to cater to – those misunderstandings. Meanwhile, Darwinism is very stringent.⁶ As Ernst Mayr (1982, 505-510) notes, Darwin's theory has at least five key (and independent) features: evolution, common descent, gradualness, population speciation, and natural selection. If Darwinism is to be restricted to Darwin's original theory, then it would be a highly restrictive doctrine. Strictly speaking, as far as we

⁵ Earlier, Thorbjørn Knudsen (2001) noted that economic evolution (as one aspect in the ideational dimension of social evolution) is "Lamarckian nesting with Darwinian," which implies a more accommodating position.

⁶ A reader rightly points out that "Darwin himself repeatedly claimed that his principles could apply to social evolution, including the evolution of languages, morals, and organizations." Based on this, he/she disputes the contention that "Darwinism is too stringent." This disagreement is due, in no small part, to the different notions of "Darwinism" and "Darwin's principles." Does "Darwinism" imply all of the five features (or principles) of Darwin's understanding of biological evolution identified by Mayr (1982), or does it merely imply some of them? Certainly, Hodgson and Knudsen's understanding of Darwinism (2010, ch. 2) admits only three central principles: variation, inheritance, and selection. One could, however, more plausibly contend that variation, inheritance, and selection are really three components of the central mechanism of evolution, rather than "principles" of Darwinism (see section three below).

know, Darwinism only applies to biological evolution on earth.⁷ When this is the case, Darwinism cannot be easily generalized, unless one equates Darwinism with evolutionism. Second, even if every other explanation of evolution (e.g., a Lamarckian explanation of cultural evolution) requires some Darwinian components, this does not mean that one should employ only Darwinism for understanding social evolution, as Hodgson and Knudsen (2010) insist. Why not apply a combination of some Darwinism and some Lamarckism, or perhaps even some non-Darwinism and non-Lamarckism? Hodgson and Knudsen's (2010) third and fourth rationales are tightly connected and require a more detailed discussion. I address them step by step in the next two sections.

The Disutility of Darwinism and Lamarckism as Doctrines

Hodgson and Knudsen's (2010) third and most critical rationale for taking a generalized Darwinism stand is that the three principles – variation, selection, and inheritance – are Darwinian. In this section, I show that this claim is tenuous at best. I proceed in three steps. I first highlight that Darwin had no exclusive claim to variation, selection, and inheritance, but only to a particular combination of the three components. Second, I argue that, with our deepening knowledge of biological evolution, it is no longer tenable to insist that (neo-)Darwinism (or Lamarckism, for that matter) is the exclusive doctrine for understanding biological evolution. Taken together, these two facts fundamentally undermine the ontological and rhetorical rationales behind Hodgson and Knudsen's insistence that generalized Darwinism is the only valid theory for understanding social evolution. Finally, I attack Hodgson and Knudsen's insistence that the duality of replicator vs. interactor is indispensable for understanding biological and social evolution.

Darwin Has No Exclusive Claim to Variation, Selection, and Inheritance

It is critical to note from the onset that the conventionally employed phrasing, "inheritance of acquired characteristics" is utterly imprecise and confounding. This is most critical because, although "acquired characteristics" within the phrase "inheritance of acquired characteristics" conventionally means only phenotypes, genetic mutations are also "acquired characteristics," strictly speaking. Moreover, in the days of Jean-Baptiste Lamarck and Charles Darwin, almost everything was lumped under the label of "characteristics," and there was no distinction of phenotype vs. genotype. This distinction was not introduced explicitly until Wilhelm Johansen's research (1911). Yet, since the publication of Gregor Johann Mendel, August Weismann, Wilhelm Johansen, and Thomas Hunt Morgan works, this distinction of phenotype vs. genotype has become a cornerstone of evolutionary biology.⁸

⁷ Neo-Darwinism becomes even more stringent by eliminating the possibility of "direct inheritance of acquired characteristics" via pangenesis initially held by Darwin (see section three below).

⁸ Apparently, this distinction of phenotype vs. genotype is tightly linked with Weismann's distinction of somatic cell vs. germ cell and Dawkins and Hull's distinction of interactor vs. replicator, although the three distinctions are not identical (see the discussion below).

The modern distinction of phenotype vs. genotype and the lack of it back in Lamarck and Darwin's time hold the key to untangling the messiness caused by the still widely deployed usage of "inheritance of acquired characteristics." Yet, few — including Hodgson and Knudsen (2012, 14-17) and their critics — have explicitly grasped the fact that the lack of such a distinction in the nineteenth century poses serious difficulties for the whole debate on whether biological evolution or social evolution is Darwinian or Lamarckian, or a bit of both.⁹

With the distinction of phenotype vs. genotype in place, two things become abundantly clear. First, what both Lamarck (1809) (in his original "inheritance of acquired characteristics" scheme) and Darwin (1868) (in his pangenesis inheritance scheme) had in mind was *direct inheritance of phenotypes without going through genetic materials* (hereafter, DIP-WGM). Meanwhile, what Weismann's barrier establishes is that DIP-WGM is impossible *most of the time*, and that only *indirect inheritance of phenotypes via genetic materials* (or IDIP-VGM) is possible (details below). Second, what truly differentiated Darwin's scheme of evolution from Lamarck's is a particular ordering or sequence of variation, selection, and inheritance. Although Darwin (1868) accepted the possibility of DIP-WGM via his scheme of pangenesis, he also contended that variation comes before the ordering activity of the environment (i.e., "natural selection") comes into play, and that variation and selection are decoupled (Mayr 1982, 354; Toulmin 1972, 337-8). By contrast, Lamarck (1809) argued that selection precedes variation, and that selection and variation are tightly linked. In other words, environmental changes induce adaptive variations directly and/or organisms desire and (often) obtain adaptive variations directly.

Thus, Darwin had no exclusive claim to the three components of variation, selection, and inheritance independently, as Lamarck too had integrated the three components in his scheme of evolution. Furthermore, Darwin had no exclusive claim to "natural selection" either, because Lamarck's scheme of selection before variation is also strictly "natural" in the sense that no human interference is involved. What Darwin had a genuinely exclusive claim to was a particular sequence of the three components: variation proceeds selection (hence *variation-selection-inheritance*). Yet, Lamarck had a valid claim to another particular sequence of the three components: selection proceeds variation (hence *selection-variation-inheritance*). Moreover, even though Lamarck's *selection-variation-inheritance* sequence is not a valid mechanism in biological evolution, it is a valid and perhaps more powerful mechanism in social evolution than Darwin's *variation-selection-inheritance* sequence (see section four).

Clarity on these issues also sheds light on a lingering question in the history of evolutionism: Just how much Darwin differed from Lamarck? Because so little was known about the genetic material and other fundamental mechanisms in biological evolution during Lamarck and Darwin's time, the possibility of DIP-WGM was widely accepted and even Darwin was reluctant (or unable) to rule it out. This is one of the

⁹ Maria Kronfeldner (2007, 494-496) is a rare exception, yet even her discussion does not go far enough.

dimensions in Lamarckian theory,¹⁰ and Darwin was a firm believer in it. On this front, Darwin differed from Lamarck only about the exact process, but not about the possibility of DIP-WGM. Whereas Darwin (1869) postulated pangenesis as the underlying mechanism for DIP-WGM, Lamarck (1809) banked on the possibility of environment-inducing adaption and organisms-desiring adaption. None of the three mechanisms is valid in biological evolution today, as commonly known.

Biological Evolution Is Not (Neo-)Darwinian (or Lamarckian)

Several key discoveries in evolutionary biology in recent years have made it clear that the rejection of DIP-WGM after Weismann was perhaps too sweeping and underspecified: there are instances of “soft inheritance” that cannot be easily classified as purely Darwinian, even in biological evolution (Bird 2007; Jablonka and Lamb 1995, 2006; Richards 2006). The first discovery is *epigenetic inheritance*, which literally means inheritance that is outside of the conventional (i.e., Mendelian-Morganian) genetic inheritance (for reviews, see Bird 2007; Jablonka and Raz 2009; Jaenisch and Bird 2003; Richards 2006).¹¹ Abundant evidence now exists that almost all eukaryotic organisms can respond to environmental changes (e.g., diet and stress) by modifying their genetic materials via (de-)methylation of nucleotides and chromatin structures via (de-)acetylation of histones, *all without actually changing the DNA sequences*. Indeed, some cases that have previously been identified as conventionally genetic inheritance are now known to be cases of epigenetic inheritance (Dachin et al. 2011, 475). Most critically, at least some of these epigenetic modifications can be directly transmitted to the next generation through meiosis. Because epigenetic modifications change the expression of specific genes, they produce detectable phenotype changes, even though the DNA sequences of these genes remain the same. As a result, epigenetic modifications are *directly* inherited and the phenotype changes entailed by these modifications are *indirectly* inherited by the next generation.

Apparently, epigenetic inheritance is not purely Darwinian. At the same time, however, because epigenetic modifications still involve modification of genetic materials, epigenetic inheritance is not the original Lamarckian inheritance either. Rather, epigenetic inheritance is “neo-Lamarckian” (Bird 2007; Jablonka and Lamb

¹⁰ Within the existing literature, there are at least six concepts of “Lamarckian” process, covering variation, selection, and inheritance. The six concepts are: (i) DIP-WGM; (ii) environment changes induces organisms to have adaptive variations; (iii) organisms desire adaptive variations (i.e., organisms have will, desire, or volition) to satisfy their new needs in a new environment; (iv) the organism’s use and disuse of some organs (as phenotypes) lead to modifications of these phenotypes and these modifications are directly inherited by the next generation; (v) evolution toward higher order, progress, and perfection; and (vi) evolution toward increased complexity. Many have discussed Lamarckism without differentiating these six notions, which has resulted in serious confusion (see Kronfeldner 2007, 2010; Hallpike 1986, 80-86; Hodgson 2001; Hodgson and Knudsen 2006a, 2010; Hussey 1999, 568-571; Mayr 1972; Nelson 2007b; Wilkins 2001, 164-170).

¹¹ Note that, although Hodgson and Knudsen (2010, 61-62, fn. 1) mention epigenetic inheritance, they fail to grasp the difficulties posed by epigenetic inheritance against labeling even biological evolution as Darwinian and not a bit Lamarckian.

1995, 2006; Richards 2006). Moreover, the fact that epigenetic inheritance has a very ancient origin (it is present in all eukaryotic organisms) points to the very possibility that epigenetic inheritance is a critically important adaptive trait of eukaryotic organisms. In other words, an organism that is capable of responding to environmental changes with *reversible* modifications of genetic materials (and hence also modifications of phenotypes) under stressful circumstances, while maintaining a stable genome, holds important advantages over an organism that is incapable of such a response (Danchin et al. 2011; Halfmann et al. 2012).

The second discovery is the finding of prion-like proteins. Prion was initially discovered as the immediate causal pathogen of a family of eventually fatal neural degenerative diseases, including scrapie in sheep, bovine spongiform encephalopathy (BSE, or the “mad-cow” disease) in cow, and Creutzfeldt-Jakob disease (CJD) in humans by Stanley Prusiner and others in the earlier 1980s (reviewed in Prusiner 1998, 2012). Prion is a protein in malfunctioned form, known as PrP^{Sc}. Most critically, PrP^{Sc} can *directly* cause neural degeneration because PrP^{Sc} molecules make *de novo* (newly) synthesized (good) prion molecules (known as PrP^C) fold into “bad” prion proteins (i.e., PrP^{Sc}). As such, although PrP^{Sc} (as a protein) does not “replicate” as gene does, PrP^{Sc} can indeed transmit the disease (as a phenotype) to a new host and to the next generation. Obviously, the transmission of these diseases via PrP^{Sc} is not Mendelian-Morganian.

At the same time, however, some mutations of the PrP^C gene inevitably lead to the making of PrP^{Sc}, and this fact also makes scrapie, BSE, and CJD genetically inheritable, which inheritance (of BSE, scrapie, and CJD) is Mendelian-Morganian. The transmission of BSE, scrapie, and CJD is thus neither purely Darwinian, nor purely Lamarckian. Rather, it contains both elements. Lamarck’s original formulation insists that the environment induces changes that are directly transmitted to the next generation without any genetic materials involved. Although the refolding of PrP^C into PrP^{Sc} can be broadly understood to be driven by environment change (including the condition of the body), PrP^{Sc} still has to rely on *de novo* synthesized PrP^C molecules in order to cause the diseases (or phenotype), and those *de novo* synthesized PrP^C molecules can only come from transcription, and then translation that is underpinned by the gene encoding PrP^C polypeptide. At the same time, some mutations of the PrP^C gene make those diseases, associated with PrP^{Sc}, genetically heritable as other instances of “(Darwinian) hard inheritance.”

Like epigenetic inheritance based on (de-)methylation of DNA and (de-)acetylation of histones, prion-like proteins are also highly conserved. More than two dozens of such proteins have been discovered in yeast (Halfmann and Lindquist 2010; Halfmann et al. 2012). Again, this shows that prion-like proteins may confer an important adaptive advantage to organisms because an organism that can react to environmental changes via modification of prion-like proteins without compromising its DNA sequences holds important advantages over an organism that is incapable of such a response. Indeed, it is highly likely that prion-like proteins play a key role in the formation of long-term memory, at least in *Aplysia* and *Drosophila* (Si et al. 2010; Majumdar et al. 2012). Even more intriguing is that epigenetic inheritance and prions

can interact with each other, at least in the wild type yeast. Indeed, “prions are a common mechanism for phenotypic inheritance in wild yeast” (Halfmann et al. 2012; see also Halfmann and Lindquist 2010). Again, such an interaction may have an important adaptive advantage.

The third key (re-)discovery is “niche construction” and “ecological inheritance” (Lewontin 1983). Niche construction is “the process whereby the metabolism, activities and choices of organisms modify or stabilize [their] environmental states, and thereby affect selection acting on themselves and other species” (Laland et al. 2015, 4). Thus, when plants turn carbon dioxide into oxygen, beavers construct dams, birds build nests, spiders weave webs, and rodents dig tunnels, they have changed their surrounding environment for themselves and other species. Moreover, niche construction has a powerful positive feedback effect, and thus entails “stable and directional changes in environmental conditions” in the long run (Odling-Smee 2010). Meanwhile, constructed niches very often pass from one generation to the next, resulting in ecological inheritance (Odling-Smee and Laland 2011). Dams constructed by beavers and tunnels dug by rodents are two prominent examples.

For my purposes here, the key point is that, unlike epigenetic inheritance that is epigenetic and prion transmission that can be both genetic and non-genetic, niche construction and ecological inheritance is entirely non-genetic and cannot possibly be (neo-)Darwinian (for more detailed discussions, see Badyaev 2008; Badyaev and Uller 2009; Odling-Smee 2010; Odling-Smee, Laland and Feldman 2003). And yet, constructed niches can exert both short and long-term selection pressures on organisms at both the genetic and non-genetic (e.g., developmental) levels. When this is the case, it is difficult to subsume niche construction and ecological inheritance under a (neo-)Darwinian framework (cf. Dawkins 1982; Odling-Smee and Laland 2011). This fact further weakens the concept that biological evolution is entirely (neo-)Darwinian.¹²

In addition to these three key discoveries, there is also the so-called “parental effect” on progenies that can be both genetic and non-genetic. Because the molecular mechanisms behind “parental effect” are less well understood, and it is unclear whether “parental effect” has any scale-up effect at the population and species level, I will refrain from discussing it here.¹³ But I hope that I have made it clear that biological evolution is more than (neo-)Darwinian (for a summary, see Table 1). I will now move to the “extended (evolutionary) synthesis” that exists even in evolutionary biology (e.g., Danchin 2013; Danchin et al. 2011; Laland et al. 2015; Pigliucci and Müller 2010).

¹² Note that the neo-Darwinian modern synthesis does recognize “niche construction” and “ecological inheritance,” but then treats them as “extended phenotype” (Dawkins 1982) (for succinct discussions on why niche construction and ecological inheritance cannot be easily subsumed under “extended phenotypes,” see Odling-Smee and Laland 2011; Wells 2015; see also the classical discussion by Lewontin 1983).

¹³ For a succinct discussion on the implications of these forms of non-genetic inheritance for an “extended evolutionary synthesis” in the evolutionary biology, see Etienne Danchin et al. (2011, 477-479).

Altogether, the deepening human understanding of the complexity of biological evolution has made it increasingly clear that Darwinism, especially the DNA or gene-centric view of evolution as its modern embodiment, is inadequate for understanding biological evolution, to say the least (Danchin 2013; Danchin et al. 2011; Jablonka and Lamb 2006; Kronfeldner 2007, 2010; Mameli 2005). Terms like “Darwinian” and “Lamarckian” are simply too blunt for capturing the complexities of biological evolution, most critically because variation, selection, and inheritance have (neo-) Darwinian, neo-Lamarckian, and other non-Darwinian and non-Lamarckian variants. This fact points to an unpleasant, yet inevitable solution: We have to stop insisting that (neo-)Darwinism (or Lamarckism, for that matter) is the only valid doctrine for understanding biological evolution as a whole, even though biological evolution certainly contains Darwinian elements and many Darwinism principles remain valid.

Table 1. Retention of Phenotype: Genetic and Non-Genetic

Phenotypes/Traits				
Non-transmitted, transgenerational, or intragenerational. These traits are of little interest to evolutionary biology. They are mostly the domain of developmental biology.	Transmitted, transgenerational, intragenerational, or both:			
	Intragenerational (i.e., among siblings): frequent in human beings and many higher animals (e.g., birds, primates, etc.)	Transgenerational: parents to offspring		Transgenerational transmission: offspring to parents
	Not inheritance per se, but transmission or diffusion	Genetic inheritance in the neo-Darwinian (or Mendelian, Weismannian, and Morganian) sense	<u>Epigenetic inheritance</u> : regulation of expression (DNA methylation, Histone acetylation); protein folding (i.e., Prions), aided by DNA inheritance; paternal effects (partially genetic and non-genetic); niche construction <u>Ideational/cultural retention</u> : only in human beings, and this process is super-Lamarckian.	Only possible with ideational transmission, and only in human beings. Such a process is neither Darwinian nor Lamarckian. Example include: use of trendy technical applications, such as internet and mobile phone, often spread from youngsters to their parents, rather than the other way around.

Source: Adapted from Figure 2 and Box 4 by Danchin et al. (2011) and from Figure 1 by Danchin (2013).

Replicator vs. Interactor: Is This the Achilles’s Heels of Generalized Darwinism?

Although never explicitly stated, attempts of generalizing (neo-)Darwinism have almost inevitably stressed the necessity of having both replicator (roughly genes) and

interactor (or vehicle) in an evolutionary system. The proponents of generalized Darwinism further insist that the replicator and interactor must possess some essential characteristics: the replicator must replicate, whereas the interactor must host the replicator and interact with the environment. As advocates of general Darwinism, Hodgson and Knudsen (2010) prove to be no exception (see also Hodgson and Knudsen 2006a, 363-366; 2006b). Indeed, they go further than most by insisting on some consensual definitions of the replicator and interactor in social evolution.

In this subsection, I explicitly challenge the generalized Darwinism's stance on the replicator and interactor. I argue that, in light of recent discoveries in evolutionary biology, it has become clear that the duality of replicator vs. interactor is based too much on a dated understanding of biological evolution – especially the gene-as-replicator-centric view of biological evolution – to be usable. More concretely, replication, as understood by generalized Darwinism, is unnecessary for some evolutionary processes to operate, and the interactor does not have to host the replicator, as understood by generalized Darwinism. As a result, generalized Darwinism's extensive banking on replicator-vs.-interactor is shaky, to say the least.

The replicator/interactor terminology is contentious even in biological evolution (for extended discussions, see Brandon and Burian 1999; Brandon and Burian 1984; Dawkins 1976, 1982, 1994; Godfrey-Smith 2000, 2009; Hull 1980, 2000, [1988] 2001, [1994] 2001; Lewontin 1970; Lloyd 2000, 2007; Okasha 2006, 13-18; Wilson and Sober 1994). For instance, whereas David Hull (1980, [1994] 2001) insists that he conceptualizes “interactor” as a component for selection, Richard Dawkins (1983, 1994) conceptualizes “vehicle” as a framework for development and calls for “abolishing the interactor.” Even more strikingly, although it was initially thought that we can easily equate genes with “replicators” in biological evolution (e.g., Dawkins [1976] 1996), the definition of gene itself has undergone much revising and updating in light of more recent discoveries in molecular biology (Gerstein et al. 2007; Gingeras 2007).

Second, the terminology of replicator and interactor implies that the replication is necessary for interaction, hence for the whole evolution process. Yet, as the proponents of generalized Darwinism themselves admit (Aldrich et al. 2008), selection (via interaction) and evolution can operate without replication even in biological evolution, as long as there is variation (Godfrey-Smith 2000, 2009, 31-39; Lewontin 1970, 1; 1985, 86).¹⁴ This is so because variation and selection are decoupled in biological evolution, according to Darwin himself (Mayr 1982, 354; Toulmin 1972, 337-8).

Third, the pairing of “replicator” and “interactor” implies that the replicator and the interactor must be two different entities (Okasha 2006, 15). This too is apparently untrue, even in biological evolution. The first primitive template (most likely, RNAs) does not confer any phenotype, as we understand it today, and it is not a replicator either. Indeed, such a template goes through a selection for its abilities to attract

¹⁴ See Joseph Henrich and Robert Boyd (2002) for a formal model showing that evolution can operate without a discrete replicator.

nucleotides and stitch them together. Thus, the replicator and replication themselves are products of evolution via selection on certain entities that are capable of self-organizing (Bourrant 2014; Maynard Smith and Szathmari 1997).

Fourth, and more critically, in light of recent discoveries in evolutionary biology, it is abundantly clear that generalized Darwinism's notion of replicator vs. interactor is no longer adequate even in biological evolution. The transmission of prions does not rely on DNA replication. In niche construction, information (i.e., the niche) has been handed down from previous generations without any replication involved. Moreover, the organisms do not host any of the information contained in the niche. Altogether, these recent discoveries in evolutionary biology suggest that the duality of replicator/gene vs. interactor/phenotype is no longer sufficient for capturing the information flow from information to expression within biological evolution. I thus move on to an information-and-expression-centric view that is no longer completely centered on DNA/gene, but includes other carriers of information, even in biological evolution (Dachin 2011, 2013). Here, information only needs to be transmitted, not replicated, and interactors (organisms, organs, tissues, cells) do not have to host the information (see Table 1). As a result, a rigid generalized Darwinism stand that critically depends on the replicator-interactor distinction loses much of its allure.

Finally, what the replicator and interactor are in social evolution is even more contested than what they are in biological evolution, as even those who advocate generalized Darwinism admit (Aldrich et al. 2008; Hodgson and Knudsen 2006a, 2006b, 2010; cf. Nelson 2006, 2007a; Pelikan 2011, 2012; Vromen 2008, 2010, 2012). Indeed, many leading advocates and practitioners of evolutionary social sciences have had limited usage of the replicator-vs.-interactor model (e.g., Boyd and Richerson 1985; Richerson and Boyd 2005), if not explicitly dismissing it (e.g., Blute 2010, 118-120).

Not surprisingly, although Hodgson and Knudsen (2010) devote much space to the replicator and interactor in social evolution, their solution to the dispute regarding this matter is not entirely convincing. Worse, as Jack Vromen (2010, 3-4; 2012, 78-79) perceptively notes, Hodgson and Knudsen (2010) do not really follow their initial, seemingly strict definitions of a replicator and interactor when facing concrete social facts. For instance, Hodgson and Knudsen (2010) explicitly label learning (or copying?) of habits and routines as replication because they identify habits and routines as social replicators. Yet, most of us can tell that learning is not replication (see also Hodgson 2011). Reality is always more complex than "arm-chair" impositions.

Ultimately, empirical utilities should decide the utility of an epistemological stand. Yet, insisting on a rigid generalized Darwinism can trap us in the irresolvable debates on generalized Darwinism and its specific terms (e.g., replicator and interactor), thus preventing us from engaging in more fruitful empirical inquiries. In light of this possibility, the whole debate of replicator vs. interactor, which is underpinned by our desire for a rigid generalized Darwinism, may be of little value for empirical inquiries – the duality of replicator vs. interactor might have been just a red herring, or simply a mistake (Lloyd 2007, 49; see also Blute 2010, 118-20; Pelikan 2012; Vromen 2008, 2010, 2012).

Social Evolution Is Much More Than Darwinian (or Lamarckian)

Biological evolution, as we know it, is a special case of a more general phenomenon, called evolution. A system can be evolutionary, but not purely Darwinian or purely Lamarckian (for some imagined ones, see Jablonka and Lamb 2006). Human society stands out as one such system. In their zeal to defend a generalized Darwinism approach to social evolution, however, Hodgson and Knudsen (2010) fail to appreciate that several new features of social evolution render the application of generalized Darwinism for understanding social evolution even more untenable. Due to the impossibility of having a detailed discussion on social evolution in a single article,¹⁵ I will simply highlight three critical aspects: (i) the ideational dimension of social evolution as more than Darwinian; (ii) natural vs. artificial selection in social evolution; and (iii) social power as a force of artificial selection and inheritance in social evolution.

The Ideational Dimension of Social Evolution Is More Than Darwinian

Within the ideational dimension of social evolution, variation, selection,¹⁶ and inheritance can operate in a non-Darwinian way (Hussey 1999; Knudsen 2001; Nelson 2007a, 85-91). For instance, unlike biological evolution – in which variation comes before selection and variation and selection are decoupled in the ideational dimension of social evolution – selection can precede variation, and selection and variation can be tightly coupled. When an individual or a group has to come up with a solution to a real challenge in a changing social environment, they can invent new ideas to cope with the new challenge, although some ideas for a solution may exist before the challenge. In this sense, in social evolution, guided variation can indeed come *after* the selection pressure becomes apparent and the environment can induce adaptive variations. Variation here is at least partly driven by selection pressure. Yet, within a Darwinian evolution process, not only variation has to come before selection – and hence selection has no role in variation – but the environment does not induce adaptive variations.

Likewise, the passing (or inheritance) of an idea or solution to the next generation can be neither strictly Darwinian, nor strictly Lamarckian. The next generation can certainly learn the existing idea or solution, but the older generation can also impose the idea or solution on the next generation (Boyd and Richerson 1985, 81-98; Kronnfeldner 2007; Nelson 2006; 2007a, 83-91; Pelikan 2011; Vromen 2012, 78). Human beings can even acquire ideas and habits from others in the same generation or even from a younger generation. In today's digital age, an elderly individual most likely learns how to use social media and many gadgets from his/her

¹⁵ The task will take at least one and perhaps more than one book. I am completing such a manuscript, tentatively titled "On Social Evolution: Phenomenon and Paradigm" (Tang n.d.).

¹⁶ I address selection separately in the next subsection because Hodgson and Knudsen's (2010) stand on selection in social evolution is even more perplexing.

children and grandchildren. Moreover, within the ideational dimension of social evolution, both genes (as information) and phenotypes (as expression) can be *directly* transmitted horizontally and vertically, back and forth. How are we going to label these processes: transmission, inheritance, replication, or descent with modification? Certainly, these processes cannot be easily labeled as either Darwinian or Lamarckian.¹⁷

Finally, Hodgson and Knudsen (2010, 67-76) mistakenly deny that ideational inheritance in social evolution is at least partially Lamarckian for two reasons (see also Hodgson 2001, 98-99; Hodgson and Knudsen 2006b, 347-354; Hull 2000, 55-56). First, their discussion is based on the distinction of replicator vs. interactor. Second (and related to the first), they implicitly demand that ideational replicators and interactors, which have been inherited (or transmitted) in social evolution, are mostly adaptive. Thus, their second rationale – like the first one (refuted above) – cannot withstand close scrutiny.

Natural vs. Artificial Selection in Social Evolution

Hodgson and Knudsen (2010) recognize that the presence of artificial selection in human society poses a serious challenge to their argument that generalized Darwinism is the proper doctrine for understanding human society. They (2010, 50-51) attempt to diffuse this challenge with three arguments (see also Hodgson 2002, 266-269). First, they insist that artificial and natural selection are not incompatible forces, partly because Darwin himself relied on insights gained from artificial selection (e.g., artificial breeding of pigeons) to shed light on natural selection. Thus, “artificial selection is not an alternative to natural selection.” Second, “the humans doing the selecting are also a product of natural evolution.” Third, “[even] when artificial selection does take place, it is not the end of the story. Different institutions or societies in which artificial selection is involved sometimes compete against each other. Hence, some additional processes of evolutionary selection may be involved. Sometimes, despite human intentions, some institutions will survive, while others do not. Natural events or other forces may influence the selection results. Any outcome of artificial must be tested in the environment” (Hodgson and Knudsen 2010, 50-51). Ultimate, all these statements serve their purpose of insisting that, even in social evolution, artificial selection is really subordinated to or subsumed under natural selection, hence their generalized Darwinism stand is justified.

Unfortunately, all three of Hodgson and Knudsen’s (2010) rationales are either invalid or misleading. First and foremost, just because Darwin had relied on insights gained from artificial selection to shed light on natural selection does not mean that natural and artificial selection are not alternatives, at least not in social evolution. Darwin’s reliance on insights gained from artificial breeding of pigeons to shed light on natural selection is methodological, whereas the differences between natural and

¹⁷ I use the term “super-Lamarckian” to label such a process (for a more detailed discussion, see Tang n.d.).

artificial selection (especially in social evolution) are an entirely ontological matter. One does not use methodology to nullify ontology.

Second, and equally critical, although “the humans doing the selecting are also a product of natural evolution” – hence artificial selection is a product of biological evolution (thus natural selection) – this does not mean that artificial selection, which they do admit as real, is really subordinated to or subsumed under natural selection. This is so because, in addition to working together with natural selection, artificial selection can operate independently from natural selection to drive social evolution. Similarly, although human intentionality does not mean that a process lacks a Darwinian element, this does not mean that the process is entirely Darwinian either. To reduce artificial to natural selection because artificial selection comes from natural selection or to sweep human intentionality under the rug of Darwinism, as Hodgson and Knudsen (2010) do, is to commit the worst kind of ontological reductionism.

Third, Hodgson and Knudsen’s (2010, 51) statement that “when artificial selection does take place, it is not the end of the story ... that [a]ny outcome of artificial [selection] must be tested in the environment” is evasive at best. Nowhere in this paragraph do the authors (2010) state explicitly that the “environment” in which “any outcome of artificial [selection] must be tested” is the natural environment before the coming of *Homo sapiens* or the no-longer-purely-natural or partly-artificial environment after the advent of *Homo sapiens*. Note also that, within this paragraph, Hodgson and Knudsen (2010) use the term *evolutionary selection* rather than *Darwinian selection*.¹⁸

Finally, the presence of human agency as the ultimate “nice construction” points to the very possibility that artificial selection has been a far more powerful force than natural selection in social evolution. Although human agency is just another product of biological evolution, it is truly extraordinary on at least two levels. First, human beings can intentionally change their environment, whereas other organisms can do so only unintentionally. Second, humans are the most extraordinary species in terms of reshaping their own environment, not the least because humans have invented culture (O’Brien and Laland 2011, 435-437).¹⁹ Indeed, some of the most dramatic transformations of human society had been (and continue to be) “self-imposed” or self-constructed (O’Brien and Laland 2011, 436) – from agriculture to warfare and wireless communication.

Certainly, the advent of settled agricultural societies profoundly shaped our evolutionary trajectory (Diamond 1997; O’Brien and Laland 2012; Smith 1998).

¹⁸ Hodgson and Knudsen (2006b, 480n3; 2010b, 50-51) are thus also mistaken to insist that artificial selection does not contradict Darwinian selection, and dismiss John R. Commons’s (1934) critique of Veblen (cf. Ramstad 1994; Vanberg 1997). Also, while Aldrich et al. (2008) cite J. Stanley Metcalfe (1998) approvingly, Metcalfe uses the term “Darwinism” only once (on p. 38). Instead, Metcalfe talks about “evolution” or “evolutionary theory”.

¹⁹ Here, I will point out that niche construction by no means nullifies the possibility of (both natural and artificial) selection in social evolution. Just because human action can reshape their environment, and this environment can then come back to shape human action, does not mean that selection no longer operates (cf. Cordes 2007, 137).

Moreover, culture (which mostly came after agricultural communities) has been an enormously powerful selection force in the biological and social evolution of human species (Laland, Odling-Smee and Myles 2010; Odling-Smee and Laland 2011). When considering that artificial selection – which subsumes “cultural selection” – has been a powerful force (and most likely a more powerful force than natural selection) in shaping human species for at least ten thousand years, it is difficult to insist that artificial selection is subordinate to (or even subsumed under) natural selection.

Social Power as a Force of Artificial Selection and Inheritance in Social Evolution

Hodgson and Knudsen's (2010) conceptualization also suffers from their desire to remain faithful to generalized Darwinism and from their affinity to (neoclassical) economics that has long neglected the role of sociopolitical power (hereafter, power). As a result, they (2010) fail to grasp that a critical selection force has arisen from the interaction between material forces and ideational forces in social evolution – namely, power. Most critically, the presence of power as a selection force in social evolution makes artificial selection in social evolution foundationally different from natural selection in biological evolution. Indeed, Hodgson and Knudsen (2010) do not allocate any role to power for either selection or inheritance in social evolution.²⁰ Yet, from policy changes, to institutional change, to culture (Bourdieu [1980] 1990; Brown 2013; Durham 1991; Elias [1939] 1994; Foucault 1980), *power is often the most critical selection force in social evolution*. Indeed, without taking social power as a critical (if not the most critical) selection force in social evolution, the history of human society would be impossible to understand.

Several critical consequences of having power as a key selection force are obvious. First, selection in the ideational dimension of social evolution, and sometimes in the material (i.e., the genetic) dimension of social evolution is often heavily biased (Durham 1991, 198-205). Very often, agents who possess more power determine which idea should spread and which should not. Second, existing ideas – especially those ideas that have been codified and backed by power – have powerful impact on the fitness of (new) ideas and sometimes genes (Foucault 1980; Tang 2011). Third, specific cultural traits and institutional arrangements may (or may not) enhance the inclusive fitness of their hosts, although culture as a whole is an adaptation (Boyd and Richerson 1985, 81-2; 175-78; Brown 2013, 221-22; Durham 1991; Richerson and Boyd 2005, chs. 4 and 5).²¹

²⁰ As I argue in detail elsewhere (Tang n.d.), power is also a powerful force of inheritance in the sense that the inheritance or retention of many ideational traits in human societies is often backed by power. Because singling out Hodgson and Knudsen's neglecting power as a critical selection force is sufficient to clarify the point that these authors' generalized Darwinism stand is inadequate for understanding social evolution, I refrain from discussing power as a key force of artificial inheritance in social evolution here.

²¹ Robert Boyd and Peter Richerson (1985), however, failed to appreciate the role of power in generating and retaining maladaptive cultural traits and institutional arrangements (see the more detailed discussion in section three of this article).

Here, it is useful to recall that Dawkins insists on “universal Darwinism” for explaining “*organized adaptive complexity*” (i.e., organic life). Yet, while human society is certainly a “[*super-*]organized complexity,” it is not necessarily “*adaptive complexity*” all around. Many social institutions and cultural traits actually persist, even though they reduce human welfare (Brown 2013, 214). Otherwise, the whole world would have been developed.²² This ontological fact that not all aspects of human society are welfare-optimizing (i.e., Pareto-optimal) or even welfare-improving (i.e., Pareto-improving) makes a Darwinian approach inadequate (if not misleading) for understanding human society. By contrast, a process of artificial selection and artificial (i.e., cultural and institutional) inheritance backed by power can readily account for why individuals and groups often retain welfare-reducing institutions for a long period of time: artificial selection based on social power can easily overpower natural selection. Thus, theories or approaches of social evolution that do not identify power as an integral component of social evolution, and/or cannot model power as a critical selection force in social evolution, simply cannot be sufficiently social evolutionary and adequate for understanding social evolution. In fact, they may be utterly misleading, and Hodgson and Knudsen’s (2010) generalized Darwinism is no exception.

Summary

Darwinism, even generalized, is a highly restricted framework. Meanwhile, although social evolution certainly contains critical (neo-)Darwinian elements, it also contains many non-Darwinian (i.e., Lamarckian, neo-Lamarckian, super-Lamarckian, some hybrids of Darwinian and Lamarckian, etc.) elements. In social evolution, variation, selection, and inheritance can operate in non-Darwinian (and non-Lamarckian) ways. When this is the case, social evolution is far more than what generalized Darwinism can accommodate, and there is no ground for insisting on generalized Darwinism or “generalized Lamarckism”.

As such, when facing concrete social facts, Hodgson and Knudsen frequently rely on the tactics of vanquishing your opponents via definitions or labels, as Vromen (2012, 79) perceptively notes. Thus, Hodgson and Knudsen define Lamarckian mechanisms narrowly and Darwinian mechanism broadly by insisting on a strict transmission of phenotype via genotype (Hodgson and Knudsen 2006b, esp. 347-354; 2010, ch. 4), so that they could claim that social evolution is not (strictly) Lamarckian, but rather (loosely) Darwinian. Yet, inheritance in the ideational dimension of social evolution does not necessarily depend on strict transmission of phenotype via genotype. Both ideational genotypes and phenotypes can be directly inherited without necessarily going through the other. Indeed, although Hodgson and Knudsen (2010)

²² Campbell (1974b) had a similar rationale for insisting on a purely Darwinian approach. He explained the near perfect fit between scientific theories and the aspects of nature that these theories seek to explain.

demand a strict differentiation of the replicator and interactor in order to stay within generalized Darwinism, their actual usages of these two concepts often stretch the two concepts beyond recognition (Vromen 2012, esp. 78-79).

In addition to their generalized Darwinism position, which is hard to defend, Hodgson and Knudsen's (2010) work suffers from additional deficiencies when it comes to social evolution. They fail to state explicitly how the social system impacts human agents in social evolution, even though insisting on generalized Darwinism as a doctrine for understanding social evolution cannot be complete without such a statement. After all, the social system is the overarching environment that shapes human beings, just as the ecological system is the overarching environment that shapes other organisms. Lastly, they fail to provide a systematic statement of what social evolution is as a phenomenon and as a paradigm. Thus, despite its important achievements, Hodgson and Knudsen's *Darwin's Conjecture: The Search for General Principles of Social and Economic Evolution* (2010) falls far short of advancing a systematic statement on social evolution as a phenomenon and a paradigm.

Toward Generalized Evolutionism for Human Society

Evolution does not have to be an exclusively – or even largely – Darwinian process. Moreover, social evolution is definitely much more than Darwinian. Yet, the Darwinian scheme, even generalized, is highly restrictive. As a result, if we insist on a generalized Darwinism stand for understanding social evolution, we have to bend many key concepts out of shape (Vromen 2008, 2010, 2012). A rigid generalized Darwinism thus may actually hinder rather than facilitate our understanding of human society.

By contrast, “generalized evolutionism” holds that as long as a process of change undergoes the three phases of variation, selection, and inheritance (either *variation–selection–inheritance* or *selection–variation–inheritance*, or both), it is an evolutionary process. Thus, we can and must deploy an evolutionary approach in order to gain an adequate understanding of this dynamics. Moreover, once we grasp that there are multiple levels of evolution within social evolution and that theorizing these different levels require different epistemological and methodological tools, it becomes clear that despite insisting on the deployment of variation, selection, and inheritance as part of its explanatory apparatus (and hence retaining the disciplining power of “evolutionism”), “generalized evolutionism” is extremely versatile in handling the enormous complexities of social evolution (Tang n.d.).

Therefore, as a scientific doctrine, “generalized evolutionism” is more accommodating and powerful than generalized Darwinism. Generalized evolutionism applies to a system as long as the system evolves via the central mechanism of variation–selection–inheritance or selection–variation–inheritance, regardless whether the system changes via a Darwinian or non-Darwinian process, or a mixture of several kinds of processes. Put differently, generalized evolutionism subsumes (generalized) Darwinism, Lamarckism, non-Darwinism, and non-Lamarckism, and makes these

doctrines special cases of evolutionism. By doing so, “generalized evolutionism” eliminates the necessity of debating these labels and doctrines.²³

In sum, “we should not expect a single, universal model for ... all the dimensions of heredity and evolution” (Jablonka and Lamb 2006, 378; see also Godfrey-Smith 2009). Certainly, Darwin (1859, 1871) himself had never explicitly stated that a rigid application of his theoretical scheme to human society is valid. And many pioneers did not use the terms “Darwinian” or “Darwinism” in generalizing the evolutionary approach to social sciences for a reason. In his more mature essay, David Ritchie (1896) already questioned the possibility of a “Darwinian” doctrine (as natural selection) for understanding social evolution, and did not use the term “Darwinism” at all (cf. Ritchie 1891). What he had in mind was extending “evolutionism” – rather than “Darwinism” – to social evolution. Neither Thorstein Veblen (1899), nor Donald Campbell (1960, [1965] 1998, 1974a, 1974b) employed these terms, even though both used the phrase “natural selection” in relation to cultural traits or ideas. Perhaps they were wiser than we think.

I would like to end my discussion on a more hopeful note. Both its proponents and opponents have been right to stress that “generalized Darwinism” is not enough. In the same spirit, I admit that merely insisting on a stand of “generalized evolutionism,” too, is not enough. Instead, we need to get down to the real business of conducting empirical research with an evolutionary approach in mind (for similar calls, see Pelikan 2011, 2012; Vromen 2008, 2010, 2012). Ultimately, a research program must be judged on how much explanatory value it can bring to empirical inquiries. When we have moved beyond the often acerbic and ultimately unhelpful war of labels and doctrines, then we can get down to the real business. On this front, starting with a “generalized evolutionism” position, existing empirical works (including my own) provide some genuine new insights into key facts regarding human society – from institutional change to the foundation for economic development before 1500 AD, through the advent of the industrial revolution, to the evolution of the international system (Diamond 1997; Elias [1939] 1994; Tang 2011, 2013, 2016; Tang and Long 2012; Tang, Hu and Li 2016).

References

- Aldrich, Howard E., Geoffrey M. Hodgson, David L. Hull, Thorbjørn Knudsen, Joel Mokyr and Viktor J. Vanberg. “In Defense of Generalized Darwinism.” *Journal of Evolutionary Economics* 18, 5 (2008): 577-596.
- Badyaev, Alexander. “Maternal Effects as Generators of Evolutionary Change.” *Annals of the New York Academy of Sciences* 1133 (2008): 151-161.
- Badyaev, Alexander and Tobias Uller. “Parental Effects in Ecology and Evolution: Mechanisms, Processes, and Implications.” *Philosophical Transactions of the Royal Society B: Biological Sciences* 364 (2009): 1169-1177.

²³ Through personal communications (from January 2011), Marion Blute, Richard Nelson, and the late David Hull confirmed that they would be comfortable with “generalized evolutionism” (see also Blute 2010; Nelson 2006, 2007a, 2007b). Eva Jablonka and Marion Lamb (2005) advance a similar stand.

- Bird, Adrian. "Perceptions of Epigenetics." *Nature* 447 (2007): 396-398.
- Blute, Marion. *Darwinian Sociocultural Evolution: Solutions to Dilemmas in Cultural and Social Theory*. Cambridge, UK: Cambridge University Press, 2010.
- Bourdieu, Pierre. *The Logic of Practice*. Stanford, CA: Stanford University Press, [1980] 1990.
- Bourrant, Pierrivk. "From Survivors to Replicators: Evolution by Natural Selection Revisited." *Biology & Philosophy* 29, 4 (2014): 519-58.
- Boyd, Robert and Peter Richerson. *Culture and the Evolutionary Process*. Chicago, IL: University of Chicago Press, 1985.
- Brown, Christopher. "Transmutability, Generalized Darwinism and the Limits to Conceptual Integration." *Cambridge Journal of Economics* 37, 1 (2013): 209-225.
- Brandon, Richard N. and Richard Burian, eds. *Genes, Organisms, Population: Controversies Over the Units of Selection*. Cambridge, MA: MIT Press, 1984.
- . "The Units of Selection Revisited: The Modules of Selection." *Biology and Philosophy* 14, 2 (1999): 167-180.
- Brinkworth, Martin, and Friedel Weinert, eds. *Evolution 2.0: Implications of Darwinism in Philosophy and the Social and Natural Sciences*. Berlin: Springer, 2012.
- Buenstorf, Guido. "How Useful Is Generalized Darwinism as a Framework to Study Competition and Industrial Evolution?" *Journal of Evolutionary Economics* 16, 6 (2006): 511-527.
- Campbell, Donald. "Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Processes." *Psychological Review* 67, 6 (1960): 380-400.
- . "Variation and Selective Retention in Socio-Cultural Evolution." In *The Foundations of Evolutionary Economics*, edited by Geoffrey Hodgson, pp. 354-370. Cheltenham, UK: Edward Elgar, [1965] 1998.
- . "Evolutionary Epistemology." In *The Philosophy of Karl Popper*, edited by Paul Arthur Schilpp, pp. 413-463. La Salle, IL: Open Court, 1974a.
- . "Unjustified Variation and Selective Retention in Scientific Discovery." In *Studies in the Philosophy of Biology: Reduction and Related Problems*, edited by Francisco J. Ayala and Theodosius Dobzhansky, pp. 139-161. Berkeley, CA: University of California Press, 1974b.
- Commons, John R. *Institutional Economics: Its Place in Political Economy*. New York, NY: Macmillan, 1934.
- Cordes, Christian. "Darwinism in Economics: From Analogy to Continuity." *Journal of Evolutionary Economics* 16, 4 (2006): 529-541.
- . "Turning Economics into an Evolutionary Science: Veblen, the Selection Metaphor, and Analogical Thinking." *Journal of Economic Issues* 47, 1 (2007): 135-154.
- Danchin, Etienne. "Avatars of Information: Towards an Inclusive Evolutionary Synthesis." *Trends in Ecology and Evolution* 28, 6 (2013): 351-358.
- Danchin, Etienne, Anne Charmantier, Frances A. Champagne, Alex Mesoudi, Benoit Pujol and Simon Blanchet. "Beyond DNA: Integrating Inclusive Inheritance into an Extended Theory of Evolution." *Nature Reviews Genetics* 12 (2011): 475-486.
- Darwin, Charles. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life*. London, UK: John Murray, 1859.
- . *The Variation of Animals and Plants under Domestication*. London, UK: John Murray, 1868.
- . *The Descent of Man and Selection in Relation to Sex*. London, UK: John Murray, 1871.
- Dawkins, Richard. *The Extended Phenotype: The Long Reach of the Gene*. Oxford, UK: Oxford University Press, 1982.
- . "Universal Darwinism." In *Evolution from Molecules to Man*, edited by D. S. Bendall, pp. 403-425. Cambridge, UK: Cambridge University Press, 1983.
- . "Burying the Vehicle." *Behavioral and Brain Sciences* 17 (1994): 616-617.
- . *The Selfish Gene*. Oxford, UK: Oxford University Press, [1976] 1996.
- Diamond, Jared. *Guns, Germs, and Steel*. New York, NY: Norton, 1997.
- Durham, William H. *Coevolution: Genes, Culture, and Human Diversity*. Stanford, CA: Stanford University Press, 1991.
- Elias, Norbert. *The Civilizing Process*. Oxford, UK: Blackwell, [1939] 1994.
- Foucault, Michel. *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*. Edited by Colin Gordon. New York, NY: Pantheon, 1980.

- Gerstein, Mark B., Mark B. Gerstein, Can Bruce, Joel S. Rozowsky, Deyou Zheng, Jiang Du, Jan O. Korbel, Olof Emanuelsson, Zhengdong D. Zhang, Sherman Weissman and Michael Snyder. "What Is a Gene, Post-ENCODE? History and Updated Definition." *Genome Research* 17 (2007): 669-681.
- Gingeras, Thomas R. "Origin of Phenotypes: Genes and Transcripts." *Genome Research* 17 (2007): 682-690.
- Godfrey-Smith, Peter. "The Replicator in Retrospect." *Biology and Philosophy* 15, 3 (2000): 403-423.
- . *Darwinian Populations and Natural Selection*. Oxford, UK: Oxford University Press, 2009.
- Haines, Valerie A. "Is Spencer's Theory an Evolutionary Theory?" *American Journal of Sociology* 93 (1988): 1200-23.
- Halfmann, Randal, Daniel F. Jarosz, Sandra K. Jones, Amelia Chang, Alex K. Lancaster and Susan Lindquist. "Prions Are a Common Mechanism for Phenotypic Inheritance in Wild Yeasts." *Nature* 482 (2012): 363-369.
- Halfmann, Randal and Susan Lindquist. "Epigenetics in the Extreme: Prions and the Inheritance of Environmentally Acquired Traits." *Science* 330 (2010): 629-632.
- Hallpike, Christopher Robert. *The Principles of Social Evolution*. Clarendon, UK: Oxford University Press, 1986.
- Henrich, Joseph and Robert Boyd. "On Modeling Cognition and Culture: Why Cultural Evolution Does Not Require Replication of Representations." *Journal of Cognition and Culture* 2, 2 (2002): 87-112.
- Hodgson, Geoffrey M. "Is Social Evolution Lamarckian or Darwinian?" In *Darwinism and Evolutionary Economics*, edited by John Laurent and John Nightingale, pp. 87-118. Cheltenham, UK: Edward Elgar, 2001.
- . "Darwinism in Economics: From Analogy to Ontology." *Journal of Evolutionary Economics* 12, 3 (2002): 259-281.
- . "Generalizing Darwinism to Social Evolution: Some Early Attempts." *Journal of Economic Issues* 39, 4 (2005): 899-914.
- . "Social Evolution Is Lamarckian: right, wrong, or misleading?" 2011. Available at www.geoffrey-hodgson.info/lamarckism.htm. Accessed April 25, 2014.
- Hodgson, Geoffrey M. and Thorbjørn Knudsen. "Dismantling Lamarckism: Why Descriptions of Socio-Economic Evolution as Lamarckian Are Misleading." *Journal of Evolutionary Economics* 16, 4 (2006a): 343-366.
- . "The Nature and Units of Social Selection." *Journal of Evolutionary Economics* 16, 5 (2006b): 477-489.
- . *Darwin's Conjecture: The Search for General Principles of Social and Economic Evolution*. Chicago, IL: University of Chicago Press, 2010.
- . "Agreeing on Generalized Darwinism: A Response to Pavel Pelikan." *Journal of Evolutionary Economics* 22, 1 (2012): 9-18.
- Hull, David. "Individuality and Selection." *Annual Review of Ecology and Systematics* 11 (1980): 311-332.
- . "Taking Memetics Seriously: Memetics Will Be What We Make It." In *Darwinizing Culture: The Status of Memetics as a Science*, edited by Robert Auger, pp. 43-68. Oxford, UK: Oxford University Press, 2000.
- . "Interactors Versus Vehicles." In *Science and Selection: Essays on Biological Evolution and the Philosophy of Science*, by David L. Hull, pp. 13-45. Cambridge, UK: Cambridge University Press, [1988] 2001.
- . "Taking Vehicles Seriously." In *Science and Selection: Essays on Biological Evolution and the Philosophy of Science*, by David L. Hull, pp. 46-48. Cambridge, UK: Cambridge University Press, [1994] 2001.
- . *Science and Selection: Essays on Biological Evolution and the Philosophy of Science*. Cambridge, UK: Cambridge University Press, 2001.
- Hussey, Trevor. "Evolutionary Change and Epistemology." *Biology and Philosophy* 14, 4 (1999): 561-84.
- Jablonka, Eva and Marion Lamb. *Epigenetic Inheritance and Evolution: The Lamarckian Dimension*. Oxford, UK: Oxford University Press, 1995.
- . *Evolution in Four Dimensions*. Cambridge, MA: MIT Press, 2006.
- Jablonka, Eva and Gal Raz. "Transgenerational Epigenetic Inheritance: Prevalence, Mechanisms, and Implications for the Study of Heredity and Evolution." *Quarterly Review of Biology* 84, 2 (2009): 131-176.
- Jaenisch, Robert and Adrian Bird. "Epigenetic Regulation of Gene Expression: How the Genome Integrates Intrinsic and Environmental Signals." *Nature Genetics Supplement* 33 (2003): S245-S254.

- Johansen, Wilhelm. "The Genotype Conception of Heredity." *American Naturalist* 45 (1911): 129-159.
- Knudsen, Thorbjørn. "Nesting Lamarckism Within Darwinian Explanations: Necessity in Economics and Possibility in Biology?" In *Darwinism and Evolutionary Economics*, edited by John Laurent and John Nightingale, pp. 121-159. Cheltenham, UK: Edward Elgar, 2001.
- Kronfeldner, Maria. "Is Cultural Evolution Lamarckian?" *Biology and Philosophy* 22 (2007): 493-512.
- . "Darwinian 'Blind' Hypothesis Formation Revisited." *Synthese* 175 (2010): 193-218.
- Laland, Kevin N., John Odling-Smee and Sean Myles. "How Culture Shaped the Human Genome: Bringing Genetics and the Human Sciences Together." *Nature Reviews, Genetics* 11 (2010): 137-48.
- Laland, Kevin N., Tobias Uller, Marcus W. Feldman, Kim Sterelny, Gerd B. Müller, Armin Moczek, Eva Jablonka and John Odling-Smee. "The Extended Evolutionary Synthesis: Its Structure, Assumptions and Predictions." *Proceedings of the Royal Society, Series B*. 282 (2015): 20151019. Available at <http://dx.doi.org/10.1098/rspb.2015.1019>. Accessed December 1, 2016.
- Lamarck, Jean-Baptiste. *Zoological Philosophy*. Translated by Hugh Eliot. New York, NY: Hafner, 1809.
- Levit, Georgy S., Uwe Hossfeld and Ulrich Witt. "Can Darwinism Be 'Generalized' and of What Use Would This Be?" *Journal of Evolutionary Economics* 21, 3 (2011): 545-562.
- Lewontin, Richard C. "The Units of Selection." *Annual Review of Ecology and Systematics* 1 (1970): 1-18.
- . "Gene, Organism, and Environment," In *Evolution from Molecules to Men*. Edited by D.S. Bendall, pp. 273-285. Cambridge, UK: Cambridge University Press, 1983.
- . "Adaptation." In *The Dialectic Biologists*. Edited by Richard Levine and Richard C. Lewontin, pp. 65-84. Cambridge, MA: Harvard University Press, 1985.
- Lloyd, Elisabeth A. "Groups on Groups: Some Dynamics and Possible Resolution of the Units of Selection Debates in Evolutionary Biology." *Biology and Philosophy* 15 (2000): 389-401.
- . "Units and Levels of Selection." In *The Cambridge Companion to the Philosophy of Biology*, edited by David L. Hull and Michael Ruse, pp. 44-65. Cambridge, U K: Cambridge University Press, 2007.
- Majumdar, Amitabha, Wanda Colon Cesario, Erica White-Grindley, Huoqing Jiang, Fengzhen Ren, Mohammed "Repon" Khan, Liying Li, Edward Man-Lik Choi, Kasthuri Kannan, Fengli Guo, Jay Unruh, Brian Slaughter and Kausik Si. "Critical Role of Amyloid-like Oligomers of Drosophila Orb2 in the Persistence of Memory." *Cell* 148 (2012): 515-529.
- Mameli, Matteo. "The Inheritance of Features." *Biology & Philosophy* 20, 2 (2005): 365-399.
- Maynard Smith, John and Szathmáry Eors. *The Major Transitions in Evolution*. Oxford, UK: Oxford University Press, 1997.
- Mayr, Ernst. "Lamarck Revisited." *Journal of History of Biology* 5 (1972): 55-94.
- . *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Cambridge, MA: Belknap Press, 1982.
- Mesoudi, Alex. *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences*. Chicago, IL: University of Chicago Press, 2011.
- Metcalfe, J. Stanley. *Evolutionary Economics and Creative Destruction*. London, UK: Routledge, 1998.
- Nelson, Richard R. "Evolutionary Social Sciences and Universal Darwinism." *Journal of Evolutionary Economics* 16, 6 (2006): 491-510.
- . "Universal Darwinism and Evolutionary Social Science." *Biology and Philosophy* 22, 1 (2007a): 73-94.
- . "Comment on: Dismantling Lamarckism: Why Description of Socio-Economic Evolution as Lamarckian Are Misleading." *Journal of Evolutionary Economics* 17, 4 (2007b): 349-352.
- O'Brien, Michael J. and Kevin N. Laland. "Genes, Culture and Agriculture: An Example of Human Niche Construction." *Current Anthropology* 53, 4 (2011): 434-470.
- Odling-Smee, John. "Niche Inheritance." In *Evolution: The Extended Synthesis*, edited by Massimo Pigliucci and Gerd B. Müller, pp. 175-207. Cambridge, MA: MIT Press, 2010.
- Odling-Smee, John and Kevin N. Laland. "Ecological Inheritance and Cultural Inheritance: What Are They and How Do They Differ." *Biological Theory* 6, 3 (2011): 220-30.
- Odling-Smee, John, Kevin N. Laland and Marcus W. Feldman. *Niche Construction: The Neglected Process in Evolution*. Princeton, NJ: Princeton University Press, 2003.
- Okasha, Samir. *Evolution and the Levels of Selection*. Oxford, UK: Oxford University Press, 2006.
- Pelikan, Pavel. "Evolutionary Developmental Economics: How to Generalize Darwinism Fruitfully to Help Comprehend Economic Change." *Journal of Evolutionary Economics* 21, 2 (2011): 341-366.

- . "Agreeing on Generalized Darwinism: AResponse to Geoffrey Hodgson and Thorbjørn Knudsen." *Journal of Evolutionary Economics* 22, 1 (2012): 1-8.
- Pigliucci, Massimo and Gerd B. Müller, eds. *Evolution: The Extended Synthesis*. Cambridge, MA: MIT Press, 2010.
- Popper, Karl. "Campbell on the Evolutionary Theory of Knowledge." In *Evolutionary Epistemology, Rationality, and the Sociology of Knowledge*, edited by Gerard Radnitzky and W.W. Bartley, III, pp. 115-120. La Salle, IL: Open Court, [1974] 1987.
- Prusiner, Stanley B. "Prions." *Proceedings of the National Academy of Sciences of USA* 95 (1998): 13383-13383.
- . "A Unifying Role for Prions in Neurodegenerative Diseases." *Science* 336 (2012): 1511-1513.
- Ramstad, Yngve. "On the Nature of Economic Evolution: John R. Commons and the Metaphor of Artificial Selection." In *Evolutionary and Neo-Schumpeterian Approach to Economics*, edited by Lars Mangusson, pp. 65-121. Boston, MA: Kluwer, 1994.
- Richards, Eric J. "Inherited Epigenetic Variation—Revisiting Soft Inheritance." *Nature Review Genetics* 7 (2006): 395-401.
- Richards, Robert J. "The Natural Selection Model of Conceptual Evolution." *Philosophy of Science* 44, 3 (1977): 494-501.
- Richerson, Peter J. and Robert Boyd. *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago, IL: University of Chicago Press, 2005.
- Ritchie, David. *Darwinism and Politics*. Second edition. London, UK: Swan Sonnenschein, 1891.
- . "Social Evolution." *International Journal of Ethics* 6, 2 (1896): 165-181.
- Runciman, Walter. *The Theory of Cultural and Social Selection*. New York, NY: Cambridge University Press, 2009.
- Sanderson, Stephen K. *The Evolution of Sociality: A Darwinian Conflict Perspective*. Lanham, MD: Rowman and Littlefield, 2001.
- Si, Kausik, Yun-Beom Choi, Erica White-Grindley, Amitabha Majumdar and Eric R. Kandel. "Aplysia CPEB Can Form Prion-like Multimers in Sensory Neurons That Contribute to Long-Term Facilitation." *Cell* 140 (2010): 421-435.
- Smith, Bruce D. *The Emergence of Agriculture*. New York, NY: Freeman, 1998.
- Tang, Shiping. *A General Theory of Institutional Change*. London, UK: Routledge, 2011.
- . *Social Evolution of International Politics*. Oxford, UK: Oxford University Press, 2013.
- . "Eurasia Advantage, Not Genetic Diversity: Against Ashraf and Galor's 'Genetic Diversity' Hypothesis." *Historical Social Research* 41, 1 (2016): 287-327.
- . *On Social Evolution: Phenomenon and Paradigm*. Book manuscript in progress. Not dated (n.d.).
- Tang, Shiping, Zhan Hu and Yun Li. "Knowledge, Institution, Power, and Growth: Toward a Unified Economics of Growth." SSRN, 2016. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2766052. Accessed December 1, 2016.
- Tang, Shiping and Joey Shi Ruey Long. "American Military Interventionism: A Social Evolutionary Interpretation." *European Journal of International Relations* 18, 3 (2012): 509-538.
- Toulmin, Stephen. *Human Understanding: The Collective Use and Evolution of Concepts*. Princeton, NJ: Princeton University Press, 1972.
- Vanberg, Viktor J. "Institutional Evolution through Purposeful Selection: The Constitutional Economics of John R. Commons." *Constitutional Political Economy* 8, 1 (1997): 105-122.
- Veblen, Thorstein. *Theories of the Leisure Class: An Economic Study in the Evolution of Institutions*. New York, NY: Random Houses, 1899.
- Vromen, Jack. "Ontological Issues in Evolutionary Economics: The Debate Between Generalized Darwinism and the Continuity Hypothesis." Paper on Economics and Evolution No. 0805. Jena, Germany: Max Planck Institute of Economics, 2008.
- . "Heterogeneous Economic Evolution: A Different View on Darwinizing Evolutionary Economics." Paper on Economics and Evolution No. 1015. Jena, Germany: Max Planck Institute of Economics, 2010.
- . "How to Make a Convincing Case for Darwinizing the Social Sciences? (Review of Hodgson and Knudsen, Darwin's Conjecture)." *Journal of Economic Methodology* 19, 1 (2012): 77-88.
- Wallace, Alfred R. "The Origin of Human Races and the Antiquity of Man Deduced from the Theory of 'Natural Selection'." *Journal of the Anthropological Society of London* 2 (1864): clviii-clxxxvii.

- Wells, David A. "The Extended Phenotype(s): A Comparison with Niche Construction Theory." *Biology & Philosophy* 30, 4 (2015): 547-567.
- Wilkins, John S. "The Appearance of Lamarckism in the Evolution of Culture." In *Darwinism and Evolutionary Economics*, edited by John Laurent and John Nightingale, pp. 160-183. Cheltenham, UK: Edward Elgar, 2001.
- Wilson, David Sloan and Elliott Sober. "Reintroducing Group Selection to the Human Behavioral Sciences." *Behavioral and Brain Sciences* 17, 4 (1994): 585-654.
- Witt, Ulrich. "On the Proper Interpretation of 'Evolution' in Economics and Its Implications for Production Theory." *Journal of Economic Methodology* 11, 2 (2004): 125-146.
- . "What Is Specific About Evolutionary Economics?" *Journal of Evolutionary Economics* 18, 6 (2008): 547-575.