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## **Generalized Darwinism in Evolutionary Economics: The Devil is in the Details**

by

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# Generalized Darwinism in Evolutionary Economics: The Devil is in the Details<sup>1</sup>

Jack Vromen

## Introduction

This paper is a follow-up on two earlier debates I was part of. One debate is documented in a special issue of *The Journal of Economic Methodology*, edited by Matthias Klaes and called *Symposium: Ontological Issues in Evolutionary Economics* (2004) The other one is reported in a special issue of *The Journal of Evolutionary Economics* edited by Ulrich Witt and called *Evolutionary Concepts in Economics and Biology* (2006), which is (as Witt notes in his *Editorial*) mainly about the appropriateness and fruitfulness of Universal Darwinism (or, following Hodgson and Knudsen, I henceforth refer to Generalized Darwinism) in and for evolutionary economics.<sup>2</sup> The present paper is meant to be a further contribution to this latter debate.

My own earlier stance on Generalized Darwinism was to give it, at least for the time being, the benefit of the doubt. I recommended to suspend judgment; to wait and see until it is worked out into a full-fledged theory and only then assess it on the basis of usual criteria for theory assessment. This was based on a negative argument only. No positive argument was given to contribute actively to making the project of Generalized Darwinism a success. It is one thing not to reject or dismiss a new theoretical project out of hand; it is quite another thing, of course, to try to help in letting the project succeed.

One needs a positive reason or motivation to actively promote (or advocate) generalized Darwinism, to contribute to its further development, to elaborate on it and so on. Such a positive reason could be ontological in kind. Indeed, as we shall see both proponents and opponents of generalized Darwinism do advance ontological considerations to back up their stance. After weighing the ontological arguments pro and con generalized Darwinism, I shall argue that rather than working in favor of Generalized Darwinism, ontological considerations work against it. On my own count, if Generalized Darwinism is understood as a heuristic device for the development of new theories in evolutionary economics, with providing detailed causal explanations of actual processes of change in economies as its final aim, the odds are against Generalized Darwinism.

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<sup>1</sup> My thanks go to Caterina Marchionni and Jan-Willem Stoelhorst for useful comments on an earlier draft. The usual caveat applies.

<sup>2</sup> Discussions of Universal Darwinism have found their way even to popularizations of economic theory (Coyle 2007).

## Hodgson and Knudsen's case for Generalized Darwinism

In a nutshell, Hodgson and Knudsen's position with respect to Generalized Darwinism is as follows:

If understood at a sufficiently high level of generality and abstraction, socio-cultural evolution (and, in particular, economic evolution) is Darwinian. The Darwinian principles of variation, inheritance and selection are just as real in economic systems and populations as they are in biological populations. The presence of these three principles is sufficient for Darwinian evolution to occur. Thus we have Darwinian evolution occurring not only in the biological but also in the economic domain. It is not just that there is Darwinian evolution going on in the economic domain, Hodgson and Knudsen argue, we cannot have satisfactory explanations of how economic systems evolve that do not refer to these three Darwinian principles. This is not to say that biological and economic evolution are the same *tout court*, however. Though the three principles of Generalized Darwinism just stated are domain-general (in the sense that they are not only working in the biological domain, but also in other domains such as the economic domain), the *details* of the mechanisms underlying the generation of new variants, and underlying inheritance (or replication) and selection in the economic domain are very different from those working in the biological domain. Invoking the three principles of Generalized Darwinism is therefore necessary but not sufficient in explaining processes of economic evolution.<sup>3</sup> Auxiliary domain-specific hypotheses have to be added to arrive at explanatory powerful theories. Among other things this entails that replicators and interactors have to be identified in the economic domain. Hodgson and Knudsen identify individual habits and organizational routines as paradigmatic examples of ('social') replicators and firms as paradigmatic examples of ('social') interactors in the economic domain.

Thus Hodgson and Knudsen's case for Generalized Darwinism involves not just a *description* of what Generalized Darwinism entails: the three general principles of variation, inheritance (or replication) and selection. It also involves the *claim* that these principles are not only applicable to economic evolution (and other forms of non-biological evolution) but are mandatory in any study of evolving systems. And, finally, it also involves a *program* (or project): more is needed than the application of just the three principles to have a satisfactory study of economic evolution. Domain-specific hypotheses and data have to be added to arrive at explanatory theories.

There is much I agree with. Hodgson and Knudsen are right in arguing, I think, that introducing a Darwinian explanatory framework in economics does not imply endorsement of genetic determinism or biological reductionism. Accepting the three Darwinian principles stated above does not commit one to hold that genes are in charge of economic behavior, for example. There is no inconsistency in accepting a generalized Darwinian explanatory framework and at the same time denying that genes are in charge of economic behavior. Likewise, accepting a Darwinian explanatory framework in

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<sup>3</sup> This is aptly stated, for example, in the title of their 2006a paper: "Why we need a generalized Darwinism, and why generalized Darwinism is not enough".

economics does not make economic evolution a subset of biological evolution. And it does neither imply that phenomena at the social level and at the level of individual agents are reducible to phenomena at the cellular and molecular level. Thus rejection of genetic determinism and of biological reductionism (which Hodgson and Knudsen take to be well-taken rejections) should not be taken to provide a good reason to reject generalized Darwinism (which Hodgson and Knudsen take to be an ill-taken rejection).

Resisting generalized Darwinism in economics on the ground that cultural evolution, and economic evolution in particular are Lamarckian, where ‘Lamarckian’ is taken to mean that acquired characteristics can be inherited, is also misguided. Generalized Darwinism does not rule out the inheritance of acquired characteristics. Thinking that it does rests on the misunderstanding that genetic inheritance is the only sort of inheritance that generalized Darwinism envisions. Such a misunderstanding is curious. For if there is one thing generalized Darwinism wants to bring out, it is exactly that genetic inheritance is just one particular mode of inheritance among several and possibly many others. There might be (and probably actually are) other replicators than genes. If non-genetic modes of inheritance are taken into consideration it is easy to see how acquired characteristics can be inherited. Through learning and instruction parents can transmit the skills they themselves have learned to their children (and also to non-kin), for example. A suitably generalized Darwinism has no problem with accommodating this.

What Hodgson and Knudsen stress, in short, is that a suitably generalized and abstract version of Darwinism is able to meet many, if not all of the *prima facie* cogent objections against developing an evolutionary theory in economics that is strictly analogous to Darwinian evolutionary biology. The objections mostly pertain to purported disanalogies between biological and economic systems. Generalized Darwinism’s ambition precisely is to abstract from those specific elements (or ‘details’) in Darwinian evolutionary biology that do not have counterparts or analogues in economic systems, so that what is left after the abstractions are made – Generalized Darwinism – contains only general principles that biological systems share with other systems (including economic systems). The project of generalized Darwinism would falter in the eyes of its proponents if its formulation were to involve references to peculiarities in biological evolution that are lacking in evolutionary processes in other domains. If it were pointed out that some particular attempt to formulate a suitable generalized Darwinism contains references to such peculiarities in biological evolution, then this need not necessarily undermine the project of generalized Darwinism. It possibly would only show that the particular formulation under consideration is not yet general and abstract enough to serve as a correct formulation of generalized Darwinism.

This also explains the general strategy that Hodgson and Knudsen adopt in countering objections against generalized Darwinism: to show that the objections only have force against non-generalized (or not suitably generalized) versions of Darwinism (especially those that have been worked out in evolutionary biology). Hodgson and Knudsen set out to show that the objections fail to hit their generalized version of Darwinism. It is to be noted that Hodgson and Knudsen seem to agree with some of the disanalogies between biological and economic systems identified by critics of “the biological analogy (or

metaphor” (cf. Foster 1997, Witt 1999). One such disanalogy is that there is not something like inheritance going on in processes of economic change. Another objection opponents raised against importing the biological metaphor was that it would introduce a *selectionist bias* in economic theorizing. Something akin to natural selection would thereby be put centre stage, at the expense of other possible evolutionary forces and agents that might be more central to processes of economic change (such as self-transformation). Thus Hodgson and Knudsen acknowledge that there are real and significant differences between biological and economic systems. But they argue that the differences relate to domain-specific details rather than to the general principles stated in generalized Darwinism. I think that this is the best, if not only available strategy to follow in making their case. As we shall later see, however, this strategy also has a serious drawback. But before I come to that, I first want to discuss the role that *ontology* is supposed to play here.

### Different clusters of ontological issues

Hodgson and Knudsen argue that applying generalized Darwinism in (evolutionary) economics is a matter of ontology rather than analogy:

“This is not essentially a matter of analogy; it is a partial description and analysis of reality. Social evolution is Darwinian by virtue of (social) ontology, not (biological) analogy.” (Hodgson and Knudsen 2006a, 16)<sup>4</sup>

I am tempted to argue that Hodgson and Knudsen invoke a false opposition here between social evolution being Darwinian in virtue either of analogy or of ontology.<sup>5</sup> But let me resist this temptation and ask instead what sense of ontology is implied here. Under the rubric of ‘ontology’ several things are discussed that are so different that they’d better be kept distinct. In fact, the things Hodgson explicitly discusses under the rubric of ‘ontology’ are not related (or at least not clearly related) to the issue of whether or not economic systems exhibit the Darwinian features of variation, inheritance and selection. The most prominent ontological issue discussed by Hodgson is the Darwinian rejection of ‘*uncaused causes*’ (Hodgson 2002, 268). Darwinism is argued to be committed to the view that intentionality, the capacity to act on one’s intentions, is a cause of action that is itself caused by other prior causes. Accordingly, Darwinism sets out to explain how this capacity has (or could have) evolved. Another issue that Hodgson brings up under the rubric of ontology is that of *a multilayered ontology*. The idea here is that Darwinism acknowledges that there are adjacent layers (or levels) of organization in reality. There is not just one basic or ultimate layer in reality, say at the molecular level (of genes, for example) or even further down at the (sub) atomic level, to which all existing phenomena

<sup>4</sup> See also “It is not that social evolution is *analogous* to evolution in the natural world; it is that at a high level of abstraction, social and biological evolution share these general principles. In this sense, social evolution *is* Darwinian” (Hodgson and Knudsen 2006a, 14).

<sup>5</sup> I would argue that applying Generalized Darwinism to evolutionary economics is a matter of both analogy and ontology. Generalized Darwinism posits similarities in general principles between biological and non-biological evolution (and economic evolution, in particular; which makes it a matter of analogy) and is based on the ontological claim that economic evolution actually exhibits these principles.

can be reduced. Instead we have several layers of organization in reality, Hodgson argues, with emergent properties featuring at all layers (except, perhaps, the most basic one). Thus human beings have properties that cannot be reduced to properties of any of their parts, and social reality in turn has properties that cannot be reduced to those of individual agents.

Following a classification I introduced elsewhere (Vromen 2004), I suggest the ‘ontological issues’ mentioned here belong to three different clusters that should be clearly distinguished from one another. The issue of whether the three principles of generalized Darwinism are adequate for studying economic evolution belongs to the *first cluster* of issues. What is at stake here are what significant features (if any) evolutionary processes in different domains have in common. Hodgson and Knudsen argue that both biological systems and socio-cultural (such as economic) systems exhibit variation, replication and selection and that therefore Darwinian evolution occurs in economic systems (Hodgson and Knudsen 2006, 6). This provides the ontological basis for their claim that the same general Darwinian framework can be applied in attempts to explain phenomena both in the biological and socio-cultural domain.

The issue of whether there are (or can be) uncaused causes belongs to the *second cluster*. What is at stake here is whether there is one giant unbroken, continuous causal chain running (like an all-encompassing tree of life) from the origin of first life on earth (or even earlier, from the Big Bang) to, say, ongoing processes of economic evolution that does not involve divine (or, more generally, non-natural) interventions. It is clear that the existence of such an all-encompassing causal chain would rule out the existence of uncaused causes. What is not immediately clear is what light such a causal chain would shed on ongoing processes of economic evolution. For example, is it possible, as Jon Elster once suggested,<sup>6</sup> that we human beings are evolved creatures that, as the sorcerer’s apprentice, are capable of transcending (and even annihilating) the very forces (such as natural selection) that produced us?

The issue of a multilayered ontology belongs to the *third cluster*. It is here that the traditional question alluded to above about the stuff or substance that reality is made of is posed. At stake here is whether entities and their properties at higher levels of organization have a life of their own, or that their existence and operations are merely derived from what is happening at lower levels of organization. Do firms and their properties (such as their organization forms and routines) exist *sui generis*, for example, or do they have a derived existence only, stemming from the interactions of the individuals partaking in their operations?<sup>7</sup> Is at bottom all of life (including ‘economic life’) ultimately a matter of subatomic particles swerving in the void? If Hodgson is right in believing that emergent properties exist at higher levels of organization, such a ‘reductionist’ view is fundamentally mistaken. The issue of the levels of organization at which replicators and interactors in evolutionary processes are to be situated also clearly belongs to this third cluster. We saw that Hodgson and Knudsen follow Hull (1981, 1988) in distinguishing replicators from interactors in evolutionary processes. As Hull observes,

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<sup>6</sup> “We may say that in *creating man natural selection has transcended itself*” Elster (1979, 16).

<sup>7</sup> See Vromen (2006) for an ontological analysis of organizational routines of this kind.

interactors in evolutionary processes (such as individual organisms) might be situated at a higher level of organization than replicators (such as genes).<sup>8</sup>

The point of insisting on clearly distinguishing the three clusters of issues is partly that the issues in the clusters are really different and, hence, should not be confused or conflated. Sometimes theses or claims are presented as if they were competitors addressing the same issues, whereas in fact they are compatible stances taken on issues belonging to different clusters. Christian Cordes (2006), for example, treats generalized Darwinism and the so-called Continuity Thesis as competitors that address the same issues. The Continuity Thesis, as defended by Witt (2003), is in line with Hodgson's endorsement of the Darwinian principle that there are no uncaused causes.<sup>9</sup> The Continuity Thesis roughly states that currently ongoing processes on economic evolution proceed on the basis of outcomes of prior evolutionary processes (both biological and cultural), that these outcomes causally affect ongoing economic evolution and that therefore these outcomes should be taken into account when studying ongoing economic evolution. Cordes compares the strengths and weaknesses generalized Darwinism and the Continuity Thesis with each other and concludes that the research project inspired by the Continuity Thesis is more promising than the project inspired by generalized Darwinism.

Cordes might be right that the Continuity Thesis inspires a more promising research project than generalized Darwinism. But his argument is flawed, as he erroneously assumes that the issues the Continuity Thesis and generalized Darwinism are dealing with are the same. They are not. As argued above, Generalized Darwinism deals with issues belonging to the first cluster. It is about general features that evolutionary processes in all domains allegedly have in common and about the explanatory framework adequate to account for these features. By contrast, the issues the Continuity Thesis deals with belong to the second cluster. It is about causal processes and about how the products of past evolutionary processes influence ongoing processes of economic evolution. The Continuity Thesis does not necessarily undermine a generalized version of Darwinism, as Hodgson rightly recognizes. Granting not just that intentionality is a product of past evolutionary processes but also that intentionality plays a crucial role in economic evolution is compatible with a sufficiently generalized Darwinism, for example.<sup>10</sup>

Thus, *pace* Cordes, the Continuity Thesis and generalized Darwinism need not imply taking contradicting stances on the same set of issues. But what Cordes does seem to be right about is that starting either from generalized Darwinism or from the Continuity Thesis might steer you in different research directions. As different points of departure for further research, generalized Darwinism and the Continuity Thesis have *different heuristics*. They draw our attention to different features, elements or aspects in

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<sup>8</sup> Mesoudi et al (2006) show what it could mean to argue that we should move *beyond analogy* to ontology: we should investigate whether neuroscience gives us reason to believe that information is processed and stored roughly in the way that Generalized Darwinism suggests it is processed and stored (this belongs to cluster III: multilayered ontology).

<sup>9</sup> As a matter of fact, Hodgson also subscribes to (what he calls) the Continuity Hypothesis.

<sup>10</sup> Cordes also seems to criticize a form of generalized Darwinism that is less general and abstract than the from Hodgson and Knudsen are willing to defend.

evolutionary processes. Generalized Darwinism spurs us to look for relevant variants, selection pressures and processes and inheritance (or replication) processes in some given domain of enquiry. The Continuity Thesis directs our attention to past evolutionary processes and their outcomes. Generalized Darwinism and the Continuity Thesis also present different agendas for further research. Generalized Darwinism invites us to look more closely into how for example new variants are generated in some given domain, while the Continuity Thesis invites us to look more closely into how precisely the products of past evolutionary processes causally affect ongoing evolutionary processes.

### *Non-causal explanations of causal processes*

Clearly distinguishing the clusters can also help us see more clearly that, sometimes contrary to first appearances, some particular stance taken in one cluster does not imply a commitment to taking a particular position in other clusters. Consider once again the Darwinist rejection of uncaused causes in the second cluster. Hodgson suggests that this implies that Darwinism sets out to give causal explanations of phenomena and processes. I take it that giving causal explanations means that attempts are made to reconstruct (at least part of) the actual causal history behind the phenomena and processes in a step-by-step fashion. The ideal in Darwinism would be to provide what Sterelny (1996) calls *actual-sequence explanations*, explanations that aim to get right the actual sequence of causes and effects in the production of some particular phenomena and processes. But in fact no such thing follows from the recognition of the non-existence of uncaused causes. There is no inconsistency in denying the existence of uncaused causes and at the same time to engage in attempts to give explanations that are not causal. In particular, one can try to explain some phenomenon (that almost all firms in an industry have the same organization form, for example) by showing that it is an instantiation of a more general explanatory pattern (or schema) that has already been observed elsewhere. When we succeed in doing so, Philip Kitcher argues, we have put our finger on what (to wit, the *general* explanatory pattern) unites the phenomenon with other phenomena (that we already have shown to be instantiations of the same pattern). Hence, on this view explanation is *unification*.<sup>11</sup> The more phenomena we can show to be instantiations of the same general pattern, the greater the explanatory power of the pattern.

What is interesting is that in his famous case study of unification-as-explanation, “Darwin’s Achievement”, Kitcher (1985) focuses precisely on the explanatory pattern constituted by generalized Darwinism’s three principles (variation, inheritance and selection).<sup>12</sup> Kitcher explicitly contrasts his notion of unification-as-explanation with received notions of causal explanation (such as Wesley Salmon’s). Thus, for Kitcher explanations in which the three Darwinian principles are invoked are not instances of

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<sup>11</sup> Some remarks of Hodgson also seem to point in this direction (e.g. generalized Darwinism provides a “... encompassing framework”, Hodgson 2002, 272, or a “... universal metatheory”, *ibid.*, 278).

<sup>12</sup> Note, though, that Kitcher only discusses the explanatory power of the three principles in their original biological domain. Furthermore, to be fully accurate, Kitcher (following Darwin) argues that the third principle is not selection, but the Struggle for Existence. Evolution by natural selection follows from the three principles working in tandem.



causal explanations but of unifications-as-explanations. What this shows is that one can accept Hodgson and Knudsen's claim that the three principles of generalized Darwinism should be invoked in any satisfactory explanation of evolution in complex systems without drawing their conclusion that it is causal explanation that we should be after. It is one thing that there is one huge causal chain running from the Big Bang (or, if you prefer, from the moment things started to evolve) and that there are no supernatural interventions (or skyhooks) in this chain. It is quite another thing that the goal in all of science must be to engage in causal explanation, meaning that attempts must be made to depict causal processes realistically and faithfully (as meticulously as possible) that gave rise to the phenomena we want to explain. We might accept the first and reject the second without running into inconsistencies.

Kitcher's rendering of the explanatory power of the three principles of variation, inheritance and differential fitness suggests that Generalized Darwinism's explanatory potential might not lie so much in being a first, indispensable step in working out minute accounts of how many *particular* things evolved as in presenting a unifying framework for seeing *general* patterns in many seemingly disparate and disconnected phenomena across several domains. By showing that the same pattern underlies instances of organized complexity and of adaptive fit not only in the biological but also in the economic domain, for example, we get an appreciation and better understanding of how organized complexity and adaptive fit *in general* (across different domains) comes about.<sup>13</sup> Rather than being interested in particular evolutionary processes, evolutionary theorists might be interested more in general patterns in and across domains (see D'Arms et al. 1998 for an insightful discussion of the debate between 'particularists' and 'generalists' in evolutionary theorizing). While evolutionary generalists typically marvel at the usefulness if not indispensability of simple, tractable formal models, evolutionary particularists tend to stress the limits and shortcomings of such models in dealing with the richness and complexities in actual evolutionary processes.

Boyd and Richerson (1987) likewise argue that one of the great attractions of adopting an explicit Darwinian framework in studying non-biological evolutionary processes (in their case: cultural evolution) is that it gives us insightful simple abstract models. The goal of such models is not to present true historical narratives of events. Instead, simple abstract models, even though they are deliberately unrealistic (Richerson and Boyd 2005, 98), enable us to detect general patterns; patterns that easily delude us if we are entangled in the nitty-gritty details of actual historical processes. As such, simple abstract models and rich historical explanation are complementary, rather than competing (ibid., 94-96). Another service that simple abstract models render to us, Richerson and Boyd argue, is that they school our intuitions. Unaided by such models, our intuitions often lead us astray. From the observation that cultural transmission is biased by (what Dan Sperber calls) psychological attractors, for example, we tend to infer that 'therefore' Darwinian models do not apply. As Henrich and Boyd (2002) point out, however, no such conclusion follows from the observation. Paradoxically, what Henrich and Boyd show in

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<sup>13</sup> Alternatively, evolutionary economists might be interested more in general reasons that prevent ideal adaptive fit from being actually realized.

particular is that replicator dynamics can be observed at the population level especially if the psychological attractors are strong.<sup>14</sup>

Kitcher's notion of unification-as-explanation also provides a different perspective on Hodgson's argument that generalized Darwinism explains little on its own (Hodgson 2002, 273; see also Hodgson and Knudsen 2004, 285). Does it? It depends on what we are after in our explanation. If it is 'detailed' causal explanation that we are after, if we want to trace the causal histories or etiologies of the phenomena we want to explain, then Hodgson is right that Universal Darwinism explains little on its own. We then need much more information than is provided in Universal Darwinism. But if it is explanatory unification we are after, then, if advocates of Universal Darwinism are right, Universal Darwinism has huge explanatory power of its own. If Hodgson and other advocates of Universal Darwinism are right, the scope of phenomena that can be explained with just the three general and abstract principles of Universal Darwinism is enormous. Indeed, it is virtually unbounded. The economy or efficiency in the ratio between the number of phenomena that can be explained (i.e., that can be seen as instantiations of the Darwinian pattern or schema; the *explananda*) and the number of explanatory principles needed (the *explanantia*) would be nothing less than stupendous.

### **What more is needed than Generalized Darwinism to arrive at causal explanations?**

It is clear that Hodgson and Knudsen hold both that we need Generalized Darwinism in evolutionary economics and that Generalized Darwinism is not enough to arrive at fully satisfactory theories in evolutionary economics. What is not entirely clear, however, is precisely what contribution Generalized Darwinism is supposed to make in the construction of fully satisfactory theories and exactly what more is needed in addition to the three principles of Generalized Darwinism to arrive at such theories.<sup>15</sup> Hodgson and Knudsen mention the "... inspiring, framing and organizing" (Hodgson and Knudsen 2006, 16) role that Generalized Darwinism could play.<sup>16</sup> Hodgson and Knudsen (2007) argue that Generalized Darwinism can serve as constructive principles for theory development. This suggests that the three principles of Generalized Darwinism are supposed to serve a *heuristic function*; the three principles are supposed to provide guidance in theory construction (see also Darden and Cain 1989, 125). What is not entirely clear, however, is how Generalized Darwinism is supposed to serve this heuristic function.

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<sup>14</sup> But see Cladière and Sperber (2007), who argue that Henrich and Boyd fail to make a convincing case because their result is based on an inaccurate modeling of attraction.

<sup>15</sup> See Stoelhorst and Hensgens (2007) for constructive proposals.

<sup>16</sup> Similarly, Nelson argues that general principles of evolution in principle can enhance the clarity, power and rigor of theorizing (Nelson 2006, 494; Nelson 2007, 92). Nelson also stresses, however, that much of the interesting empirically oriented evolutionary theorizing in the social sciences is done independently of such general principles. In these cases general evolutionary principles served not to inspire and guide theory construction, but to organize and structure the discussion only after the evolutionary theories were already constructed.

Here again, I submit, Kitcher's discussion of Darwin's great achievement in biology is helpful. According to Kitcher, Darwin's major innovation consisted in the formulation of a few general explanatory principles that served at least two heuristic functions (Kitcher 1993, 32). Not only made Darwin biologists look specifically for instances of heritable variation and of selective pressures in explaining the occurrence of some particular trait in the individuals of some species (or population). Darwin also identified the questions that biologists should address. In particular, Darwin made biologists search for theoretical accounts of processes of heritable transmission and of the origination and maintenance of variation. In short, with his development of a general explanatory scheme, Darwin to a large extent set the research agenda for the next generations of evolutionary biologists to come.

Kitcher's characterization of Darwin's great achievement also sheds light on what more is needed in addition to the three principles of Generalized Darwinism to arrive at satisfactory full-fledged theories. Darwin's general explanatory scheme can be said to be abstract in that its scope is not restricted to particular groups of individuals with particular properties. Its scope includes all groups of individuals with properties that evolved by natural selection. This is why Kitcher's representation of Darwin's explanatory scheme contains dummy letters such as *G* for groups of individuals and *P* for their (heritable) properties. The first heuristic function of Darwin's explanatory scheme is that it makes biologists look for particular instantiations of it. Thus we might be interested in why a certain group of finches evolved particularly shaped beaks. This involves first substituting the dummy letters for non-logical expressions and then looking for historical evidence that, given the then prevailing ecological conditions (or selective pressure), ancestors of the present group of finches were fitter than then living other finches with other-shaped beaks. The replacement of the dummy letters by non-logical expressions if we apply the general abstract scheme to explain particular groups of individuals with particular properties can be called a *concretization* of the scheme.

The second heuristic function of the scheme is that it makes biologists search for theoretical accounts of things that are presupposed in the scheme. In particular it spurs biologists to investigate how heritable transmission works and how variation originates and is maintained. If these accounts involve specifying the mechanisms or processes underlying heritable transmission and the emergence and maintenance of new variants, we might say that this amounts to *specifications* of underlying mechanisms. In short, Kitcher's discussion suggests that whatever more is needed to get from the general principles of generalized Darwinism to full-fledged causal theories, this at any rate requires first concretization(s) and then specification(s).

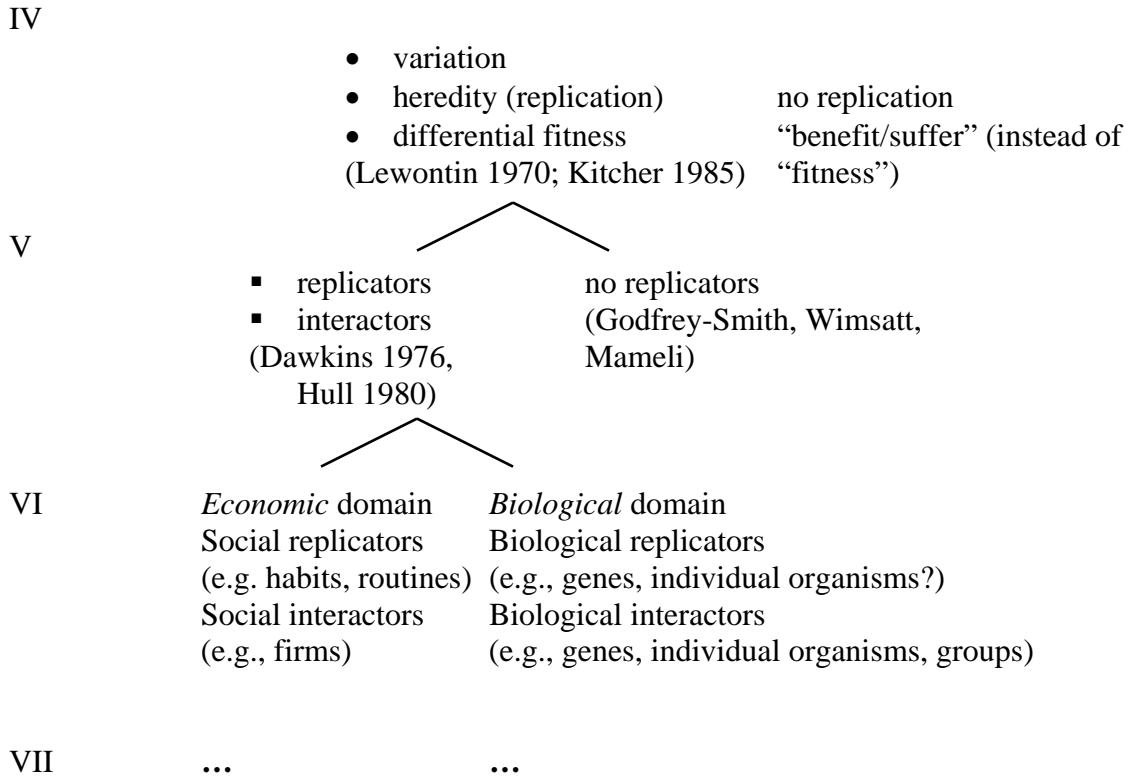
As noted before, Hodgson and Knudsen do not spell out exactly what more is needed than the three principles of generalized Darwinism to arrive at satisfactory full-fledged causal theories about the evolution of economic phenomena. They talk about domain-specific auxiliary hypotheses and domain-specific empirical material that have to be added to the three principles. They do not explicate what exactly they have in mind here and how such hypotheses and empirical material have to be fitted together with the three principles. What is clear, however, is that they believe that concretizations and

specifications of the three principles are also needed. More specifically, they identify firms (rather than individuals) as *interactors* and habits and routines (rather than genes) as *replicators* as concretizations that are specific for the economic domain. They also repeatedly stress that the *details of the specific mechanisms* at work in the economic domain differ from those in the biological domain (Hodgson 2002, 273; 272; Hodgson and Knudsen 2006, 3). Thus Hodgson and Knudsen hold that the specifications of the mechanisms underlying the processes of interaction and of replication in the economic domain are different than the specifications of these mechanisms in the biological domain. Unfortunately, Hodgson and Knudsen leave it at this. They do not elaborate on what specifications of the mechanisms in the economic domain they have in mind.

Summing up now, we saw that Hodgson and Knudsen are looking for a generalization of Darwinism that meets two *desiderata*. First it should be general and broad enough to cover evolutionary processes in all complex systems, including notably economic systems. It is here that Hodgson and Knudsen see the main difference with earlier pleas to found evolutionary economics on ‘the biological metaphor’. The problem with such pleas was that ‘the biological metaphor’ was not sufficiently domain-unspecific; it involved taking features on board that are specific to the biological domain only. The second *desideratum* is that the generalization of Darwinism should be helpful in guiding the construction of theories that causally explain specific evolutionary processes in particular domains (again including notably specific evolutionary processes in the economic domain). As Hodgson and Knudsen argue, their own generalization of Darwinism explains little on its own. Starting with generalized Darwinism, additional steps are to be taken to arrive at causal theories with great explanatory power. Whatever more this entails, it at any rate involves concretizations of the principles and specifications of the mechanisms underlying them.

Hodgson and Knudsen’s discussion of generalized Darwinism suggests that the two *desiderata* can and should be met in sequential order. Their discussion of ‘the biological metaphor’ indicates that generalizing Darwinism primarily (if not wholly) is a matter of *abstracting* from all features in Darwinian evolutionary biology that pertain only the biological domain. Only by shrugging off elements that are specific to the biological domain we can retain elements that are truly general in the sense of domain-unspecific. To put the same point in negative terms: a form of Darwinism that is unable to leave behind peculiarities of the biological domain is doomed to fail from the start. Hodgson and Knudsen clearly believe that their own generalization of Darwinism (their own generalized Darwinism) in terms of the three principles variation, inheritance and selection meets this first *desideratum*. Subsequently Hodgson and Knudsen take additional first steps to show that their version of generalized Darwinism is also able to meet the second *desideratum*: to construct an economic evolutionary theory on the basis of it that is able to causally explain specific evolutionary processes in the economic domain. To this end they first assume that in an acceptable economic evolutionary theory replicators and interactors have to be identified and they then identify firms as economic interactors and habits and routines as economic replicators.

This can be represented as follows.



**Figure I**

What this figure is meant to bring out primarily is that there are different levels of abstraction to be discerned in Hodgson and Knudsen’s view. The three principles of Hodgson and Knudsen’s generalized Darwinism at level IV are supposed to be the most abstract principles in the Figure; the identification of firms as social interactors and habits and routines as social replicators at level VI is supposed to be the most concrete part in the Figure. If we think of the Figure as a tree, making abstractions means that we ascend the tree and making concretizations and adding specifications means that we descend the tree. I take it that Hodgson and Knudsen hold that both Generalized Darwinism’s principles at level IV and the depiction of Darwinian evolutionary processes at level V are domain-unspecific. Domain-specific elements only enter the picture at level VI. I also take it that Hodgson and Knudsen hold that more domain-specific auxiliary hypotheses have to be added to arrive at satisfactory causal theories than just identifying firms as social interactors and habits and routines as social replicators at level VI. This means that further concretizations, specifications and additions are needed that will introduce additional levels beyond level VI.

### Other optional routes not taken

As Hodgson and Knudsen themselves realize, the specific concretizations of the three principles of generalized Darwinism that they propose are not implied by the principles. They do not follow logically from the principles. Far from being forced moves, they are optional choices. Starting from generalized Darwinism's three principles at level IV, there are other options that Hodgson and Knudsen might have chosen. In particular, acceptance of the principle of inheritance (or replication) does not imply that the existence of replicators has to be granted at level V.<sup>17</sup> As several commentators have pointed out, strictly speaking no particle-like entities such as genes that are transmitted from parents to offspring need to exist for Darwinian evolution by natural selection to occur (cf. Mesoudi et al. 2004, 1). All that is needed is that existing variants are more or less reliably transmitted to the subsequent generation. Parents and their offspring should be more similar in the relevant respects than randomly drawn individuals (Godfrey-Smith 2000; see also Wimsatt 1999).<sup>18</sup> There can be replication in this sense without replicators. So starting with the three principles of variation, replication and selection, further steps could be taken in the direction of a full-fledged economic evolutionary theory that do not involve the identification of replicators.

#### *Are replication and interaction two separate processes in non-biological evolution?*

As already noted above, Figure I does not present a complete picture of what according to Hodgson and Knudsen is to be done to arrive at a full-fledged economic evolutionary theory. What is missing at any rate is a specification of the processes of replication and of interaction in economic systems. Thus far Hodgson and Knudsen have not provided such a specification.<sup>19</sup> But the fact that they posit replicators and interactors at level V strongly suggests that they hold that there are two processes going on, replication and interaction. On this account, Darwinian evolution by natural selection is not a single process, but the result of the interaction of two separate processes. As Hull et al. (2001) cogently argue in their attempt to give a general characterization of selection processes:<sup>20</sup>

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<sup>17</sup> It goes without saying, I hope, that nothing in the concept of social (or economic) interactor prescribes that firms (rather than groups, for example) should be identified as social interactors (and likewise for habit and routines as social replicators). To foreclose misunderstanding, note that my point here is only that descending the tree is not a matter of fleshing out logical implications, and not that no good reasons can be given for the choices that Hodgson and Knudsen make.

<sup>18</sup> See also "All that may be required is a process that retains features of interactors (event or object) across generations in a lineage" (Hull et al. 2001, 525). Interestingly, Hodgson and Knudsen refer to both Godfrey-Smith (2000) and Wimsatt (1999) to support their case. For the issue at hand, however, the two papers undermine rather than support their case.

<sup>19</sup> Hodgson and Knudsen do argue, however, that habits of behavior (as social replicators) do not directly make copies of themselves, but replicate indirectly, by means of their behavioral expressions (cf. Hodgson and Knudsen 2007). As far as I can see, insofar as it is appropriate at all to call this replication, it is likely to have low fidelity (see Sperber's incisive critique below).

<sup>20</sup> If there is one person who inspired Hodgson and Knudsen to formulate and defend a version of generalized Darwinism, it is David Hull. Hodgson and Knudsen dedicate their most elaborate defense of generalized Darwinism to date (Hodgson and Knudsen 2006) to David Hull.

The most fundamental distinction made in this paper is between passing on information via replication and the biasing of this replication because of environmental interaction. As we have argued at some length, selection is not a single process but composed of two processes – replication and environmental interaction. As a result, the issue of the levels at which selection occurs must be subdivided into two questions: at what levels does replication take place and at what levels does environmental interaction take place.

(Hull et al. 2001, 527)<sup>21</sup>

Other commentators agree (cf. Mameli 2004, 2006). The bottom line or most minimal requirement for evolution by natural selection to occur, they argue, is that there are two separate (and independent) processes:<sup>22</sup>

1. A process taking care of *'heritable' variation* – the minimal requirement here is that the correlation of relevant properties between parents (or role models) and offspring should exceed that of randomly drawn individuals in the population.
2. A process taking care of *differential reproduction* – individuals with higher 'fitness' are leaving more offspring than individuals with lower 'fitness'. Paraphrased in terms of interaction, this means that interactors interact as cohesive wholes with their environment in such a way that this environmental interaction causes replication to be differential.

The joint operation of the two processes yields the result that the 'heritable' properties of the 'fitter' individuals spread in the population at the expense of those of the individuals with lower 'fitness'.

Hodgson and Knudsen apparently believe that they are on safe ground in arguing that the decomposition of evolutionary processes into the two processes of replication and interaction is general enough to cover also processes of cultural (or social) evolution and of economic evolution in particular. But are they? Wimsatt convincingly argues that in cultural evolution processes of inheritance (replication) and of selection (interaction) cannot be separated. In biological evolution, it makes sense to distinguish (analytically, if not physically) stages (or processes; mechanisms) of inheritance, development and selection. But this does not make sense in cultural evolution. "... development and selection ... both impinge upon cultural heredity in a constitutive way." (Wimsatt 1999, 290) The three are totally inseparable in cultural evolution (ibid.).

To see why, let us look at what generally is believed to be one of the most advanced Darwinian treatments of cultural evolution to date, Boyd and Richerson (1985) and Richerson and Boyd (2005). Like Hodgson and Knudsen and other Darwinists, Boyd and

<sup>21</sup> See also "... we define selection as repeated cycles of replication, variation, and environmental interaction so structured that environmental interaction causes replication to be differential." (ibid., 513; Italics in the original).

<sup>22</sup> There are other (and perhaps for the economic domain more promising) formulations of Universal (or Generalized) Darwinism in terms of 'blind variation and selective retention' (Campbell 1974, Cziko 1995, Plotkin 1994). This formulation omits 'replication' (and 'parents' and 'offspring') altogether. Since this is not the formulation of Darwinism Hodgson and Knudsen opt for, I will not go into this here. See Stoelhorst for further discussion.

Richerson distinguish inheritance (or transmission) and selection in cultural evolution. In cultural evolution, Boyd and Richerson argue, the transmission of behaviorally relevant traits (such as skills and social norms) is non-genetic and notably involves imitation of cultural ‘parents’ (who need not coincide with the biological parents) by cultural ‘offspring’. If selection in cultural evolution (‘cultural selection’) were strictly analogous to natural selection in biological evolution, one would expect the relative fitness of the culturally transmitted traits to determine subsequently which traits spread in the population. But this is not how Boyd and Richerson (and other leading anthropologists working on cultural evolution, such as Dan Sperber; see also Mesoudi et al. 2004, 2) conceive of selection in cultural evolution. Selection in cultural evolution rather refers to the selection of whom to imitate. It is a choice made (consciously or not) by imitators that is supposed to predate cultural transmission processes. First comes the decision whom to imitate and only after this decision is made it remains to be seen what the imitator takes over (or wants to take over) from the person(s) imitated.

Thus Wimsatt is right in arguing that selection is constitutive of the replication process in cultural evolution. The replication process involves not only the identification of what is transmitted from parents to offspring and how it is transmitted, we could say, but also the identification of who are the parents and who are their offspring. If we want to know what is replicated, the first thing we need to know is who are the models for replication (the parents) for the offspring. In biological evolution we know the latter independently from selection. The identification of parents and their offspring is independent of selection. Selection here only affects whether individuals have offspring, not what sort of offspring they have. In cultural evolution this is different. Selection here means that certain particular ‘parents’ are selected by imitators (the ‘offspring’) as models for imitation. Thus the identification of parents and their offspring depends on selection. This implies that selection is an integral part of replication in cultural evolution and as such selection is inseparable from replication in cultural evolution.<sup>23</sup>

#### *Why replication is a non-starter in cultural transmission in the first place*

It could be objected that this difference in parent-offspring relation between biological and cultural evolution is insignificant for the reliability and fidelity in the process of replication. The fact that in cultural evolution (prospective) children choose their parents on the basis of their pre-evolved psychological mechanisms, whereas there is not such a choice in biological evolution, does not make a significant difference, it can be argued. The significant thing arguably is that despite this difference the end result in both biological and cultural evolution is the same: after the parent-offspring transmission the offspring resembles their parents in the relevant respects (at least more so than that they resemble other individuals in the population), so that condition 1 stated above (of

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<sup>23</sup> Although Richerson and Boyd (2005) retain the analytical distinction between cultural selection and replication (or transmission), they recognize that the dividing line between them is hard to draw if cultural transmission is biased (which they take to be the rule, rather than the exception), and in particular of the bias involved is model-based (as in the case of conformist transmission, for example; Richerson and Boyd 2005, 79).



‘heritable variation’) is met. But is this condition really met in cultural evolution? So far we did not question that imitation leads to more or less faithful and reliable transmission of traits. Yet there seem to be good reasons to call this in question.

As some of its leading advocates readily acknowledge, the image invoked in notions such as ‘replication’ and ‘inheritance’ is one of *copying*: “Replication is inherently a copying process. Successive variations must in some sense be retained and then passed on.” (Hull et al. 2001, 514). As incisive critics such as Maurice Bloch (2000) and in particular Dan Sperber (1996, 2000) argue, when it comes to think about cultural transmission this image is seriously misleading (for a balanced treatment, see Sterelny 2006). Rather than being critical only of the notion of meme and being engaged in an attempt to develop a generalized account of replication that does justice to cultural transmission (as is suggested by Hodgson 2006, 211. See also Hodgson and Knudsen 2007, 4), Sperber wants to dispense with the notion of replication altogether. Sperber argues that it would be misleading even to keep something like high-fidelity copying as a reference point, which is what we do in saying that cultural transmission often or typically leads to failures to replicate, mutations, or noise. For this would get the essence of cultural transmission completely wrong. The goal of acquisition in cultural transmission is generally not to acquire a replica of other people’s variants. Cultural transmission rather is a constructive process in which the goal is to acquire a piece of knowledge or a skill that suits the individual’s own dispositions and preferences. This explains why we should consider acquired pieces of knowledge and skills that deviate from the pieces of knowledge and skills transmitted to be normal and functional rather than accidents or malfunctions.

In acquiring some piece of knowledge or skill from some role model, people bring their own pre-evolved cognitive machinery and in particular their pre-evolved psychological mechanisms with them. The operation of these mechanisms will normally lead to a transformation of the input (such as public expressions of knowledge and skills) in the production process (within the people acquiring the knowledge and skills) leading to output (in the form of acquired knowledge and skills, or overt behavior). Even if people are explicitly asked to reproduce a drawing as accurately as possible ten minutes after they have been shown the drawing (for some ten seconds), for example, transformations will occur. One might think that the transformations and modifications of the information incessantly brought about by the workings of psychological mechanisms produce quite some variety between individuals in the things they acquire and also erratic changes in what is acquired by individuals over time. But Sperber argues that generally this is not the case. One of the main reasons for this is that individuals happen to have many pre-evolved psychological mechanisms in common with each other and that these mechanisms tend to be stable in time.<sup>24</sup> Sperber calls such shared and stable pre-evolved psychological mechanisms *attractors*. The bias in cultural transmission produced by attractors is systematic (in the sense both of individual-unspecific and stable in time) rather than random or erratic. In short, attractors, rather than high fidelity in replication,

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<sup>24</sup> Another reason Sperber gives is that there might be environmental constraints and affordances acting as gravitational forces in cultural transmission.

see to it that there is some macro-level stability in cultural entities within whole populations over time.

Although Sperber's objections may not be equally forceful against all forms of cultural transmission (Sterelny 2006), I think they are rightly widely considered to be powerful and convincing. The upshot is that studying cultural transmission in terms of replication is a non-starter. Far from being a copying process, cultural transmission is a constructive process in which deviations from the model are the rule rather than the exception. It might be more fruitful to conceive of cultural transmission as part of a learning process in which acquired pieces of knowledge and skills are retained only if they suit the individual's dispositions and preferences. That is, only if the acquired pieces turn out to be beneficial or useful for the individual in question when they are acted upon, will the pieces be retained.

To sum up, in processes of non-biological evolution it seems artificial and contrived if not seriously misleading first to maintain that we have two component processes (replication and interaction) instead of one processes and then to conceive of the first component process (replication) in terms of copying. If we want to do justice to the peculiarities of non-biological evolution, it seems we'd better dispense not just with the notion of a replicator, but also with the notion of replication. The upshot of all this is that Hodgson and Knudsen's formulation of generalized Darwinism is not general enough to do justice to evolutionary processes in non-biological domains (and to cultural evolution, in particular). Thus Hodgson and Knudsen's formulation of generalized Darwinism does not meet their own first *desideratum*. It seems we need a version of Darwinism that is even more general than Hodgson and Knudsen's Generalized Darwinism. In the image of the tree we introduced earlier it seems we have to ascend beyond Hodgson and Knudsen's Generalized Darwinism. What version of Darwinism could we possibly move to?

### **Selection type theories as an even more general version of Darwinism**

A promising candidate is Darden and Cain's (1989) *selection type theories*. Darden and Cain (1989, 108) argue that they have to move to an even more abstract level than the one Kitcher's schemas is situated on, precisely for the reason Generalized (or Universal) Darwinism is constructed for: to find a formulation of Darwinism (or of selection, in Darden and Cain's parlance) that is sufficiently general and abstract to accommodate processes of selection in several domains (and not just in the biological domain).<sup>25</sup> Just like Universal Darwinists, Darden and Cain pick out immunology (to be more precise: clonal selection theory for antibody formation) and Edelman's neural Darwinism as theories in the non-biological domain that their own notion of selection type theories should be able to cover.

Darden and Cain's 'selection type theory' is more abstract, and hence more general, than Kitcher's depiction of Darwin's general explanatory scheme in biology in that its scope is

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<sup>25</sup> See also Skipper (1999), who embraces Darden and Cain's notion of selection type theories.

not confined to cases in which superior (or inferior) results result in more offspring via a reproduction step. Their selection type theory is also applicable to cases in which the beneficial property is not inherited by offspring. The beneficial property should somehow spread in the population (relative to non-beneficial properties) also in their selection type theory, but the way in which this is realized need not be through survival and inheritance (or replication).<sup>26</sup>

Like Kitcher and Hodgson and Knudsen, Darden and Cain also emphasize the *heuristic function* of their selection type theory in theory construction. But they also draw attention to the fact that selection type theory can serve a *diagnostic function* in spotting gaps and lacunas in attempts to actually work out selection type theories in some specific non-biological domain. One of the crucial things any worked out selection type theory has to specify, Darden and Cain argue, are the *critical factors* in some past environment that determine what particular sorts of individuals benefit and what other sorts suffer. Critical factors might be associated with a shortage of food or water, but also with the existence of predators or with the availability of fertile mating partners, for example. The specific sort of critical factor that shapes the extant selection pressure also determine what variant properties are relevant to benefiting or suffering of the individuals having the properties from the selective interactions. So any worked out selection type theory should identify and specify the relevant critical factors in the environment and the related relevant properties in the individuals that are exposed to the critical factors. It is in this respect that Darden and Cain find Edelman's neural Darwinism wanting. More precisely, Edelman's neural Darwinism tells too little about what are the critical factors in signal configurations and hence also about why certain particular neuron connections are better able to cope with the critical factors than others (ibid., 123). This is a gap in Edelman's neural Darwinism that needs to be filled in further theory construction.

Note that Darden and Cain do not set out to develop an abstract and general account of evolutionary theories. They confine their attention to selection theories within a possibly wider category of evolutionary theories. Contrary to what Hodgson and Knudsen maintain, just as Darden and Cain's selection type theories their own version of generalized Darwinism belongs to a family of attempts to generalize Darwinism that exhibit a *selection bias*. They all cling to the idea that the frequency (or proportion) of the properties that make individuals having them benefit (or rather suffer) increases (or rather decreases) in the population over time. In this respect Hodgson and Knudsen's version of generalized Darwinism is not so different after all from earlier attempts to base evolutionary economics on 'the biological metaphor' as Hodgson and Knudsen want us to believe. One of the main reasons of opponents to resist 'the biological metaphor' was its purportedly unjustified emphasis on the evolutionary force of selection at the expense of other possible evolutionary forces such as drift, migration, recombination and especially self-organization and self-transformation. Hodgson and Knudsen distance themselves from earlier advocates of 'the biological metaphor' because they believe that 'the biological metaphor' takes on too many features that are specific for the biological

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<sup>26</sup> Darden and Cain suggest that theories lacking a reproduction step might be called 'election' rather than 'selection' theories (Darden and Cain 1989, 118). Peter Godfrey-Smith (2007) is reluctant to call such a generalization 'Darwinian'.

domain. But it seems that with the formulation of their own favored Generalized Darwinism they have not been able to shake off the selection bias inherent to ‘the biological metaphor’.

If we want to dispense with the selection bias, we should ascend to an even higher level of abstraction than the level at which Darden and Cain’s selection type theories are located. *Population thinking* might be a good candidate. As Richerson and Boyd (2005) put it, population thinking involves that “... we keep track of the different variants, independent little bits or big complexes as the case may be, present in a population, and try to understand what processes cause some variants to increase and others to decline” (Richerson and Boyd 2005, 91). In population thinking, it is not presupposed that natural selection (or some other form of selection) is the dominant, let alone only process causing changes in population frequencies of variants. These might be caused by altogether different processes, such as drift, migration, recombination or self-organization.

### **The devil is in the details**

Hodgson and Knudsen might object that in identifying variation, inheritance and selection as the three general principles of Generalized Darwinism, they need not, do not want to and as a matter of fact do not actually take on board any of the connotations discussed above (to wit, the selectionist bias, replication as copying, the separateness and independence of mechanisms of replication and interaction). Their adherence to the general principles of variation, inheritance (replication) and selection, to a general discussion of Darwinian evolutionary processes in terms of replication and interaction, and to general discussion of such processes in terms of replicators and interactors suggest that they hold that the connotations also apply to the socio-cultural domain. But they might deny that any of these connotations fit the socio-cultural domain. They might hold that these connotations are specific for, and hence confined to the biological domain. If so,<sup>27</sup> the foregoing arguments that the connotations do not fit socio-cultural evolution do not undermine Hodgson and Knudsen’s position. Rather than countering the arguments, Hodgson and Knudsen would happily embrace them.

What would follow from this? It in fact would imply that the sort of Darwinism Hodgson and Knudsen endorse is to be situated higher in the tree than where I situated it (at level IV). Rather than endorsing selection-type theories, what Hodgson and Knudsen would really advocate would be something like population thinking (at level II). If processes of biological and socio-cultural evolution have features in common only at this high level of abstraction, even more domain-specific ‘details’ have to be added to arrive at the sort of detailed causal theory that Hodgson and Knudsen seem to envisage as the final goal of Generalized Darwinism in evolutionary economics. But the specific shape and contents that Darwinism got in evolutionary biology (and to which the above connotations do apply) cannot give any guidance in adding such details. The highly general and abstract principles of Generalized Darwinism do not give much structure and guidance for doing

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<sup>27</sup> If this is really what Hodgson and Knudsen hold, then I urge them to speak out more clearly on these issues.

this either. This means that there is a lot of tough work still to be done. If this can be called a matter of adding details, *the devil surely is in the details!*

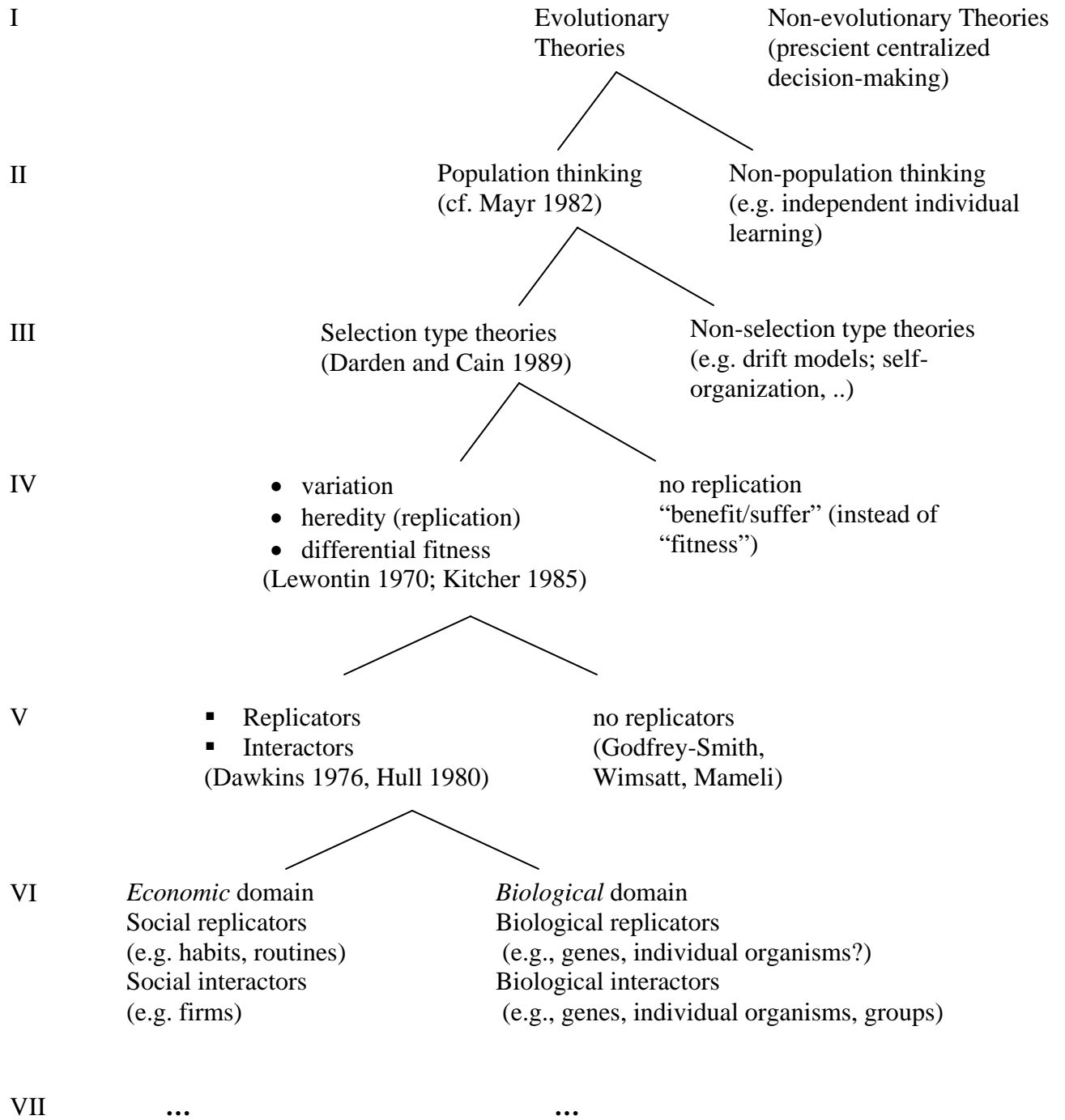


Figure II

Recall that Hodgson and Knudsen see their version of Generalized Darwinism as the first step only in the construction of a theory that is able to give detailed causal explanations of processes of economic evolution. Their version should not only be general enough to cover evolutionary processes in all domains (their first *desideratum*), it should also be helpful and instrumental in constructing such a causal theory (their second *desideratum*). In my image of a tree this means that if we start with the domain-specific version of Darwinism in evolutionary biology (that do exhibit the connotations discussed above), we first have to ascend the tree. Once we have settled on a sufficiently general version that has brushed off all domain-specific elements and retained only truly domain-unspecific principles, we have to descend again. But what steps should we take in descending the tree? It is clear that we cannot go the route that is specific to biology. The concretizations and specifications that we are familiar with because they got some coinage in evolutionary biology are blocked. For ontological worries that they do not fit the subject matter of economics prompted us in our search for truly general principles to ascend the tree further than Hodgson and Knudsen do in the first place.

We now see that Hodgson and Knudsen are caught in a dilemma here. Either we do everything we can to meet the first *desideratum*: find a formulation of Darwinism that is general enough to do justice to all evolutionary processes (whatever the specific domain). But this requires us to ascend the tree to eerie heights. Indeed the formulation must then be so abstract and so general that it is bereft of much (if not all) substance and contents. The theoretical structure and guidance that it gives to the search for the many additions that are needed to construct a full-fledged causal theory is next to nil. In other words, the second *desideratum* will then be difficult to meet (if at all). Or we do everything to meet the second *desideratum*: find a formulation of Darwinism that has sufficient theoretical structure to guide the construction of the causal theory (or theories) sought for. But the natural (if not only) place to look for such a formulation are Darwinian causal theories in evolutionary biology. The problem with such causal theories of course is that they are far from domain-unspecific. Thus the first *desideratum* will not be met.

## Conclusions

Hodgson and Knudsen deserve praise for their advocacy of Generalized Darwinism. They defend Darwinism in studying socio-cultural (and in particular, economic) evolution in the most (and perhaps only) sensible way: to find a formulation of Darwinism that is abstract and general enough to do justice to the special features of socio-cultural evolution. Hodgson and Knudsen also deserve credit for not mixing up different sorts of ontological issues. They rightly argue in particular that Generalized Darwinism is compatible with the Continuity Thesis.

The ontological considerations at stake in Hodgson and Knudsen's case for Generalized Darwinism amount to the issue of whether there are significant features that processes of socio-cultural evolution have in common (at an appropriate abstract level) with processes of biological evolution. Ontological considerations of this kind also played a major role in the earlier debate about the accuracy of the biological metaphor. What is more, we

found that roughly the same ontological objections that were raised against the biological metaphor can be (and actually are) raised again against Generalized Darwinism. These objections seem to be sound and seem to be shared by friends and foes of Darwinism in non-biological domains alike. Taking the objections seriously, it was argued, necessitates finding a formulation of Darwinism that is even more general and abstract than Hodgson and Knudsen's Generalized Darwinism.

Hodgson and Knudsen want their version of Generalized Darwinism to play a constructive role in the development of theories in evolutionary economics that can explain actual historical processes in a detailed way. They recognize that this entails that domain-specific hypotheses have to be added to Generalized Darwinism. If the version of Darwinism that is able to do justice to non-biological evolution is to be even more general than Hodgson and Knudsen's Generalized Darwinism, even more hypotheses have to be added than Hodgson and Knudsen envisage to arrive at detailed causal theories. Given that the specific concretizations and specifications of such an even more generalized Darwinism that are given in evolutionary biology are blocked, the guidance given in this by an even more generalized Darwinism is pretty poor. In fact it is next to nil. This seems to suggest that if we stick to the function Hodgson and Knudsen want Generalized Darwinism to serve, it is best not to waste more time with discussing the merits and demerits of Generalized Darwinism and go to the investigation and specification of the details right away.

It might be a more promising avenue to defend Generalized Darwinism on other grounds. The main function and explanatory power of Generalized Darwinism might lay elsewhere. It may serve altogether different functions than providing heuristics for the development of theories that can give causal explanations of the actual evolution of economic phenomena. Formulation of some generalized version of Darwinism might facilitate cross-disciplinary transfer (Mesoudi et al. 2006), of modeling techniques (Boyd and Richerson 1985), for example. As Henrich and Boyd (2002) suggest, borrowing sophisticated modeling techniques from evolutionary biologists might be warranted even in the face of obvious disanalogies between biological and cultural evolution. Even if 'replication' is a nonstarter in cultural evolution, replication dynamics might still apply in cultural evolution at the population level. This is an interesting and remarkable result. But if the model applied becomes so disconnected from the actual causal process in the real world as it is in Henrich and Boyd's case, one might rightly remain skeptical of the model's explanatory power (Sober 1991).

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