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An autecological interpretation of the firm and its environment

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Abstract Explaining the survival and failure of firms is an important issue for researchers and managers of firms in society. Ecological approaches to the study of firms have existed for over 100 years, and have been increasingly popular during the past 40 years, especially since the pioneering works of Hannan and Freeman on one hand, and Aldrich on the other. This paper, in keeping with recent developments elsewhere in mainstream ecology outlines and positions the theoretical and philosophical foundations of an alternative ecological approach, autecology, that has not yet been formulated for the study of firms. The autecological approach affords the individual firm more autonomy in creating its own future evolutionary trajectory. The idea of an ecological complex is developed to provide clear focus on what is central to the application of autecology to the study of firms. The paper also considers several emergent research opportunities that highlight the potential value of employing an autecological approach to the study of firms.

Keywords Autecology · Operational environment · Ecological complex · Environmental modification

1 Introduction

The degree of firm autonomy associated with organizational evolution remains of interest to organization scholars (see Abatecola 2014). This paper contributes directly to this ongoing debate by arguing firms can and do shape the nature of such processes themselves. Rising to the recent challenge of Martinez and Aldrich (2012) who argue for the need to develop more fine-grained accounts of the process of selection and adaptation, this paper introduces an alternative ecological approach

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suitable for exploring such issues in the broad domain of organizational studies. What makes this approach unique is the incompatibility of its underlying philosophical foundations vis-à-vis existing ecological approaches. It is an approach that sets the level of analysis equal to the extent to which the firms we seek to study scale their *operational* environment, on a study-by-study basis. The notion of an operational environment (Spomer 1970), or, that *specific* portion of the environment to which any particular firm interacts with in order to perform exchanges, brings a particular focus to particular environmental variables (e.g. local conditions, local consumer behavior and/or resource availability) directly related to the survival of any individual firm, rather than emphasizing those external factors that are likely to influence the firm less, and which belong in the external environment (e.g. regional unemployment rates).

It will be argued that to understand the extent of autonomy any firm may hold over its evolutionary development we must understand its individual ecology. The proposed autecological approach views firms as located in their own distinct environments. If individual firms experience a unique operational environment, and if, the nature of their interaction with a host of unique environmental factors is directly relevant to their ongoing survival, then the ecological study of *individual* firms is important. It is argued here that all firms may have the potential to alter aspects of their operational environment and increase their chances of survival. Therefore, this paper presents a unique way of combining the potential strategic freedom of the firm within an established ecological framework. Through introducing this new approach, the intended contribution of this paper is to highlight the opportunities to use an established ecological framework to study the strategic behaviour of individual firms, something until now, not possible with current approaches.

Importantly, the autecological approach presented in this paper does not seek to displace the existing organizational ecology approach (Hannan and Freeman 1977, 1989). It merely answers past calls (see Baum 1996) to increase the degree of contextual realism associated with the ecological investigation of firms and the environments with which they interact. In doing so, we are also able to focus directly upon the firm and the role of the individual entrepreneur/manager and their actions, something not easily done from a population/community perspective (see Carroll and Khessina 2005). As such, this approach also differs from the growing body of work related to co-evolutionary dynamics (Abatecola 2014; Breslin 2014; Child et al. 2013; Geels 2014), in that the level of expected analysis is concerned with individual firms interacting with *unknown* localized factors that need to be identified. That is, no initial assumption of agency or strategic management is made in the first instance. Firms that survive may simply have been adopted (Alchian 1950) by their local environment in ways not possible for other *apparently* similar firms (see Jones 2007).

Autecology is therefore not seen as naturally related to the various co-evolutionary approaches operationalized in organizational studies research (e.g. Abatecola 2014; Baum and Singh 1994; Breslin 2014; Child et al. 2013; Geels 2014; Murmann 2003). It sees firms as often isolated from population density-dependent (competitive) factors, and quite likely to be impacted by a broader range

of environmental variables, such as unique local events and/or processes. There is however room in an autecological approach to accommodate aspects of co-evolution, of the *symmetrical* kind described by Child et al. (2013), but not so *asymmetrical* co-evolution that essentially denies firms of *all* sizes the ability to significantly shape their environments.

A simple way to locate the focus of autecology, and thus its relation to firm autonomy, is to consider the contrast that Sahlins and Service (1960) draw between general and specific evolution. Specific evolution is concerned with adaptive improvement *relative* to the adaptive problem confronted. This is the domain of autecology, within which *all* firms that survive, from the simplest to most complex, are seen as equal in terms of being well adapted to their operational environments. We are interested in the diversity of sub-types of firms that most likely comprise an industry, frequently relying on different adaptive mechanisms to survive through time and space (see Jones 2009). By contrast, general evolution is focused upon the emergence of higher forms of organization, with less attention given to identifying the actual industry-based differences between firms that are assumed to have been subject to adaptive modification over time. Thus, autecology is focused directly on explaining the *many* adaptive mechanisms that individual firms may rely upon to survive. Traditional organizational ecology (i.e. Hannan and Freeman 1989) is more concerned with the changes occurring over time in populations of firms due to differential selection driven primarily by competitive factors. However, from an autecological perspective, general evolution in effect is the end product of specific evolution. Without individual firms attempting to adapt to their local environments, it would not be possible to observe change occurring at the population or community levels.

The idea of autecology has not been previously been applied to study firms. Therefore, no attribution is intended when reference is being made to several key works (Andrewartha and Birch 1954; Brandon 1990, 1996; Hengeveld and Walter 1999; Rathcke 1983; Rose 1997; Schoener 1974; Spomer 1970; Walter and Hengeveld 2014) that such work has a direct application to the study of firms. As others have previously attempted (e.g. Baum and Singh 1994; Hannan and Freeman 1977; Nelson and Winter 1982), the challenge is being able to import the intended theoretical and methodological foundations from one domain of inquiry to another. Every attempt though, has been made to consult with autecologists, and ecologists more generally to achieve a consistency in meaning (Hodgson 2004) so that this initial paper can lay a solid foundation for future autecological studies of firms.

It is also important to note, that beyond using organizational ecology (hereinafter referred to as OE) to position organizational autecology (hereinafter referred to as OA), no claim of superiority of one approach over another is being made. The autecology literature (see Walter and Hengeveld 2014) places much emphasis upon species-specific adaptations. In this paper, the same focus is brought to bear upon firm-specific adaptations. Whilst this focus will be explained with reference to several examples, it is important to note that within any specific industry several types of firms could be expected to participate, each demonstrating different adaptive mechanisms. For example, in the pizza restaurant industry there will be different types of franchised firms and different types of independent firms all

participating in that particular industry, even adjacent to one another. Thus, the idea of the cryptic species (Paterson 1993) is of great importance. Whereas Freeman and Hannan (1983) managed to collapse 33 types of restaurants (e.g. Italian, Chinese, French etc.) in three categories (i.e. generalist, fast-food establishment, and other specialist), Jones's (2009) autecology-based study kept all 23 restaurant types separate, and ultimately identified six distinctly different types of firms in the one category of pizza. The six types of pizza firms represent an equivalent to a cryptic species complex. Each firm in this context is similar to the others in terms of what it sells and the telephone directory their history is located in, but very different in terms of how they are organized and interact with their different operational environments. By combining such differences among firms into one category, or as members of a population of firms that includes yet other types of restaurants, as is common in OE, research findings could clearly be distorted by ignoring the different adaptive mechanisms each type of firm uses in its own operational environment. Such an approach does not preclude the possibility of combining data relating to firms of a recognized type at some later point for analytical purposes. However, given that OE and OA are built on different assumptions, argued you be mutually exclusive (Hengeveld and Walter 1999), it is not assumed that the OA research approach be placed hierarchically below OE.

Clearly, there is a need to address the precise ecological dynamics occurring between individual firms and their environments. Hence, the opportunity to consider an alternative ecological paradigm, autecology, its underlying foundations, its research focus, and its potential contribution to the field of organizational studies. The remainder of this paper will be organized as follows. First, consideration will be given to comparing the underlying logic of OE as it contrasts to that of OA, as developed here. Second, the potential value of using autecology in an organizational studies context will be discussed. Third, the idea of an *ecological complex* will be proposed and its potential contribution to the organizational studies literature contemplated, with examples provided to support its development. Inspired by the past work of Duncan (1959) that sought to untangle ecological and demography approaches when studying firms, the conceptual development of an ecological complex offers researchers three very specific interrelated dimensions through which to conduct autecological research, they being the firm, its operational environment and the autecological dynamics that connect the firm and its operational environment. Fourth, the research implications of further developing autecology in our domain of research will be contemplated. Finally, the key ideas of the paper will be discussed with regards to the potential value of further developing the OA approach.

2 Organizational ecology

Within the OE perspective of Hannan and Freeman (1977, 1989) firms are viewed collectively from the perspective of a common environment, with the survival of any one individual firm not of any great importance (Hatch 1997). Thus, OE currently constitutes "an approach to the macrosociology of organizations that

builds on general and evolutionary models of change in populations and communities of organizations" (Hannan and Freeman 1989: xi), rather than the interactions and influences of individual firms upon their *operational* environment, as proposed by the OA approach. So, within the OE approach it is the effects of the competitive environment on the structures and organizing of firms, rather then the influence of the firms upon their environments that is of specific interest. That is, firms must overcome factors produced from the ongoing presence of competition to survive. Its foundations have been built upon the idea that firms are "complicated systems with strong limitations on flexibility and speed of response" (*ibid*: xii). The intellectual foundations of the approach represent a "reopening of the lines of communication between sociology and ecology" (Hannan and Freeman 1977: 962), inspired by the early works of Hawley (1944, 1950). Such inspiration reveals many of the key premises upon which the OE approach is founded.

First, it is taken for granted that "units … [i.e. firms] … subjected to the same environmental conditions … acquire a similar form of organization" Hawley (1968: 334). That is, an external environment affects all in the population in a consistent way. Also, further assumptions are made about the prevalence and influence of common environments through which the social, cultural and technical features are imprinted across cohorts of organizations. Because these features or characteristics were assumed to be highly resistant to change, the vital ingredients for a process of evolutionary selection within populations of firms were deemed present.

Second, this approach was born from the intellectual dispositions of sociologists. The emphasis is upon collective action, not individual interaction. Survival is achieved through a process of competition that plays out between members of a given population and/or related communities that may also compete for common resources. An obvious problem within this approach is the overreliance upon competition as an organizing mechanism. As Hodgson (2004) points out, in neither evolutionary biology nor social markets is competition considered a universal property of such systems.

Explicit in such thinking is the presence of a knowable carrying capacity against which limits will be set on the assumed availability of resources that related organizations within a population could compete for. This thinking was brought to life through the use of the density dependence approach with the idea of legitimacy (of organizational form) cast as the driver of initial population density and competition was seen as the regulator of such density (Hannan and Carroll 1994). However, in OE, "density serves as a surrogate for the difficult to observe features of the material and social environment that affect the rates, particularly competition and legitimacy" (Hannan and Freeman 1989: 131). Thus, competition and legitimacy are not directly observed; rather they are inferred from studying demographic data. Populations and communities are assumed to evolve via law like patterns that are determined by the relationship between estimated carrying capacities and observed/estimated densities. The underlying logic of the OE approach can be stated as follows:

> Firms exist in populations sharing a common environment. The environment has limited resources and firms therefore compete. This leads to the

> differential selection of organizational forms with a better fit to the competitive environment.

In contrast, the underlying logic of OA can be stated as follows:

> Firms exist in proximity to other firms, frequently sharing a common external environment, but typically with their own distinct operational environment. They maintain their existence through solving problems in their operational environment.

Non-controversially both approaches accept the existence in society of firms as social entities, however OA is more concerned in the specific goals, boundaries and activities systems (Aldrich 1999) of each individual firm. In OE, firms share a common environment and are viewed from a population/community perspective, whereas in OA firms are viewed via their observable differences and potential for unique environmental interaction. Finally, In OE, firms are largely at the mercy of environmental change, where in OA, firms can use various adaptive mechanisms to maintain their operations through time and space. Having established these clear differences between the OE approach and the proposed OA, it is now appropriate to consider briefly the historical development of OA and its potential value to the domain of organizational studies.

3 The autecological approach

Historically, autecology is the study of individual species, accounting for all life history events as mediated by environmental interaction (Bews 1935). Daubenmire (1974) saw autecology as the process of developing the ecologic life histories of any common species. Likewise, it is argued here that OA can deepen the foundations of what is known of firm-level adaptive processes to the benefit of OE. The obvious potential for the development of OA in organizational studies is explainable by the absence of the approach in past and current ecological explanations of firm survival. Due to the sociological foundations of human ecology, autecology was ignored with preference given to the synecology approach, or community-based ecology. Starting with the community-based approach first developed in OE by Park (1915) and then subsequently developed by McKenzie (1924), Hawley (1950) and modern day researchers Hannan and Freeman (1977, 1989), a concern for autecology has never surfaced due mostly to its incompatibility with sociological thought. Therefore, an opportunity exists to develop a more fine-grained understanding of the behavior of firms and their endeavors to survive through time and space. Thus, in addition to interpreting the impact of period effects (Aldrich 1999) upon firm survival, there is also a need to understand how such effects translate into harmful or benign effects vis-à-vis the actual operational environment of individual firms.

This is because OA makes no assumption that individual firm even shares its operational environment with any other firm. OA see the individual firm as left to it's own devices to survive, and that survival is mediated through individual firms interacting with an environment that is peculiar to its presence. Importantly, in OA

no ecological processes are initially ruled in or ruled out and where an entirely different set of ecological logic allow us to rise to the challenge of Sears (1980: 223), that when the ecologist enters the study area, he or she "sees not merely what is there, but what is happening there".

In the absence of the need to see the operation of universal ecological laws, the autecologist is free to *directly* observe the actual *interactions* that produce ecological patterns. "The autecological paradigm … rejects the notion that law-like common influences, like density dependence, are equally imposed on all individuals of all species by the dynamics of the population they are [assumed] a part" (Hengeveld and Walter 1999: 147). Applying this logic to our domain and accepting that a firm's environment is subject to random change through both time and space, "ecological and evolutionary processes are dependent on the degree to which … [firms] … match with their spatially heterogeneous environment" (*ibid*: 150).

Therefore, from an autecological perspective, it is through the organization of a firm that each entity participates in ecological processes, and its subsequent evolution is thus affected. Be that through the choice of location, maintaining their existence through times of environmental change, achieving growth and/or geographical expansion. Given that environmental change is inevitable, a fundamental concern of the autecologist is: (1) accounting ecologically for how firms cope with such change, and (2) understanding how firms contribute to such environmental change. There is a desire to separate the firm from human abstractions such as assigning membership to a population and/or community, which viewed autecologically, are "temporary and dynamic aggregations of … [individual firms] … open to stochastic influence" (*ibid*: 152).

Importantly, a key process acknowledged by most, but investigated seriously by very few now becomes visible to the autecologist, that being the subtle two-way interaction between each individual firm and its particular operational environment. A process that takes place whilst it seeks to improve the nature of its operational environment vis-à-vis the nature of selection it is exposed to. This process, known as niche construction has until recently been rarely investigated. However, the recent work of Luksha (2008) and Jones (2009) highlights the process of niche construction (Odling-Smee et al. 2003) as an ecological process through which firm environments may be altered. Given the difficulties that often surround the use of the word *niche* in mainstream ecology, this process will be referred to an *environmental modification* in the development of OA, to bypass anticipated confusion.

Specific types of firms both make and are made as a consequence of their unique interaction with their operational environment; they are not seen as simply at the mercy of competitive selection. The interacting elements (Jones 2005) of any given firm are both selected for or against by the process of environmental selection, and also hold the potential to shape the nature of such selection processes. To fully understand the nature of the autecological approach and the central role proposed for the process of environmental modification, the next section will introduce the idea of an ecological complex. However, let us conclude this section by recognizing the underlying philosophical ideas upon which the OA perspective is being developed.

First, the specific focus of attention within OA is the individual firm, not a population or community. As such, attention is given to the resource inflows/outflows as they pertain to an individual firm vis-à-vis various identifiable environmental axes (i.e. observable local factors like resource availability and consumer behavior that can be placed along several continuums). Therefore, and in contrast to the current formulation of OE, OA releases our focus from the assumed presence of a carrying capacity and density dependent processes such as competition or resource partitioning. However, OA does not deny the possible existence of such ecological processes. It is also open to the influence of a range of environmental variables that may range from local fashion, the positive facilitating effects of alternative similar outlets that are positioned nearby, who contribute cooperative and/or complementary effects. In this simple example, cooperation and facilitation (see Rathcke 1983) are but two ecological processes potentially related to the existence of any individual firm that impact upon resource availability. Rather than assume the presence of a market in or heading towards equilibrium, the dynamic spatio-temporal distribution of firms takes precedent as a starting point. Individual firms and their specific adaptations to various environmental axes across a heterogeneous landscape are of primary concern. OA, like OE is interested in explaining the distribution and abundance of specific types of firms. However, the firms studied from the OA approach would be expected to use different resources and ecological processes to maintain their existence.

4 An ecological complex

The idea of an ecological complex is used to connote an inseparable group of constantly interacting elements that allow the mind of the novice OA researcher to focus upon that which matters, and to be freed from that which doesn't. In Fig. 1

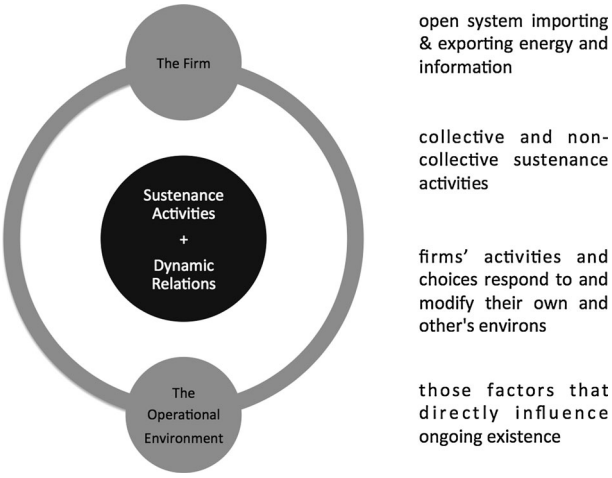

Fig. 1 The ecological complex

below, three elements are illustrated; the firm, its operational environment, and the dynamic processes through which their interaction is mediated.

4.1 The firm

Accepting that all firms are observed to have goals, boundaries and activity systems (Aldrich 1999), we can ask the following questions. Do the firms we seek to understand share similar goals? Do their operations occur within the same geographical boundaries, and/or interact with each other in such a way that they influence each other's exchange of resources? Finally, are the firm's sustenance activities [i.e. organized regular and enduring activities aimed at supporting firm survival, see Gibbs and Walter (1959)] reconcilable to those other firms also of interest? To the extent the latter two questions are answered in the negative, the OA researcher is on solid ground to highlight the ecological independence of the individual firm. Jones (2007, 2009, 2013) highlights the different goals that pizza restaurants demonstrated, the fact that they rarely interacted competitively with other pizza restaurants, and that they demonstrated great variance across the sustenance activities used to support their survival. In essence, the firms studied by Jones did not interact within a common environment, were not subject to any overarching competitive selection pressures, and thus were able to be studied from an autecological approach.

OA sees firms as open systems who survive by importing and exporting energy and information to and from their operational environment; not simply because they have inherited or copied the right routines and/or due to fortuitous environmental selection. Rather than discriminately determining which firms are worthy of our time as researchers, be they gazelles, elephants or merely mice, OA is concerned with *all* firms. In the spirit of Haukioja (1982), all firms are worthy of study if they maintain themselves at the moment of our observations. Their very existence provides evidence of the firm's abilities to evolve over time through a raft of idiosyncratic ecological processes appropriate for that firm in a given operational environment. Incorporating the ideas of Rose (1997) brings a focus upon the notion of firms that exist. From this perspective, the existence of a firm is explainable with reference to the degree of stability within its routines associated with organizing all of the firm's key functions.

Therefore, to exist through time a firm must demonstrate (1) sufficient stability in the routines associated with resource inflows/outflows, (2) orderly organization of these routines into a cohesive whole, and finally, (3) some degree of order between firm and its environment. Neither routines nor firms can be seen as isolated from their own operational environments; they constantly interpenetrate each other. Assuming that environments constantly change, change is the only constancy for the firm; stasis therefore, just as in biology, is fatal (see Wake et al. 1983). From this perspective, every firm has a lifeline associated with their developmental trajectory, the timeless challenge faced by every firm: to *be* and *become*, so as to exist through constant adaptation. Put simply, firms change over time, from an initial configuration of goals, boundaries and activity systems (i.e. being) to newer configurations (i.e. becoming) in order to survive. However, there must be sufficient stability in the

firm's organization to anchor the change process so that each firm can span both the requirements of its immediate present and eventual future. As discussed elsewhere (Breslin and Jones 2012), the idea of the Baldwin Effect is one type of explanation of how this timeless challenge can be understood. Defined by Weber and Depew (2003: 195) as "the acquisition of behaviors through reinforcement learning" through the process of natural selection, the idea of such plasticity has long been of interest to evolutionary theorists. Assuming the internal dynamics of any given firm determine the limits of its evolution, then its capacity to respond to environmental stimuli will be of great importance. From the OA perspective, however, the environment must be explainable with considerable precision to ensure we can observe such adaptive processes.

4.2 The environment

A fundamental premise of OA is an assumption that individual firms operate in and are adapted to an operational environment particular to their existence. Therefore, it is assumed that the distribution and abundance of firms throughout society can be explained without a primary reference to the presence of population density and/or any assumed associated competitive interaction. Thus, from the current renaissance of autecological thinking in mainstream ecology (see Hengeveld and Walter 1999; Rohde 2005; Walter and Hengeveld 2014) various other ideas can be imported, that brings to life the seminal autecological ideas of Andrewartha and Birch (1954, 1984). From these ideas we can entertain the possibility of environmental selection rather than competitive selection as a means for explaining the *sustenance activities* of firms, with the actual heterogeneity of the environment is highlighted to enable firm adaptedness to be viewed as a property-in-an-environment, along the lines of Alchian's (1950) environmental adoption.

In contrast, OE prefers to aggregate data to national, state or city levels and assume the existence of an *overall* environment (based typically on a large N) that, while changeable, will make similar demands on all firms. Jones (2009) demonstrated that the pizza restaurants in his study made vastly different demands on their local environments, with different types of pizza restaurants in the same town serving different types of customers different products and services. Without viewing the firm–environment interaction at the individual level it is easy to misinterpret the actual demands that firms make upon their environment or that the environment makes upon them. Clearly it is critically important that our comprehension of any environment and its influence is well understood by the researcher. As will be shortly discussed, this is of paramount importance when we also accept that firms may indeed modify aspects of their environment.

The recent work of biologist Brandon (1990: 11) offers a succinct and simple way to account for dimensions of any environment. Starting with a recognition that natural selection and evolution are indeed different processes, Brandon highlights the fact that selection is highly sensitive to the environment and that evolution attributable to natural selection must occur within a common environment for his Principle of Natural Selection (PNS) to hold true. That is, "If *a* is better adapted than *b* in environment E, then (probably) *a* will have greater reproductive success

than *b* in E". However, if *a* and *b* do not share a common environment, then their relative fitness can not be attributable to a single process of natural selection acting upon both. At the heart of OA is an explicit acceptance of this line of reasoning. Brandon further helps us to understand how to identify *un*common environments. He suggests three specific environmental dimensions through which the process of evolution occurs. First, the *external* environment typically refers to the sum total of all factors external to the firm that influence its survival. However, this overarching view of the environment does little to highlight which factors are of most importance to one firm or another. It essentially relates to the factors that all firms in all industries are most likely exposed to (e.g. high interest rates), regardless of their overall importance to actual firm survival.

Then, Brandon identifies the second dimension as the *ecological* environment, which is a narrowing down of focus. Now we are only concerned with those factors that specifically affect an individual firm's ability to survive (e.g. the increasing availability of specific vital resources). The third and last dimension is the *selective* environment. The selective environment refers to those factors of the external environment (i.e. consumer taste) that specifically determine the differential fitness of an individual firm's interacting elements (such as their products and services, see Jones 2005). Under such a proposal, the *external* environment can exist independently of any individual firm, and most aspects of it could not be altered substantially by any typical individual firm. Therefore, what matters it would seem, is the relationship between the firm and its *selective* and *ecological* environments.

In Fig. 2, we can unite the ideas of Brandon (1990) with the central idea of the operational environment in this simple way. Each firm interacts with it's own

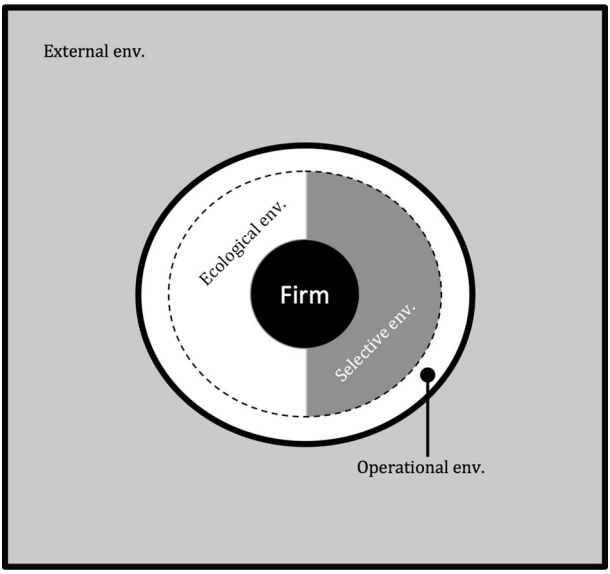

Fig. 2 The firm and its operational environment

operational environment. This operational environment is comprised of potentially negative and positive factors. That is, the *selective* and *ecological* environments that have no existence independent of the firm; and thus they represent the actual operational environment (Spomer 1970) of the firm. Whilst some firms may seemingly share very similar operational environments (e.g. two petrol stations in the same street), there are still many localized factors that prevent them from being identical (e.g. one focusing on takeaway food and the other on mechanical services), and thus, environmental heterogeneity is an issue that must be accounted for. Further, having moved our level of analysis from the external (or macro) environment, to the operational environment of the firm, we are now able to observe the process of resource exchange between firm and environment, as it matters to the existence of any given firm.

More importantly, we are able to observe how the goals, boundaries and activity system of any firms (Aldrich 1999) are altered through such interaction, and how firms modify aspects of their operational environment. There are likely to be unequal degrees of selection pressure spread across time and space that may relate specifically to discrete spaces or observable selective neighborhoods within which similar types of firms will not be selected for or against equally. The findings of Jones (2007, 2009) demonstrated that firms located across 23 geographically related towns experienced vastly different access to resources and selection processes. Further, within each town, it was observed that the pizza restaurants existed within an operational environment of their own creation. This is consistent with Andrewartha and Birch's (1954) assertion that resource availability varies from one location to another. With an OA approach, one should not expect an even distribution of resources and/or selective pressures from one firm to another. The challenge for the OA researcher is to understand how individual firms solve their survival problems; rather than assume the environment essentially determines such outcomes.

4.3 Dynamic interaction

From the OA perspective, the nature of interaction between firm and environment represents a constant process of interpenetration between firm and environment. A process of attempting to constantly acquire resources (e.g. inputs and revenue) and provide resources (e.g. products and services) to other stakeholders in its operational environment. In contrast to the prevailing logic of OE (see Hannan and Carroll 1994), OA assumes that while individual firms are subject to environmental selection forces, those very firms are capable of also altering such selection pressures through modifying aspects of their own operational environments.

Despite the fact that little research has examined such a process of modification (although see Jones 2009 and Luksha 2008), there is no shortage of support for firms modifying their environments (see March 1994; Popper 1972; Rumelt 1979; Scott 1987; Winter 1964, 1990). However, most recent work in this area is from a co-evolutionary perspective, either attributing such modification to collective behavior, or large corporations, not small individual firms. Drawing upon the work of Odling-Smee et al. (2003: 41) and Lewontin (1983), Jones and Luksha positioned the

investigation of adaptive change relative to the ongoing reciprocal interaction between the firm, the firm's behavior and its environment. Rather than merely being on the receiving end of competitive selection, firms can both modify aspects of their operational environment and be adapted as a consequence of interaction with their operational environment. Therefore, just as Darwin's (1881) previously observed, it is possible that a process of ecological inheritance (planned or otherwise) can also occur alongside generational inheritance. Thus, OA in highlighting the process of environmental modification extends a focus upon specific generative mechanisms through which empirical explanations of *how* firms might alter their environments may be crafted. OA research seeks to understand how individual firms modify the feature-factor relationship between firm and operational environment. It does so specifically by looking for evidence of firms changing one or more of the factors of its operational environment, "either by physically perturbing factors at its current location in time and space, or by relocating to a different space–time address, thereby exposing itself to different factors".

From the standard evolutionary perspective, populations of firms transmit information (routines, cultures and organizational structures) from one generation to the next, under the direction of competitive selection. However, from the OA perspective, individual firms may modify their operational environments. Each firm (and/or those similar) inherits both information and a legacy of modified selection pressures (i.e. ecological inheritance) from incumbent firms. To recap, there are differing views within the current literature as to whether or not *individual* firms are capable of altering their environments. Such differences of opinion are not assisted by the paucity of empirical studies addressing this fundamental issue. Developing the idea of environmental modification, as explained above, offers a new window through which to consider *how* and under *what* conditions firms may alter their operational environments, and potentially those of other firms.

4.4 Combining the components of the ecological complex

Through casting the firm and its operational environment as components of an ecological complex, we can see the structures of the firm and the dimensions of its environment more precisely. Put simply, once we accept the reality of the presence of a dialogic relationship (see Bruyat and Julien 2001) between the firm and its operational environment, we advance our capacities to understand both. That is, we cannot expect to understand the workings and situation of any firm without specific reference to its operational environment (as distinct from the external environment it also shares indirectly with other related and unrelated firms). Likewise, it is pointless to discuss an operational environment without reference to a specific firm. Once we have developed this level of focus, the firms and its interacting elements can be seen for what they are. The nature of the routines and the stability that ensures sustenance activities are performed become readily apparent. The nature of behaviors associated with modifying aspects of the operational environment can be searched for, discovered and understood. The actual complex web of direct and indirect relations between the firm and its operational environment can be discerned. Such observations ultimately make it possible for the OA researcher to understand

how an individual firm can *be* and *become*; a task argued to be at the heart of the OA researcher seeking to understand firm-specific adaptive mechanisms.

The work of Jones (2007: 40) illustrates how such environmental heterogeneity can be reconciled to the survival of individual firms. Further, it helps explain how different forms of selection (i.e. stabilizing, directional and disruptive) can have origins in an individual firm's operational and/or external environment. This work also highlights how the process of environmental modification can impact differentially even within small geographic areas, highlighting the presence of sub-types of firms that the OE approach would normally seek to combine and categorize as generalists or specialists. An important finding to emerge from this research is that "the presence of selection, and the industry landscape are all slippery concepts that cannot simply be captured as static features of an industry across time and space". The idea of an ecological complex provides a lens for OA to enable such complexity and irregularity to be discovered and understood.

5 Discussion

A number of important observations can be made from the above discussion. First, OA does not seek to challenge the validity of current OE theory. OE has developed a strong body of literature that remains vibrant. Rather, this paper seeks to highlight the opportunity to develop OA as an alternative ecological approach through which different research opportunities and insights can be addressed. Rather than assuming there are limitations placed on organizational structures by different environmental conditions (Hannan and Freeman 1977), we are free to accept that there is no optimal organizational structure that any one firm should adopt. We are now open to consideration of how an individual firm can both *be* and *become*, through consideration of the process of autopoiesis (Rose 1997) through precise delineation of firm boundaries (see Radosavljevic 2008) and environment interaction. This provides OA with an opportunity to align an ecological explanation to new approaches in strategic management (see Magalhaes and Sanchez 2009) that are yet to discover such ecological foundations. Thus, a promising research question to be explored through OA might be; how do firms adapt to the spatio-temporal dynamics in their operational environment, using current resources to reconfigure the future of any feature-factor firm–environment relations? This is a question ripe for answers in many contemporary landscapes where firms are forced to modify the feature-factor relationship between them and their operational environments in response to the increasing online curiosity/behavior of consumers.

Such a question leads us towards asking, in what ways do firms modify those aspects of the operational environment they directly interact with to maintain their survival? Alternatively, we can ask, in what ways do other firms inadvertently alter aspects of other firms' operational environments for better or worse? The work of Jones (2009, 2013) provides evidence of how firms can coexist (without knowing how or why) through the modification of resource flows influenced by non-predatory behaviors. Assuming that these findings are not unique, it begs the question as to just how common such interrelated events might be vis-à-vis their

capacity to override the strategic endeavors of the entrepreneur and/or the frequently assumed blanket influence of the external environment? Further, to what extent do firms actually understand the nature of environmental change occurring that is directly related to their ongoing sustenance activities? The findings of Jones cast doubt on the degree of awareness that many entrepreneurs have in discerning the actual factors in their local environment that fundamentally matter to their survival. An awakening of this potential should produce positive effects for them.

This perhaps leads us to consider one of the most interesting outcomes of further developing the OA approach. The idea of a firm's environment is something that either confuses researchers or is taken for granted. In his seminal contribution on human ecology, Hawley (1950: 12–13) noted, "environment is a generic concept under which are subsumed all external forces and factors to which an organism or aggregate of organisms is actually or potentially responsive. The very breadth of the concept restricts its use for the purposes of precise description. In general however, environment refers to the medium in which an organism exists. Environment comprises the raw materials of life and the conditions, both favorable and unfavorable, that affect the use of those materials". OA offers us the opportunity to move beyond such pessimism. From Hawley's (and his current followers') sociological stance, such a position is understandable. Once firms are aggregated into populations and populations into communities, trying to define environments precisely is not surprisingly, difficult. In contrast, OA sees the wonder of Darwin's entangled bank not as many firms operating in one common environment, but rather as many interrelated firms that each also maintain a special and unique relationship with their operational environments.

This is the unique opportunity that OA offers the domain of organizational studies, to recast entirely how we view firms ecologically, to embrace that endless diversity of form and purpose and to not abstract away all things essential to understanding the relationship between the firm and its operational environment. We regularly make judgments about external (macro) environments as being either eutrophic (resource rich) or oligotrophic (resource poor) relative to one or more populations, and seek to use such positions to explain firm survival outcomes. OA allows researchers (and therefore also managers/entrepreneurs) to consider how individual firms manage the relationship between their operational environments so as to insulate themselves from potentially damaging factors present within their external environment. By enrolling greater precision into our ecological studies we reintroduce many alternative explanations of why firms survive. For example, Both Kangas and Risser (1979) and Jones (2009, 2013) used ecological *guilds* to draw a focus on groups of related, yet different types of fast food restaurants operating. Root (1967: 335) defines a guild as "a group of species that exploit the same class of environmental resources in a similar way". From this approach, the interrelated nature of the firms is initially viewed through their (loose) guild membership, the common resource they seek (i.e. consumers' patronage) and then ultimately, differences in the modes of operation vis-à-vis their specific operational environments are then open to investigation/interpretation. Both studies used Schoener's (1974) original conception of resource partitioning [as distinct from Carroll's (1985) different approach] to explain differences in resource sharing, with Jones also

drawing upon Rathcke (1983) to provide an explanation of the lack of competition observed in the guild. Such areas of focus and questions do no seek to undermine the development, focus and/or future of OE research. They merely are questions produced from adopting a different ecological starting point; one in which the individual firm rather than the population and/or community is of primary interest.

What is common in the above opportunities is an openness to all forms of data. OA requires the researcher to obtain data and observations at close range. To drawn upon the mix-method approaches (see Creswell 2003) increasingly used to investigate complex phenomena via iterative processes where the research process can accommodate multiple hypotheses and/or postulates. The recent work of Jones (2009, 2013) hints at the profitable study of industries where franchising is common. Industries where the powerful influence of franchise advertising contribute to the dynamic spatio-temporal distribution of firms. It is quite likely that a host of other ecological processes may be directly related to the survival of firms. Perhaps of most interest might be the confirmation that small firms across a range of industries actually can alter aspects of their operational environment in ways that support their ongoing survival.

6 Conclusion

Inspired by the work of Hengeveld and Walter (1999), OA moves the research focus from population equilibrium and concern for community structures to an explicit consideration of the dynamic spatio-temporal distribution of firms. OA seeks to understand the full range of ecological processes that can be called upon to help explain the movement of resources in and out of any particular firm vis-à-vis the environmental axes they confront/create. Processes and concepts such as carrying capacity and density dependence sit alongside all other ecological tools/ideas, to be used as and when they are *observed* to be appropriate.

Finally, this paper sought to introduce a new ecological approach argued to be useful for studying firms. The proposed OA approach differs from the established OE approach in terms of the underlying assumptions that this approach is based upon. To assist in the development of OA, the idea of an *ecological complex* has been offered for consideration. It has been argued that once the firm and its environment are cast as elements of an ecological complex, we can see the features of the firm and the factors of its operational environment more precisely. Such clarity is required to see the firm-level behaviors, argued to relate to the modification aspects of the firm's operational environment in ways that potentially support their ongoing existence. It has been argued that this alternative approach can co-exist alongside the current OE approach, so long as the underlying philosophical assumptions are respected. Just as others have attempted before (see Astley and Fombrun, 1983), there are alternative ways to view firms ecologically, be that from a population or community perspective, or as now proposed, from the perspective of the individual firm and its distinctive ecology. Doing so will undoubtedly open up many new research opportunities for those researchers interested to exploring the world using an ecological lens through which new forms of qualitative and

quantitative data can be combined and analyzed using different techniques. It is hoped that eventually our collective development of this exciting new (but old) approach may eventually produce an ecological theory of the individual firm and the autonomy it demonstrates.

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