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SELECTED VARIATION: THE POPULATION-LEVEL IMPLICATIONS OF MULTISTAGE SELECTION IN ENTREPRENEURSHIP

JONATHAN T. ECKHARDT* and MICHAEL P. CIUCHTA
Department of Management and Human Resources and The Weinert Center for Entrepreneurship, University of Wisconsin, Madison, Wisconsin, U.S.A.

This article examines the population level implications of microlevel theories of entrepreneurship. The actions of those who seek to organize opportunities, as well as the hurdles that they must overcome to successfully exploit them, give rise to an evolutionary multistage selection process. The article indicates that the consideration of selection events leads to a more complete understanding of the entrepreneurial process and how microlevel theories influence important outcomes in entrepreneurship. Other theoretical and empirical implications of staged selection for research in entrepreneurship are discussed. Copyright © 2008 Strategic Management Society.

INTRODUCTION

The individual-opportunity nexus describes entrepreneurship as the discovery, evaluation, and exploitation of entrepreneurial opportunities, where opportunities are defined as situations in which new goods, services, raw materials, markets, and organizing methods can be introduced for profit (Eckhardt and Shane, 2003; Shane, 2003; Venkataraman, 1997). Research that has utilized this perspective has typically focused on particular aspects of the theory, such as opportunity recognition or exploitation, but has yet to examine the population-level outcomes of the interaction of individuals and opportunities. Similarly, the population-level outcomes of other microlevel theories of entrepreneurship (Baron, 2008; Busenitz and Barney, 1997; Ireland and Webb, 2007) remain underdeveloped.

In this article, we develop a population-level model that is derived from the individual-opportunity nexus. In the basic model, entrepreneurs initially draw from a pool of opportunities and then are subjected to a second selection event, such as market acceptance. The population-level model indicates that to understand important theoretical outcomes in entrepreneurship, theories and methods must appropriately consider the fundamental nature of the process. Further, the model shows that when individual effects are aggregated, microlevel theories have significant population-level outcomes. As a result, under certain conditions the model is a powerful mechanism for predicting observable outcomes of the entrepreneurial process at specific points in time.

We compare the multistage selection model to the single-stage model that is implicitly assumed to exist in most entrepreneurship research. The comparison indicates that scholars can strengthen theoretical arguments by incorporating prior selection events explicitly into their theories. For example, the model indicates that when ordered events exist in the

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*Correspondence to: Jonathan T. Eckhardt, Department of Human Resources and The Weinert Center for Entrepreneurship, University of Wisconsin, 5252 Grainger Hall, 975 University Avenue, Madison, WI 53706, U.S.A.
E-mail: jeckhardt@bus.wisc.edu

entrepreneurial process, outcomes—such as why some ventures are more likely to receive financing from external sources (Eckhardt, Shane, and Delmar, 2006), or why small firms may be better at specific activities (Katila and Shane, 2005)—can be understood only when examined as a multistage selection process. The model also indicates that under certain conditions, several forms of entrepreneurial creativity can foster specific types of selection processes.

INDIVIDUALS AND OPPORTUNITIES

Opportunities

We start with entrepreneurial opportunities. As noted above, entrepreneurial opportunities are defined as situations in which new goods, services, raw materials, markets, and organizing methods can be introduced for profit (Eckhardt and Shane, 2003). Because we assume opportunities are situations in which goods and services can be sold for *profit*, opportunities are a subset of what is technologically feasible at a given point in time. Second, although we later relax this assumption, we assume that opportunities exist independent of human cognition (Baron and Ensley, 2006; Eckhardt and Shane, 2003). Third, we assume that opportunities consist of some characteristics that are unchangeable. Although entrepreneurs and organizations have the option of changing the opportunity they are pursuing—such as launching a high-end restaurant instead of a pizza shop in a specific location—in our model we treat the high-end restaurant as a different opportunity from the pizza shop in the same location. Fourth, the exploitation of opportunities requires human creativity. To exploit an opportunity, entrepreneurs must create physical products or processes to provide services, devise business models, and, in some cases, construct new organizations. These are risky and uncertain organizing activities that generally require entrepreneurs to display significant creativity (Alvarez and Barney, 2007; Knight, 1921; Sarasvathy, 2001; Shane, 2003).

Exploitation through individuals

Opportunities are organized and brought to market by individuals, who act alone or with others through licensing, existing organizations, or via the creation of new organizations. Although firms and groups of individuals assemble resources to exploit opportunities, the event that leads to an opportunity being selected for the process of exploitation is an individual cognitive act (Shane, 2003). Following Eckhardt and Shane (2003), we assume that prior to exploitation, sufficient information does not exist for entrepreneurs to factually ascertain whether they have discovered or recognized an entrepreneurial opportunity. Instead, individuals develop and make decisions based on conjectures about the existence of an opportunity (Hamilton and Harper, 1994; Shane, 2003). Scholars have argued that the likelihood that an individual will develop a conjecture about a specific opportunity is driven by three factors: the information the individual receives about the existence of specific opportunities; the prior knowledge of the individual; and specific attributes of the individual (Venkataraman, 1997).

Information. The stock of information available to actors about the potential existence of entrepreneurial opportunities is not static. As Kirzner (1997: 70) explains, entrepreneurs operate in a world of 'ceaselessly changing tastes, resource availabilities, and known technological possibilities.' Information about the existence of opportunities is assumed to be unevenly distributed among actors (Eckhardt and Shane, 2003; Venkataraman, 1997), and a given individual is exposed to information about only a subset of all opportunities that exist at a specific point in time.

Prior knowledge. Differences in prior knowledge foster differences in the ability of individuals to perceive specific entrepreneurial opportunities. An individual's accumulated knowledge establishes a knowledge corridor of understanding that represents the ability of an individual to develop reasonable conjectures about specific domains of knowledge, including the existence of an entrepreneurial opportunity (Piroli and Anderson, 1985; Shane, 2000; Venkataraman, 1997). An individual's body of knowledge is largely derived from idiosyncratic life experiences, such as formal education, travel, participation in membership organizations and social networks, and independent study. Further, because individuals typically select into different life experiences, and advanced education is typically specialized, the stock of prior knowledge is unevenly distributed among individuals. In support of the importance of prior knowledge in discovery, Shane (2000) provides empirical evidence that indicates that individual prior knowledge of markets, customer problems, and means of solving these problems influenced the likelihood that individuals developed conjectures about specific entrepreneurial

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opportunities based on a patent developed at the Massachusetts Institute of Technology.

Individual attributes. Although information and prior knowledge are necessary conditions for an individual to develop reasonable conjectures about the existence of an entrepreneurial opportunity, these conditions are not sufficient. Instead, the literature indicates that differences among individuals influence how they process information (Baron and Ensley, 2006; Corbett, 2007), as well as the propensity that they will act on what they perceive and understand (Evans and Leighton, 1989). Recent work also suggests that the genetic characteristics of individuals may influence the physiology of their brain function, which, in turn, might influence the development of conjectures and the likelihood that individuals will develop specific psychological traits that are associated with greater likelihood of exploitation (Nicolaou and Shane, forthcoming; Nicolaou *et al.*, 2008).

The nexus of individuals and opportunities

The exploitation of an opportunity is an uncertain endeavor that often necessitates the creation of an organization, procedures, and products through the involvement of a disparate group of individuals and institutions, including entrepreneurs, capital providers, regulators, governments, and advisors (Shane, 2003). The decision to exploit is preceded by the development of a conjecture that an opportunity exists. As discussed above, individuals are likely to develop a conjecture that a specific opportunity exists if they are exposed to information about the opportunity, they have sufficient prior knowledge to understand the opportunity, and they have the propensity to act (Eckhardt and Shane, 2003). Although the decision to exploit an opportunity is an individual cognitive act, the decisions and actions of the population of entrepreneurs foster population-level outcomes on the characteristics of the pool of opportunities that are observed at various stages of the entrepreneurial process.

SELECTED VARIATION

At the population level, the entrepreneurial process gives rise to an evolutionary multistage selection process (Campbell, 1969). In general, evolutionary selection models in the social sciences assume three characteristics that shape the attributes of a population (Aldrich, 1979). First, entities exist, and variation in entities must exist in the underlying population (Nelson and Winter, 1982). Second, selection events exist and entities do not all have equal likelihood of successfully satisfying selection criteria (Hannan and Freeman, 1977). Third, some static attributes of selected entities exist, so that differential selection leads to differences in frequency counts of attributes in entities that are retained (Campbell, 1969).

At the population level, the process of entrepreneurship possesses all three of these characteristics. First, opportunities vary significantly in their characteristics. For example, analysis reported in Shane (2008) suggests that an important characteristic of an opportunity is the industry to which it belongs, because opportunities in some industries are more likely to grow than those in other industries. Second, the varying characteristics of opportunities are likely to differentiate their likelihood of selection. For example, business failure rates published by the Small Business Administration indicate that medical diagnostic laboratories are less likely to fail than taxi and limousine service ventures.[1] Third, although entrepreneurial opportunities are transient, opportunities have static attributes. Managers can change fundamental attributes of businesses including organizational structure and management. In the case of new ventures, founders can change the opportunity that is being pursued. For example, a firm formed to exploit a specific commercial opportunity to sell video graphics cards can modify the business model to exploit an opportunity to sell network cards instead. However, the characteristics of these opportunities themselves are static. If a static attribute is more likely to lead to the selection of some opportunities over others, then this attribute will be overrepresented in the population of opportunities that survive selection.

Sources of variation

The pool of opportunities is constantly changing. As Venkataraman (1997) explains, opportunities are created by two different processes. In the Schumpeterian perspective, opportunities are created by exogenous change—such as technological innovation

[1] See Armington (1998) for a description of the data. The data is available in electronic format from the Office of Advocacy, U. S. Small Business Administration, 409 Third Street S.W., Washington, DC 20416.

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and natural disasters—leading to situations in which individuals can launch new products and services (Schumpeter, 1934). Opportunities created by exogenous change often represent a fundamental disruption of the existing economic order. However, because of perpetual advances in science and technology driven by institutions and individuals operating outside the market system, exogenous change is not necessarily represented by discrete events that disrupt established market relationships. In the Kirznerian perspective, opportunities exist because of changes occurring in the data of markets that are driven by a myriad of sources, such as perpetual shifts in tastes, resources, and errors of market participants (Kirzner, 1997). In either case, the stock and characteristics of opportunities available for exploitation are under constant change.

Several different typologies of sources of entrepreneurial opportunity exist that suggest several different sources of variance in the distribution, stock, characteristics of, and location of opportunities. As Shane (2003) explains, many of these typologies can be aggregated into three dimensions: technological changes, political and regulatory changes, and social or demographic changes. Scant research has been conducted on factors that influence the sources of opportunities, and often the existing studies have focused on a single factor. Hence, little is known about the relative importance of these three factors, or even if a different typology would be more appropriate. Despite these limitations, several studies suggest that the stock and variation in the characteristics of the pool of opportunities is not random. For example, Klevorick and colleagues (1995) conducted survey research of industrial research and development that indicates that scientific advances generated by universities and governments, and technological advances by firms operating within and outside industries are important sources of variation in the distribution of entrepreneurial opportunities in some industries. Shane (1996) found support for a relationship between entrepreneurship and technological change, but failed to find support for his measures of political change and changes in demand (GNP growth). Sine and David (2003) found that institutional change in the electric power industry fostered opportunities for entrepreneurs to start new firms, and the findings of Sine, Haveman, and Tolbert (2005) suggest that a causal relationship may exist between institutional change and the variance in technological opportunities. Some evidence suggests that political turbulence is negatively associated with the survival of new firms (Carroll and Delacroix, 1982; Carroll and Hou, 1986). Findings from Barnett (1997) suggest that changes in regulations can both reduce and foster opportunities to form new firms. Other research indicates that the technological regime of the industry (Malerba and Orsenigo, 1997; Shane, 2001; Winter, 1984) as well as the characteristics of knowledge (Malerba and Orsenigo, 2000; Teece, 1986) may influence the characteristics of the pool of opportunities. Evidence indicates that geographic proximity to sources of capital (Sorenson and Stuart, 2001) or academic research centers, or changes in demographics (Shane, 2003), may also influence the characteristics of opportunities at specific places or points in time.

The nature of selection

Although most evolutionary treatments of the entrepreneurial process focus on a single staged selection event (Hannan and Freeman, 1977), we argue that opportunities pass through a multistage selection process that evolves over time. In general, multistage selection models assume that multiple selection screens exist in the process, that selection into subsequent stages is contingent on the outcome of prior selection screens, and that characteristics necessary for selection at one stage may be quite different from characteristics that are necessary for selection into subsequent stages (Eckhardt *et al*., 2006). Although not all selection events in the entrepreneurial process are ordered, and not all selection events are irreversible, within the process under which opportunities are brought to market, ordered irreversible selection events exist that give rise to a multistage selection process. For example, for an opportunity to be embodied in markets, it first must be selected into the process by one or more entrepreneurs and then must be selected by the market. It is impossible for an opportunity to be incorporated into markets unless an entrepreneur, either working alone or with others, takes action to exploit the opportunity.

Sources of selection events

The entrepreneurial process consists of two types of selection events—internal and external selection (Aldrich, 1979). Internal selection events occur either within the individual-opportunity dyad or within a nascent organization that has been formed to exploit an opportunity. An example of an

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internal selection event would be the selection into the organizing process by an individual entrepreneur. Although some may question the validity of treating internal individual-opportunity dyad selection as a population-level selection event, internal selection events have systematic population-level outcomes to the extent that similar selection criteria are common across many founders (Meyer, 1994). For example, Eckhardt *et al.* (2006) found evidence that indicates that the process under which nascent ventures receive financing from external sources is a multistage selection process. For a venture to receive financing from external sources, a founder must decide to seek financing for the venture, and then an investor must fund it. Although the within individual-opportunity decision to seek funding from external sources for any given venture was driven by the entrepreneurs who were directly involved in the management of a single venture, it was found that entrepreneurs of all ventures used sufficiently similar selection criteria such that a selection screen existed that systematically influenced the characteristics of the population of ventures that were presented to investors for financing. Further, much of the reduction in variance was driven by within individual-opportunity selection. Of the 221 ventures in the sample, only 81 (36%) sought financing from external sources, while most (78%) were granted financing given they asked (Eckhardt *et al.*, 2006). Hence, the evidence indicates that internal selection events systematically winnow the characteristics of the population of opportunities that exist at later stages in the entrepreneurial process.

External selection is the second type of selection event that exists in the entrepreneurial process. Selection events external to the individual-opportunity dyad or to the nascent organization that has been formed to exploit an opportunity systematically winnow the population of opportunities as they pass through the entrepreneurial process. Two examples of external selection screens are the characteristics of products that consumers deem desirable and the characteristics of opportunities that capital providers see as important in determining whether a venture will be awarded financing (Eckhardt *et al.*, 2006). A large number of studies have examined the influence of single-stage external selection on various populations in entrepreneurship. For example, the organizational demography literature examines factors that influence the mortality of organizations (Carroll and Hannan, 2000; Hannan and Freeman, 1977). However, outside of studies that statistically model failure while examining other outcomes, few studies have examined sequential selection events in the entrepreneurial process.

In addition to the types of selection, it is important to consider two other aspects of selection events. First, selection events may arise from a variety of different causal mechanisms. In the case of the decision on the part of individuals to pursue opportunities, selection criteria across individuals need only be similar, but not necessarily rational, as assumed in some models of entrepreneurial behavior (Khilstrom and Laffont, 1979). For example, to the extent that those who are at risk of exploiting opportunities exhibit specific cognitive biases, and if they select opportunities to pursue in part as a result of this bias, then a population-level selection screen will arise out of the cumulative individual-level decisions to pursue specific opportunities as a result of the common bias. Second, the unit of selection can shift between the types of selection (Aldrich, 1999). For example, although founders may elect to pursue an opportunity based on its characteristics, a subsequent external selection event—such as the decision on the part of investors to provide capital—may be based on the characteristics of both the opportunity and the founders (Baum and Silverman, 2004).

The process of selection

Considering the entrepreneurial process as a multistage selection process over time yields implications fundamentally different from those generated from approaches that treat entrepreneurship as a single-stage selection process, which is how the process is commonly treated in the literature (Hannan and Freeman, 1977). In particular, an important implication from evolutionary theory is that the processes of selection, as well as the criteria that drive selection at each stage, are important in determining outcomes (Haldane, 1932; Mohr, 1982). For example, Figure 1 is a simple two-stage selection model that illustrates the differences between the multistage and single-stage selection models in the entrepreneurial process. In this example, opportunities and technologies are symbolized by circles or triangles, and are identified as having one or more characteristics, denoted A and B. The example assumes that individuals seek to exploit opportunities and technologies that exhibit characteristic A, whereas consumers seek to purchase products based on opportunities that exhibit characteristic B. The opportunities that are shaded exhibit characteristics that

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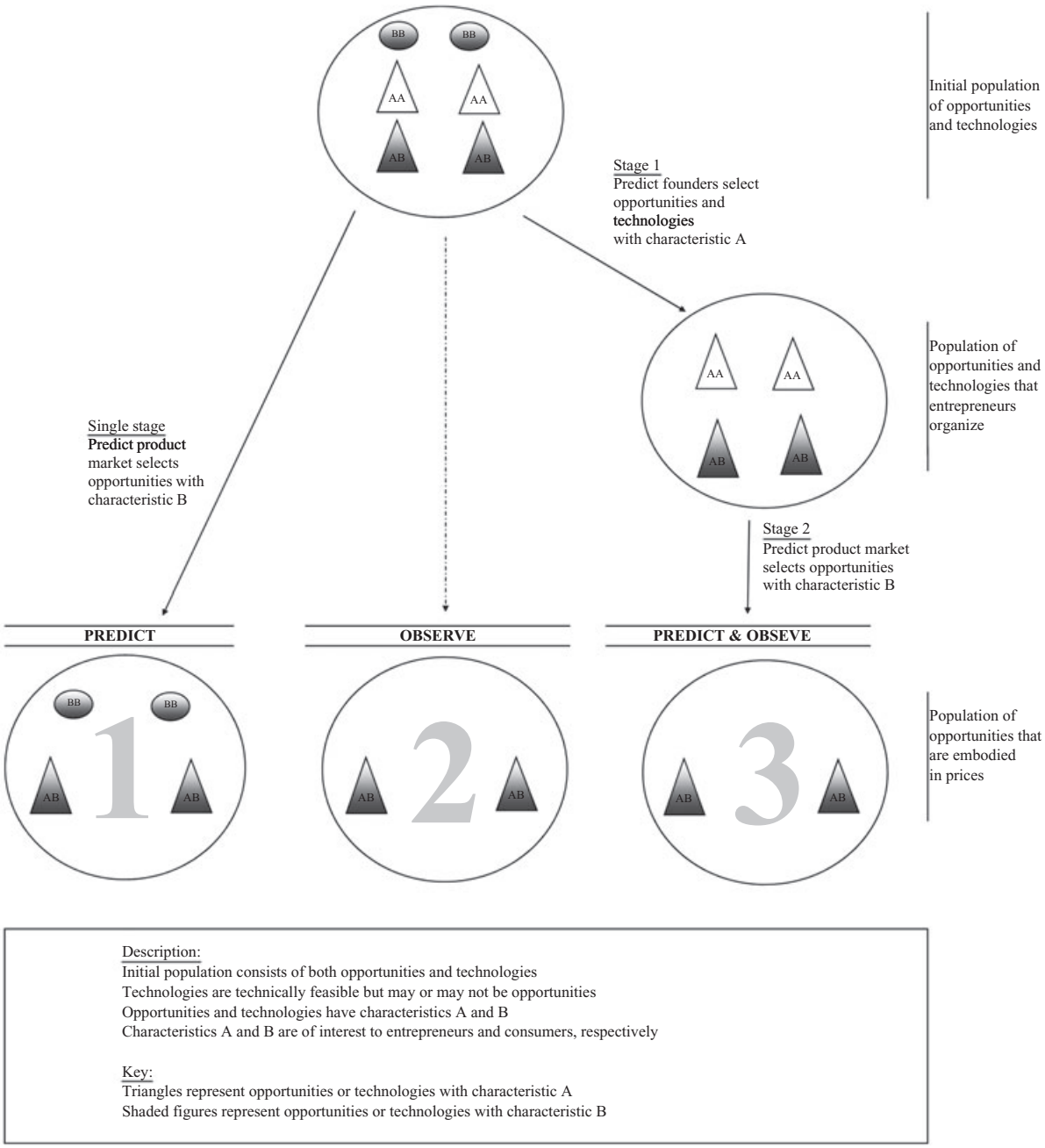

Figure 1. Single stage versus multistage selection process

satisfy the product market selection criteria, B, while the unshaded opportunities lack this characteristic. Triangles represent opportunities that exhibit the characteristic A, which increases the likelihood that an individual will exploit the opportunity. Circles stand for opportunities that lack this characteristic.

Standard single-stage selection models theorize that opportunities are more likely to survive if they meet market selection criteria (Hannan and Freeman, 1977). However, these approaches are inadequate for two key reasons. First, they fail to explain why there is so little variance in the characteristics of opportunities being exploited. Second, they fail to address why the subset of opportunities being exploited is not representative of the population of available opportunities. A multistage selection approach can explain this

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lack of variation: this approach argues that opportunities which ultimately survive pass through multiple selection events.

Figure 1 illustrates this point. Standard theories hypothesize that shaded opportunities that exhibit characteristic B will be observed to be successfully exploited in the marketplace, as represented by the process ending in the circle labeled 1. However, the process ending in circle 2 shows that standard theories cannot explain why those opportunities that are successfully exploited exhibit the same shape. In other words, standard theories cannot explain why some opportunities that meet product market selection criteria (the shaded ellipses in Figure 1) are not ultimately observed in the marketplace. The problem with single-stage theories is that they overlook the fact that within the entrepreneurial process, opportunities that satisfy product market selection criteria will remain unexploited if they do not also meet founders' selection criteria.

The multistage selection approach ending in circle 3 appropriately considers the sequential nature of the process. In the first stage, founders attempt to exploit only those opportunities that meet their criteria—those opportunities that include characteristic A. In the second stage, only those opportunities that meet product market selection criteria by possessing characteristic B survive the process. The multistage selection approach shows that only those opportunities that are selected by entrepreneurs and the product market are observed as successfully being exploited. Figure 1 shows that the existence of multiple selection events, as well as the order of the selection process, must both be considered to understand the outcome. Therefore, the multistage selection approach provides a more complete explanation of the entrepreneurial process. We now shift our emphasis toward examining the effects of differences in selection criteria between stages.

Staged selection

In general, three different possibilities exist regarding the implications of the multistage selection process of entrepreneurship. First, differences in selection criteria between the actions of founders and later selection stages could give rise to opposing selection, which refers to the propensity of founders to select opportunities that are less fit in subsequent selection. Second, selection criteria between the two stages could be orthogonal, meaning that the selection criteria are different, but not opposing. Lastly, selection criteria could be congruent in cases in which the selection criteria are the same at each stage.

We expand the basic model depicted in Figure 1 to more fully examine the population-level effects of the relationship between selection criteria. As in our original model, opportunities have one or more characteristics, denoted A or B, resulting in three different types of opportunities, AA, AB, and BB. In addition, two ordered selection events exist. In the first stage, each founder draws from the initial pool an opportunity to pursue, thereby creating a second pool that consists of the opportunities being exploited. In the second stage, those opportunities that best fit product market selection criteria are most likely to be observed being successfully sold in the marketplace.

Figure 2 depicts these three different selection possibilities. In Figure 2, the type of opportunity is determined by its characteristics, and an opportunity consists of two characteristics in some combination of A and B. The likelihood that an opportunity with characteristics *cc* will be selected past the first selection stage is defined as its fitness W_{cc1}, which ranges between 0 and 1. A fitness value of 1 indicates that an opportunity with characteristics *cc* is certain to be selected in stage 1, and a fitness value of 0 indicates that the opportunity will not be selected in stage 1. In the second stage, market fitness (W_{cc2}) is determined by the fit of the characteristics of the opportunity (*cc*) with the characteristics of consumer demand. Because we define opportunities as situations in which new goods, services, raw materials, markets, and organizing methods can be introduced for *profit*, in all cases W_{cc2} is greater than zero in Figure 2.

Opposing selection. Panel A of Figure 2 shows opposing selection in the multistaged selection process. In Column 2, we start with an initial pool of 40 opportunities of each type, yielding a total of 120 opportunities. For opposing selection, in stage 1 founders are most likely to select opportunities of type AA and they are least likely to select opportunities of type BB. After founders make their selections, 36 of the 48 opportunities being exploited are of type AA. In stage 2, the market is most likely to select opportunities of type BB, and is least likely to select opportunities of type AA. Note that a comparison between Column 4 and Column 2 shows that as a direct result of the founders' selections, a random draw from the pool of opportunities under exploitation is less likely to result in an opportunity exhibiting characteristics of interest to product

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Panel A: Opposing selection

Stage 1: founders are most likely to select opportunities of type AA and least likely to select opportunities of type BB
Stage 2: the market is most likely to select opportunities of type BB and least likely to select opportunities of type AA

Type	Freq. in initial pool of opportunities	Founder selection (stage 1) Fitness		Founder selection (stage 1) Outcome freq.		Product market selection (stage 2) Fitness		Product market selection (stage 2) Outcome freq.		Probability selected
(1)	(2)	(3)		(4)		(5)		(6)		(7)
AA	40	W_{AA1}	0.9	36		W_{AA2}	0.1	4		0.09
AB	40	W_{AB1}	0.2	8		W_{AB2}	0.2	2		0.04
BB	40	W_{BB1}	0.1	4		W_{BB2}	0.9	4		0.09

Panel B: Orthogonal selection

Stage 1: founders are most likely to select opportunities that exhibit at least one A
Stage 2: the market is most likely to select opportunities that exhibit at least one B

Type	Freq. in initial pool of opportunities	Founder selection (stage 1) Fitness		Founder selection (stage 1) Outcome freq.		Product market selection (stage 2) Fitness		Product market selection (stage 2) Outcome freq.		Probability selected
(1)	(2)	(3)		(4)		(5)		(6)		(7)
AA	40	W_{AA1}	0.9	36		W_{AA2}	0.1	4		0.09
AB	40	W_{AB1}	0.9	36		W_{AB2}	0.9	32		0.81
BB	40	W_{BB1}	0.1	4		W_{BB2}	0.9	4		0.09

Panel C: Congruent selection

Stage 1: founders are most likely to select opportunities of type AA
Stage 2: the market is most likely to select opportunities of type AA

Type	Freq. in initial pool of opportunities	Founder selection (stage 1) Fitness		Founder selection (stage 1) Outcome freq.		Product market selection (stage 2) Fitness		Product market selection (stage 2) Outcome freq.		Probability selected
(1)	(2)	(3)		(4)		(5)		(6)		(7)
AA	40	W_{AA1}	0.9	36		W_{AA2}	0.9	32		0.81
AB	40	W_{AB1}	0.2	8		W_{AB2}	0.2	2		0.04
BB	40	W_{BB1}	0.2	8		W_{BB2}	0.2	2		0.04

Notes
Outcome frequencies are rounded to nearest whole number

Figure 2. Multistage selection models

markets than was the entire cohort of opportunities shown in Column 2. This is the opposing selection problem. In cases of strong opposing selection, in which $W_{AA1} = 1$, $W_{AB1} = 0$, $W_{BB1} = 0$ and $W_{AA2} = 0$, $W_{AB2} = 0$, $W_{BB2} = 1$, exploitation will not be successful (Barnett, Swanson, and Sorenson, 2003). An example of opposing selection that has been widely studied in entrepreneurship is adverse selection in entrepreneurial finance (Akerlof, 1970; Amit, Glosten, and Muller, 1990).

Orthogonal selection. In the case of orthogonal selection, founders and the product markets may differ in the importance they attach to different attributes of opportunities. For example, founders may seek to exploit opportunities based on their own small sample inferences about what the markets may

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deem important (Busenitz and Barney, 1997), but consumers in the product market may view as desirable other characteristics exhibited by the opportunity. Panel B of Figure 2 depicts the effects of orthogonal selection, in which it is assumed that founders seek to exploit opportunities that exhibit characteristic A, but the market is most likely to select opportunities that exhibit characteristic B. As shown in Panel B, orthogonal selection may constrain the choices of consumers to the extent that opportunities exist in Column 2 that exhibit characteristic B, but are of little interest to the exploitation decisions of founders. Hence, they are not exploited by entrepreneurs.

Congruent selection. In processes of congruent selection, founders select opportunities for exploitation using the same criteria as desired by the product market. Congruent selection may occur if founders do not exhibit systematic biases, for example if they are not overly optimistic, or if founder and product market interests are the same for some or all characteristics of opportunities. Returning to Figure 2, Panel C depicts congruent selection, in which any opportunity of type AA is most likely to be selected by founders as well as the product market. In the case of congruent selection, the founder selection event that preceded selection by the product market is enabling because a random draw from the pool of opportunities under exploitation in Column 4 is more likely to yield an opportunity of interest to consumers than a draw from the initial pool of opportunities shown in Column 2.

The nature of staged selection is important to address to gain a theoretical understanding of the characteristics of opportunities that will ultimately be observed as successfully exploited. Nevertheless, in each case the existence of staged selection events fosters theoretical and empirical complexities that have been overlooked in the literature. These complexities must be addressed in order to empirically measure the factors that drive selection—even if the empirical interest is only focused on the second stage (Berk, 1983). Returning to Figure 2, in cases of opposing selection (Panel A) and congruent selection (Panel C), founders' selections constrain the ability to draw empirical inferences because of the resulting reduction in variance (Klepper, Nagin, and Tierney, 1983). For example, it is difficult to examine whether product markets reward opportunities that exhibit characteristic B, as very little variance exists on B in Column 4 of panels A or C of Figure 2. In the case of orthogonal selection (depicted in Panel B of Figure 2), failure to appropriately model the two stages would provide no explanation as to why some opportunities, such as those of type BB in the example, are rarely exploited, given that opportunity BB met the market selection criteria. Hence, it is important to appropriately model the process under which opportunities are exploited to accurately understand why opportunities with certain characteristics are more likely to be exploited than others. Appropriate modeling of the process is also necessary to understand empirically why opportunities with some characteristics are more likely than others to be observed in the population of opportunities that are successfully exploited.

Creativity and selection

Scholars have argued that human creativity is important to the entrepreneurial process (Alvarez and Barney, 2007; Shane, 2003). We examine how three different treatments of creativity influence the multistage selection model of the entrepreneurial process. First, entrepreneurs may innovate in response to expectations about the characteristics of consumer demand instead of merely drawing from an exogenously generated pool of opportunities (Schmookler, 1966). Second, scholars have proposed that when creating markets for novel goods and services, entrepreneurs may be able to create or influence the characteristics of consumer demand (Sarasvathy, 2001). Third, to exploit specific opportunities, entrepreneurs can engage in a variety of different organizing strategies and also introduce novel forms of organizing (Shane, 2003). We discuss how these different types of creativity influence the outcomes of the multistage selection model.

Innovation. Entrepreneurs may innovate in response to their expectations of consumer demand. For example, Schmookler asserted that bodies of scientific knowledge are often applicable to a variety of commercial contexts and that innovation in specific applications of scientific knowledge may be driven by the commercial value the knowledge will yield in a specific context (Schmookler, 1966). Similarly, Aldrich and Martinez (2003) assert that viewing innovation as opportunity recognition may amount to an *ex post* rationalization of an *ex ante* creative act. In our model, this means that individuals and firms may expand the pool of opportunities in existence in Column 2 of Figure 2 in response to their perceptions of the product market selection criteria that will prevail in Stage 2. If an individual decides

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to pursue an innovation in response to expectations of consumer demand, then the opportunity will be exploited and included in the pool of opportunities selected by founders shown in stage 1. To the extent that individuals misgauge or are uninterested in the product market selection criteria that will exist in stage 2, either opposing selection or orthogonal selection will apply, depending on the nature of the discrepancy. However, if innovators are correct about the characteristics of stage 2 selection criteria, and if they successfully innovate and introduce into the entrepreneurial process innovations that are consistent with stage 2 selection criteria, then congruent selection—and the associated issues discussed in the previous section—will apply.

Selection criteria. Scholars writing in the market creation tradition have theorized that when introducing novel products and services, entrepreneurs do not merely respond to expectations of consumer demand. Instead, entrepreneurs may be able to modify the characteristics of demand or, in some cases, create demand for novel products and services (Aldrich and Fiol, 1994; Sarasvathy and Dew, 2005). Examples of these efforts include legitimacy building actions, such as formal certification (Sine, David, and Mitsuhashi, 2007), and concerted attempts to effectively sell ideas to key resource providers (Martens, Jennings, and Jennings, 2007).

In our model, this means that individual entrepreneurs are able to modify or create the characteristics of the selection criteria that exist in stage 2. To the extent that entrepreneurs are able to modify the characteristics of demand to fit the characteristics of opportunities that they are attempting to exploit, then congruent selection shown in Figure 2 will dominate. However, if constraints exist that limit the ability of entrepreneurs to modify or create selection criteria that are favorable to the opportunities they are pursuing, then orthogonal or opposing selection may arise. Further, if the modification or creation of selection criteria by an individual entrepreneur affects the fitness of opportunities being pursued by other entrepreneurs—as would be the case if at any given time resources available to purchase novel products and services were not limitless—then even in regimes in which creativity is possible, orthogonal or opposing selection may arise for a subset of individuals and organizations. Hence, even in settings in which entrepreneurs are able to enact stage 2 selection criteria, the problems of multistage selection remain.

Organizing strategy. Entrepreneurial creativity can be manifested in the entrepreneurial process in the approaches that individual entrepreneurs take toward organizing opportunities they have decided to pursue. For example, an entrepreneur may decide to utilize particular franchise terms, introduce a novel business model, or engage in specific organizing actions to exploit an opportunity (Azoulay and Shane, 2001; Delmar and Shane, 2003). We examine the implications of this form of entrepreneurial creativity by modifying the model shown in Figure 2. We introduce two different approaches to organizing, O_1 and O_2. For simplicity, we assume that the market prefers O_2 over O_1 in all cases, independent of the characteristics of the opportunity.[2] Figure 3 depicts the multistaged selection model with creativity represented as the selection of an organizing method by founders. In the expanded model, individuals first decide if they will pursue a specific opportunity, thereby creating the pool of opportunities being exploited that is shown in Column 4. Subsequent to selecting an opportunity, the entrepreneur implements an organizing strategy of either O_1 or O_2. In our example, we assume that 50 percent of the entrepreneurs select O_1 and 50 percent select O_2 for all types of opportunities that are being pursued. In stage 2, product market fitness is determined both by the characteristics of the opportunity and by the organizing strategy.

Figure 3 indicates that the opposing, orthogonal, and congruent selection problems remain in cases in which entrepreneurial creativity is represented as the ability of individuals to select different organizing strategies. In addition, Figure 3 suggests that under some types of selection, the organizing strategy chosen by the entrepreneur may play a major role in determining the characteristics of opportunities that are ultimately exploited. For example, in the case of congruent selection, if organizing strategy O_1 were assumed to be much less likely to result in product market selection than that which is depicted in Panel 3, then significant variance in the population of opportunities observed being successfully exploited would be driven by the organizing strategy. Stated differently, it is possible, in principle,

[2] Note that while we assume that O_2 has a higher fitness than O_1 in all cases, in reality the fitness of a specific organizing strategy is likely to be a function of the characteristics of the opportunity being pursued (Eckhardt and Shane, 2003). However, the implications of the staged selection model that are examined here are not substantially different if the fitness of specific organizing strategies is assumed to be driven, in part, by the characteristics of the opportunity.

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Panel A: Opposing selection

Stage 1: founders are most likely to select opportunities of type AA and least likely to select opportunities of type BB
Stage 2: the market is most likely to select opportunities of type BB and is least likely to select opportunities of type AA, and O_2 is the most fit organizing strategy

Type	Freq. in initial pool of opportunities	Founder selection (stage 1)			Founder Organizing Strategy		Product market selection (stage 2)		
		Fitness		Outcome freq.	Strategy	Outcome Freq.	Fitness		Outcome freq.
(1)	(2)	(3)		(4)	(5)	(6)	(7)		(8)
AA	40	W_{AA1}	0.9	36	O_1	18	$W_{AA2}O_1$	0.1	2
					O_2	18	$W_{AA2}O_2$	0.2	4
AB	40	W_{AB1}	0.2	8	O_1	4	$W_{AB2}O_1$	0.3	1
					O_2	4	$W_{AB2}O_2$	0.4	2
BB	40	W_{BB1}	0.1	4	O_1	2	$W_{BB2}O_1$	0.8	2
					O_2	2	$W_{BB2}O_2$	0.9	2

Panel B: Orthogonal selection

Stage 1: founders are most likely to select opportunities that exhibit at least one A
Stage 2: the market is most likely to select opportunities that exhibit at least one B, and O_2 is the most fit organizing strategy

Type	Freq. in initial pool of opportunities	Founder selection (stage 1)			Founder organizing strategy		Product market selection (stage 2)		
		Fitness		Outcome freq.	Strategy	Outcome freq.	Fitness		Outcome freq.
(1)	(2)	(3)		(4)	(5)	(6)	(7)		(8)
AA	40	W_{AA1}	0.9	36	O_1	18	$W_{AA2}O_1$	0.1	2
					O_2	18	$W_{AA2}O_2$	0.2	4
AB	40	W_{AB1}	0.9	36	O_1	18	$W_{AB2}O_1$	0.8	14
					O_2	18	$W_{AB2}O_2$	0.9	16
BB	40	W_{BB1}	0.1	4	O_1	2	$W_{BB2}O_1$	0.8	2
					O_2	2	$W_{BB2}O_2$	0.9	2

Panel C: Congruent selection

Stage 1: founders are most likely to select opportunities of type AA
Stage 2: the market is most likely to select opportunities of type AA, and O_2 is the most fit organizing strategy

Type	Freq. in initial pool of opportunities	Founder selection (stage 1)			Founder organizing strategy		Product market selection (stage 2)		
		Fitness		Outcome freq.	Strategy	Outcome freq.	Fitness		Outcome freq.
(1)	(2)	(3)		(4)	(5)	(6)	(7)		(8)
AA	40	W_{AA1}	0.9	36	O_1	18	$W_{AA2}O_1$	0.8	14
					O_2	18	$W_{AA2}O_2$	0.9	16
AB	40	W_{AB1}	0.2	8	O_1	4	$W_{AB2}O_1$	0.2	1
					O_2	4	$W_{AB2}O_2$	0.3	1
BB	40	W_{BB1}	0.2	8	O_1	4	$W_{BB2}O_1$	0.2	1
					O_2	4	$W_{BB2}O_2$	0.3	1

Notes
Outcome frequencies are rounded to nearest whole number
For each type in each panel, founders select O_1 for 1/2 of opportunities exploited, and O_2 for the other 1/2 of opportunities exploited

Figure 3. Multistage selection models with organizing strategies

that most opportunities successfully exploited under congruent selection would be similar in two aspects. They would most likely be of type AA and they would also most likely be similarly organized, using organizing method O_2.

IMPLICATIONS FOR THEORY AND RESEARCH METHODOLOGY

This article indicates that the population-level outcomes of individual selection models in entrepreneurship foster a multistage selection process that evolves through time. The basic model starts with an exogenously generated pool of opportunities. Following Venkataraman, Shane, and Eckhardt (Eckhardt and Shane, 2003; Shane and Venkataraman, 2000; Venkataraman, 1997), either through purposeful search or happenstance, individuals are exposed to information about the existence of one or more opportunities. If individuals have the requisite prior knowledge to perceive an opportunity they have been exposed to, and have a propensity to act on it, they may decide to exploit the opportunity. To the

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extent that agents are likely to systematically select opportunities through the entrepreneurial process in similar ways, a multistage selection model arises at the population level.

Although our examination has been focused on two specific stages of selection, other ordered staged selection events are likely to exist in different aspects of the entrepreneurial process. For example, evidence indicates that venture financing can foster staged selection events (Baum and Silverman, 2004; Eckhardt *et al.*, 2006). Further, if other microlevel theories are relevant at multiple stages, such as models of individual decision making (Busenitz and Barney, 1997), then a multistage selection model is likely to arise. The frequency and strength with which these population-level screens operate in the entrepreneurial process remain an empirical question. However, even slight changes in the relative fitness that arise out of minor differences in selection at specific stages can foster important theoretical and statistical ramifications for scholars.

In general, population-level theories explain why entities exhibit specific characteristics in certain environments (Aldrich and Zimmer, 1986). In entrepreneurship, entities of interest include technologies, individuals, ventures, and—as presented here—opportunities. In the case of opportunities, at any point in time certain opportunities that have been pursued with specific organizing strategies are observable at various stages in the process. Our theory suggests that, as a result of staged selection, those opportunities that are observed at various stages of the entrepreneurial process share certain characteristics.

Central to population-level outcomes of the multistage selection theory articulated here is the importance of ordered events. In contexts in which the entrepreneurial process is not ordered, the theory is invalid. For example, in the Eckhardt *et al.* (2006) examination of the venture finance process mentioned above, ventures were modeled as receiving funding conditional on founders seeking external capital. If ventures typically received financing without seeking funds, then the multistage selection model would be irrelevant. However, the population-level implications of the multistage selection model shown in figures 2 and 3 are likely to be relevant, even if not all entities involved in the process are subjected to ordered selection. For example, if 10 percent of ventures receive financing without seeking external capital and 90 percent of ventures only receive financing conditional on seeking funds, then the theoretical and empirical implications of the population-level model will apply. This is the case because the characteristics of the initial pool of ventures offered for financing will be systematically different from those of the pool of ventures actually being pursued at a given time. However, to the extent that events are not ordered in the entrepreneurial process, or if selection in prior stages is unsystematic, then the population-level outcomes of the multistage selection model will not apply.

Our theory describes entrepreneurship as a funneling process that starts with a pool of opportunities at a specific point in time. This pool of opportunities is winnowed through staged selection events, yielding a subset of successfully exploited opportunities. Those opportunities that are successfully exploited become inputs into established evolutionary theories that start with the existence of an organization (Levinthal, 1991; Miner, 1994; Nelson and Winter, 1982). Those opportunities that are not successfully exploited at a given point in time may be available for exploitation in a following period. The multistage selection process of entrepreneurship has several important theoretical and methodological implications for scholars examining a range of research questions in entrepreneurship.

First, although scholarly definitions of entrepreneurship often define entrepreneurship as a socioeconomic process that evolves through time (Shane and Venkataraman, 2000), most theoretical and empirical research in entrepreneurship generally examines each component of the process separately. From a process perspective, the question is not whether something emerges or whether specific actions are successful. Instead, to explain how entities emerge, process theories focus on the nature and sequence of events that lead to the formation of entities with specific characteristics (Van De Ven and Poole, 2005). The multistage population model articulated here indicates that theories based on single events of a process are likely to be incomplete and potentially inaccurate and, hence, research should explicitly consider how the process unfolds.

Second, our analysis suggests that sources of variance and initial conditions are important. Although scholars have noted that the stock of opportunities available for exploitation by enterprising entrepreneurs is ceaselessly changing, little is known about factors that influence the pool of opportunities. This knowledge is particularly lacking about which factors stimulate high-value opportunities. Similarly, our basic model has assumed that all opportunities

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have a nonzero probability of being successfully exploited; however, individuals who are attempting to organize ideas that have no commercial application and, hence, are not opportunities, are part of the process and may be a potentially important source of variance in the system.

Third, our model indicates that an important area of inquiry is the identification of selection events in entrepreneurship. Research indicates that important selection events in the entrepreneurial process include the financing process (Eckhardt *et al.*, 2006), the individual decision to become involved in entrepreneurship (Busenitz and Barney, 1997; Evans and Leighton, 1989), firm birth, and failure (Hannan and Freeman, 1977). However, other important selection events may exist. Hence, delineating specific selection mechanisms and the ways they relate to specific outcomes remains a much under-theorized area of research. As Aldrich (2001) notes, many of these events will not be captured in archival sources.

One potential way to uncover selection criteria is by adopting a cohort-based sampling frame, such as that used by The Panel Study of Entrepreneurial Dynamics. Here, a range of data was collected on a cohort of entities over time (Aldrich, 2001; Reynolds and Curtin, 2004). Another method to detect the existence of prior selection events is to observe commonalities among surviving entities that cannot be explained by selection criteria required to survive past the current stage (Dew, Sarasvathy, and Venkataraman, 2004; Spyropoulos *et al.*, 1981). For example, returning to Figure 1, a researcher may notice that product markets select the entities that exhibit characteristic B and additionally may recognize that all the entities that are observed to be successfully exploited also exhibit characteristic A—a recognition that could stimulate the search for a prior selection event. Qualitative and historical methods may uncover the existence of selection events that might go undetected using other approaches (Kirsch, 2000). For example, in a large sample study, Azoulay and Shane (2001) interviewed several founders to get a better understanding of a potential selection event. Similarly, Baker and Nelson (2005) relied on extensive case histories to establish their process model of bricolage and firm growth.

Selection events remain important to consider even in cases in which the theoretical interest may be in a specific causal event within the entrepreneurial process: this can occur when scholars examine research questions using data that are conditional on prior events without fully integrating prior events into their research methodology and theoretical approach (Eckhardt *et al.*, 2006). For example, Chen, Yao, and Kotha (forthcoming) develop an intriguing theory regarding the relevance of passion in financing decisions in the entrepreneurial process. Specifically, they postulate that venture capitalists (VCs) would be more likely to fund businesses led by passionate entrepreneurs. To examine their hypotheses, in the field study portion of a multimethod study, judges in a business plan competition watched teams give business plan presentations and then were asked to evaluate the passion of the entrepreneurs, as well as whether or not they themselves intended to invest. In our framework, the judging event decision represents a stage 2 event, and each entrepreneur's decision to participate in the competition represents a stage 1 event. The empirical analysis by Chen *et al*. (forthcoming) failed to find support for the postulated relationship, and the authors suggested that this lack of support for the passion effect may be attributed to a restricted range—in other words, the lack of variance on their measures of passion in the sample may have precluded their ability to fully examine the relationship between entrepreneurial passion and financing outcomes.

Our model suggests that the lack of variance on the passion measure may have been driven by self-selection on the part of the entrepreneurs, if passionate entrepreneurs were more likely to seek financing than the population of entrepreneurs in general. By focusing on the prior selection stages, the researchers might develop a stronger theory about the role of passion in the entrepreneurial process. By incorporating the prior selection stage explicitly into their theory and empirical test, researchers might find that contrary to the null finding in the field study, passion might play a role—perhaps both in the entrepreneur's decision to seek financing and the VC's decision to grant funding (Heckman, 1979; Shaver, 1998).

Our model also suggests that in cases in which statistical controls for prior selection events are included, selection events can provide an opportunity to expand theory. For example, using a sample of inventions that the Massachusetts Institute of Technology licensed to firms, Katila and Shane (2005) studied environmental factors that might differentially influence specific performance outcomes for new firms. The authors note that new firms might purposefully choose to license inventions in which established firms are not interested and, hence, they correct for this self-selection using Lee's (1983) generalization of Heckman's (1979) two-step

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selection correction. The authors focused their theory on the determinants of positive outcomes and, hence, the prior selection event remained unexplored. However, because only 40 percent of the inventions were licensed by the firms in the study, it appears as if this earlier selection event may have played an important role in influencing the outcome. A multistage approach would explicitly incorporate the first stage selection event into the theory developed by Katila and Shane (2005).

Fourth, our model suggests that an important area of inquiry is investigation into the impacts of the different types of selection. For example, as shown in Figure 2, opposing and orthogonal selection represent path-dependent processes in which the decisions of actors at later stages are unfavorably constrained. The identification of path-dependent processes may have important implications for theory development, public policy, and technology entrepreneurship. Similarly, orthogonal selection may give rise to exaptation (Dew *et al.*, 2004) or innovations that may serve niche markets (Shah, 2005).

The multistage selection model also has important implications for research in entrepreneurial creativity. The model clearly delineates three distinct areas of creativity that warrant additional research. Entrepreneurs might introduce opportunities into the system that may or may not be significantly different from those that are introduced into the system by exogenous processes. Identifying what these differences might be and when they may occur is a promising area of research. In addition, although not fully examined in this article, mimicry or learning on the part of entrepreneurs may influence the distribution of opportunities at various stages in the process in important ways (Kim and Miner, 2007). Further, our model suggests that an important area of creativity is the modification and/or creation of selection criteria. Scholars may find it fruitful to examine factors that limit or enhance an entrepreneur's ability to modify selection criteria, as well as how modifications to selection criteria might differentially influence the fitness of the population of opportunities being pursued at a specific point in time (Garud, Jain, and Kumaraswamy, 2002). Lastly, the model suggests that an important source of variation is the selection of organization strategy on the part of entrepreneurs. Hence, research on the relationship between the specific characteristics of opportunities or selection settings and specific organizing strategies such as business models might be a fruitful area for further research.

CONCLUSION

This article advances scholarly work in entrepreneurship by generalizing microlevel theories to focus on population-level outcomes of the interaction of individuals and opportunities. Following Mohr (1982), the model shows that to understand entrepreneurship, it is important to appropriately consider the process under which entrepreneurship evolves through time and also to take into account key selection events that winnow variance at specific points in the process. The actions of those who seek to organize opportunities, as well as the hurdles that must be overcome to successfully exploit opportunities, give rise to an evolutionary, multistage selection process that fosters important implications for the theoretical understanding and empirical study of the entrepreneurial process.

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