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Opportunity, Discovery and Creativity: A Critical Realist Perspective.

Abstract

In this article we draw upon the philosophy of critical realism to reflect upon and offer a resolution to two issues concerning discovery processes and opportunity development. First, paradoxes in the relationship between opportunity discovery and creativity are identified and explained. Second, the question of how to investigate opportunities is discussed and a solution informed by critical realism is presented, whereby three new types of discovery are identified and defined for empirical investigation. Using critical realism to augment entrepreneurial opportunity theory we propose that discovery processes have significance beyond discovery theory and can be considered revealing for theories of opportunity development more generally. We conclude with conceptual and practical comment on the importance of ontological theorising for entrepreneurship.

Keywords: opportunity, discovery, creativity, critical realism, entrepreneurship.

Introduction

Entrepreneurship scholars generally accept that creativity is important to entrepreneurship (Brazeal and Herbet 1999; Dimov 2007a; 2007b; Gartner 2007; Gielnik et al 2012; Manimala 2009) and discovery theories of opportunities regard creativity as an important part of both the opportunity discovery and exploitation processes (e.g. Shane 2003; Fiet, et al 2012). Within discovery theory, the assumption has been that opportunities exist objectively, prior to entrepreneurial action and independently of any particular entrepreneur. Entrepreneurs can then discover and exploit these opportunities (e.g. Alvarez and Barney 2007; Alvarez et al 2012). How innovative or new the exploited opportunity becomes is also regarded as important for entrepreneurship, with theorists suggesting a link between innovativeness or newness and economic performance (e.g. Cooper and Park 2008; Fiet 2007; Rosenbusch et al 2011; Shane 2000). Indeed, newness is also claimed to be important to the very definition of opportunity. For example, Baron (2006) claims opportunities have three central characteristics: potential economic value (i.e. they are valuable, useful, appropriate, and adaptive), newness (i.e. innovativeness, new process, new product), and perceived desirability. For discovery theory then, the relationship between opportunity, discovery, creativity and the innovativeness or newness of a business venture is at the heart of theory building.

However, the relationship between these things is not straightforward and three problems have been identified that need careful reflection. First, within creativity studies, discovery has long been associated with creativity, but here the standard position has been to suggest that creativity can lead to discoveries. For example, creativity theorists suggest that scientific breakthroughs, such as in the work of Darwin on evolution or Einstein on general relativity, were made possible because of the high levels of creativity of the respective scientists involved. Their creativity (along with many other capabilities) enabled these scholars to make their discoveries (e.g. Gooding 1996; Rothenberg 1995, 1996). Whereas, discovery theories of opportunities suggests that

opportunities (and therefore discovery of them) precede the creativity required to identify and exploit them (Kirzner 1973; 1997). This mode of theorising means an opportunity is held to exist prior to entrepreneurial action; the action then takes place, involving in part, entrepreneurial creativity and through this action (and creativity) the opportunity can be exploited (e.g. Corbett, 2005; Lumkin and Lichtenstein, 2005).

However, this logic introduces some challenging paradoxes for opportunity discovery and exploitation. If the end result of identifying and exploiting an opportunity is something innovative or new, such as a new business venture, then questions need to be asked about the origin of this newness. If its source is the opportunity, that is to say it is purely discovered, then we have to ask what is new, as discovery implies finding something that already exists. Alternatively, if the new business venture is created through entrepreneurial action (including creativity) then the question of what has been discovered becomes problematic. A complete explanation of this relationship between opportunity, discovery and creativity which also offers an account of the origins of this newness, is yet to be offered within existing theory (e.g. Gielnik et al, 2012).

The second problem facing discovery theory revolves around the difficulties in conducting research into opportunities. As Dimov (2011) highlighted, the opportunity remains an interesting albeit elusive concept for empirical research. The opportunity is not something tangible or measurable, rather it is the potential for something not yet operating, or the set of circumstances that enable entrepreneurial change to happen. If opportunity discovery is to remain a central concept for theory then the means through which it can be empirically identified require development. At the very least, sustainable and identifiable proxies for the opportunity need to be identified to enable empirical research to progress.

Finally, because understanding of opportunity discovery has developed within the framework of discovery theories, discovery processes have been assumed to be limited in their significance for wider theories of entrepreneurship, especially creative process theories. For example, it has been argued that discovery theory assumes opportunities exist objectively and, therefore, discovery of opportunities is characterised as taking place in a world of relative certainty (e.g. Alvarez and Barney, 2007; 2012). Whereas, creative process theories suggest the world entrepreneurs encounter is characterised by uncertainty (e.g. Fletcher, 2006) and, therefore, the type of opportunity presupposed within discovery theory will be fundamentally at odds with the world entrepreneurs experience in practice. Indeed, the very co-existence of these theories is problematic because they are currently deemed to contain different ontological assumptions about the nature of the social world (e.g. Alvarez and Barney, 2007; 2012). This clash of ontologies is perhaps one of the reasons that discovery processes are generally not investigated within creative process theories and if discovery is to be considered important within wider entrepreneurship theory they need to be reconciled with the ontological assumptions of these wider creative process theories.

This work examines the three issues outlined from the perspective of the philosophy of critical realism, as developed by Bhaskar (1993; 1998; 1978/2008). It is argued that the ontological arguments contained within critical realism can augment understanding of opportunity development and provide a framework for considering discovery processes as vital to theory building. Critical realism has an account of causality that facilitates explanation of how causal properties can exist independently of our knowledge of them, it offers a framework for understanding the nature of potential (such as an opportunity) and, therefore, offers a route for understanding the emergence of new things from such potentials. In drawing on these concepts the central contribution of the work is developed: identifying three categories of discovery that enable new means of empirically investigating opportunities. In addition, these discovery types are argued to be consistent with the wider creative process theories of opportunity development.

The work proceeds through identifying the paradoxes surrounding opportunity, discovery and creativity within discovery theory. Then, the philosophy of critical realism is introduced and a resolution to the paradoxes is proposed that places discovery at the heart of the creative process. It is argued that identifying these different types of discovery deepens understanding of opportunity development through differentiating opportunities according to the type of discovery made. We then argue that discovery processes are also consistent with the uncertainty that is more often associated with the creative process views of opportunity development. In doing so, we demonstrate that exploring discovery processes is equally important for these wider theories of opportunity development. We conclude by considering the role of ontological theorising both as a means of understanding entrepreneurial opportunities in abstract terms and to make the practical advice offered to entrepreneurs increasingly fit for purpose.

Discovery theory and creativity

Discovery theory can be traced back to the Austrian economic tradition, especially the works of Kirzner (1973), Mises (1996), and Hayek (1937; 1945). For Hayek, opportunities result from the uneven distribution of knowledge in society, whilst for Kirzner (1985) “alert discovery of arbitrage opportunities” represented “the quintessential element of entrepreneurship” (Berglund, 2007: 247). Discovery theory has been extensively researched and theorised within the entrepreneurship field, with particular scrutiny given to a variety of related aspects, including scanning (Drucker, 1985), Bayesian learning (Fiet, 1996), passive discovery of opportunities (Herron and Sapienza, 1992; Kaish and Gilad, 1991), and cognitive approaches (Baron, 2004; Gaglio and Katz, 2001). These approaches generally take opportunities to be recognised through a subjective process but also posit them as “objective phenomena that are not known to all parties at all times” (Shane and Venkataraman, 2000: 220).

When explaining how opportunities are formed, discovery theories place the emphasis on the role of exogenous shocks to an industry or market (e.g. Kirzner 1973; Kirzner 1997; Shane 2003). Kirzner also argued opportunities must be hidden otherwise more entrepreneurs would exploit them, competition would increase and markets would be in a state of equilibrium more often. The lack of observed and wide spread market

equilibrium led him to conclude that opportunities must only be capable of being discovered by those with the relevant know-how and experience (Shane, 2003). He later argued that his account did not preclude Schumpeterian assumptions of the entrepreneur requiring creativity, instead suggesting that the ‘know-how’ he referred to can include the kind of creativity suggested by Schumpeter (Kirzner, 2009). Discovery theory, therefore, suggests that the temporal sequence of entrepreneurship starts with the opportunity and through entrepreneurial action, moves through the discovery and exploitation of opportunities and ends with the outcome of a successfully exploited opportunity in all its forms.

Creativity is generally regarded as involving bringing into being something that is new, appropriate, valuable and recognised (Amabile 1996; Runco and Jaeger 2012; Stein 1974). By the very fact that entrepreneurship can result in something new, it has been held to have ‘intrinsic linkages’ with human creativity (Manimala, 2009: 126). Indeed, creativity has been described as the “soul of entrepreneurship” (Morris and Kuratko, 2002:104) because it is required to spot the patterns and trends that define the opportunity (Baron 2006). More recently, Gartner (2007) made a wider connection with creativity through arguing entrepreneurship is a ‘science of the imagination’. There have also been important advances in our understanding of entrepreneurship which focus on the role of human creativity within entrepreneurial processes (e.g. Dimov, 2007a; 2007b; Lee et al. 2004; Sarasvathy, 2008; Shane, 2003) and one of the most far-reaching is the ‘creative process view’ of entrepreneurship (e.g. Sarasvathy 2001; 2008; Sarasvathy et al, 2003).

Dahlqvist and Wiklund (2012) recognise the importance of newness (and therefore creativity) to entrepreneurship more generally by arguing market newness should be the primary dimension upon which to measure opportunity variance. Yet the explanation of how this newness in entrepreneurship comes about is still developing. For example, Gielnik et al (2012) highlight that ‘a detailed examination of the role of creativity in the opportunity recognition process is lacking and empirical findings are mixed.’ In addition, we argue, there is a need to resolve underlying ontological paradoxes concerning the role of opportunity, discovery, creativity and the end result of such processes, for example, a successful business, new venture, innovation, new combination of resources, or the introduction of new profits (Berglund 2007; Casson 1982; Corbett 2007; Eckhardt and Shane 2003; Kirzner 1973; Mises 1996; Shane and Venkataraman, 2000; Shane 2003).

Within creativity studies, discovery has long been associated with creativity but the standard position¹ has been to suggest that creativity can lead to discoveries, especially within the field of science. Whereas, the field of entrepreneurship has suggested that discovery (of opportunities) is significant to novel entrepreneurial ‘outcomes’ (Kirzner 1973; 1997). For example, Kirzner (1997: 75) claims that a new venture is ‘created’ through an act of ‘discovery’ by suggesting ‘all kinds of discovery essentially create something genuinely new, something simply not present (as far as

¹Although there has also been some comment on their current incommensurability (e.g. Tweney 1996).

human knowledge up until now could fathom) in the pie of available inputs and outputs given just prior to the moment of discovery.’ This is the root of one paradox within discovery theories of opportunities. If the ‘novelty’ in the outcomes of entrepreneurship, such as a new venture, comes solely from the opportunity, in other words it is purely discovered, then we have to ask what exactly is new because something is, in effect, being found. Alternatively, if the entrepreneur’s creativity and attempts to exploit the opportunity lead to the novelty in these outcomes then currently, we equally have to ask what has been discovered?

A second paradox within discovery theory centres around the origins of the newness within entrepreneurship. In Shane’s (2012) recent review of a decade of entrepreneurship research, he suggests that opportunities are situations in which it is possible to recombine resources in a way that generates profit and that a business idea is the interpretation of how to do it. However, if we consider where business ideas come from then either they are considered a reflection of the opportunity, in which case they are, once again, discovered and the role of creativity is reduced, or we follow Klein (2008) and suggest that business ideas are ‘social constructions’ which are ‘created ex nihilo.’ Ex nihilo creation refers to things that appear, quite literally, from nothing (e.g. Boden 2004; Perkins 1988; 1994). However, this explanation requires caution because it introduces mystical creation into entrepreneurial action - the bringing into being of something out of nothing, or, rabbits out of hats. As Ward (2004:176) observes ‘one cannot produce something from nothing – ex nihilo nihil fit...Creative ideas do not appear, ex nihilo, full-blown in the minds of their originators, but rather must be crafted from the person’s existing knowledge.’ Clearly, creativity is important to the discovery perspective (e.g. Fiet 2007; Lumpkin and Lichtenstein 2005) but as it stands the emergence of the novelty in the exploited opportunity is difficult to explain without contradiction. A thought experiment reveals how both the assumptions are troublesome.

If an entrepreneur discovers a recently developed technology within a university, the technology itself would not be new at this point, it is merely found for the first time by this entrepreneur. One way to treat the opportunity is like this technology, a pre-existing and tangible phenomenon that requires finding and reporting to the market in the form of a new business venture. Clearly this is not the case for opportunities, they may contain tangible phenomena (such as technology, people, resources, places etc.) but they are, by definition, the potential for something not yet in existence (e.g. the new venture) and so require the recombining of existing resources and the imagining of new means-ends relationships (Dimov 2011; Venkataraman et al 2012). However, this example begs the question: Within discovery theory, what exactly is being discovered? If the novelty in the outcome is discovered from within the opportunity then, in this example, there’s a need to explain how the technology (and all the other resource combinations) pre-existed and can be considered new.

If we assume the novelty in the exploited opportunity is imagined or created by the thoughts or sense-making of the entrepreneur, then the pre-existing technology is combined with other resources and the imagined combination develops into the op-

portunity to be exploited. Here, aside from problematic issues concerning *ex nihilo* creation², if this is the accepted explanation of emergence in entrepreneurship then, in this instance, the novelty in the exploited opportunity is the result of the creativity of the entrepreneur rather than anything discovered within the pre-existing resources. The explanation of why the emergence of the end result of opportunity development requires discovery is still missing. Indeed, Kirzner (2009) recently recognised this tension when he suggested that ‘there is a profound philosophical question as to whether it is legitimate to see speculative profit opportunities as ‘waiting’ to be grasped.’ Either discovery processes have run their course as part of the explanation in entrepreneurship, or they require the deeper philosophical examination Kirzner alluded to for research into them to continue. To explore all of these issues, the philosophy of critical realism is drawn upon because the issues identified seem to have, at their root, a problem with the ontology of emergence. To achieve this, some of the principles of critical realism will be sketched and these principles applied to the ontology of opportunities, creativity and, in particular, the role of discovery processes.

Critical Realism

Critical realism has already been fruitfully drawn upon or used to under-labour theoretical developments for entrepreneurship (e.g. Gilman and Edwards 2008; Edwards, Sengupta and Tsai 2010; Leca and Naccache, 2006; Clark and Blundel 2007; Kitching, Hart, and Wilson 2013; Ramoglou, 2013) and entrepreneurial opportunity theory. For example, Mole and Mole (2010) have demonstrated critical realism offers a new conceptual framework for considering the individual-opportunity nexus. We follow Mole and Mole’s (2010) argument that Archer’s (1995; 2000) work enables the analytical separation of structure and agency within entrepreneurship theory, thereby providing the means to explore this relationship here. Our approach deepens this analysis through exploring the consequences for entrepreneurial opportunity theory when Bhaskar’s (1978/2008) concepts of causal powers, the stratified nature of reality and the nature of emergence are introduced.

Bhaskar (1978/2008) argued that because it is possible to identify causation through experimental activity there must be underlying causal mechanisms (or powers) enabling these events to be measured. However, as these causes are not always directly apparent outside of this experimental activity (they require scientific work in order to be identified) and they are not found consistently within the social sciences, he concluded that the causal mechanisms that lead to them must be considered separate from the events they generate. In other words, causes must be considered as ‘causal powers’ that operate continuously regardless of any immediate effect. This led Bhaskar to conclude that the social world must be stratified into at least three domains: the real, the actual, and the empirical. These insights have important consequences for our understanding of entrepreneurship but they require unpacking before they can be applied.

² There is a debate within creativity studies concerning why such explanations can have implicit assumptions of *ex nihilo* creation within them. We refer the reader to the work of Boden (2004) for a discussion of the issues. In short, if an idea has a history in thought then identifying what is new is problematic. If you can demonstrate there is no history to the idea in thought, the explanation of where the idea came from can become *ex nihilo* by default.

What follows therefore is an exposition of each of these domains, the types of causal powers they contain and how these causal powers are able to act.

The domain of the real

For Bhaskar (1978/2008), the domain of the real contains all the causal powers operating within the social world as well as the potential causal powers that are yet to emerge, including the possibilities for new things. Causal powers that already have their properties are referred to as exercised powers. This means the properties of the power are complete but still may not be producing any effects. For example, we can have the causal power to speak but whether we actually speak is contingent. A second type of causal power Bhaskar identified within the domain of the real is un-exercised powers. These are causal powers that are yet to develop their properties because their internal conditions are not sufficiently formed. An example of this type of power is the causal power of humans to write. At birth this is un-exercised because for writing to develop, interaction with other causal powers (such as nutrition, education and so on) is required. Importantly, these two types of causal power explain the relationship between causal powers and the emergence of new things. When a new thing emerges it would have emerged from a currently un-exercised power to become an exercised power.

The domain of the actual

The separation of causal powers from their effects meant Bhaskar proposed another state for a causal power: a causal power that is exercised and actualised. This refers to a causal power that is producing its effects in some way. There are many examples of this and for the social sciences this domain is crucial to explanation. An individual may have all the causal powers necessary to start a business but whether these causal powers are actualised might depend on their intent, appropriate social and economic conditions, or perhaps on whether they have access to finance. It is between the domain of the real and the domain of the actual that explanation can explore the difference between what currently is acting and what might be possible given appropriate enabling or constraining conditions.

The domain of the empirical

The final domain Bhaskar identified is the domain common to all other philosophies of science: the domain of the empirical. This domain consists of the exercised and actualised causal powers that are available to be seen, measured or made sense of. One of Bhaskar's most important contributions to the understanding of causality was to demonstrate that whilst we may need empirical events to enable the identification of a causal power, the argument that causal powers must always produce empirical events was a false one. The separation of these domains is extremely important since, as Bhaskar states:

...the powers of beings (entities, structures, fields, totalities...) can be possessed without being exercised and exercised without being actualised in any particular outcome, let alone whether they are experienced (perceived or otherwise detected) by science (or human beings generally) (Bhaskar, 2000:29).

The separation of reality into these three levels enables Bhaskar to make the case for causal powers to exist transfactually - that is to say they act continuously, without necessarily producing effects and indeed, without our knowledge of them. Entrepreneurship theory has generally focused on the later 'skilled' stage of opportunity actualisation (in other words from Bhaskar's domain of the actual to the domain of the empirical) and to a lesser degree on the 'sources' of opportunity (from the domain of the real to the actual) mainly because the opportunity has been regarded as difficult to explore empirically until something has been developed or is being done (e.g. Dimov 2011), or in Bhaskar's terms until an exercised or un-exercised causal power is actualised (and available to observation).

The domain of the real, whilst relatively ignored within entrepreneurship theory, has important implications for theory as it allows exploration of the possible, and it is this realm of the possible that helps define the opportunity as well as causing problems for empirical research (e.g. Dimov 2011; Plummer et al 2007). Krueger and Brazeal (1994: 94) observed that 'Before there can be entrepreneurship there must be the potential for entrepreneurship' but in the twenty years since they suggested the importance of the potential for entrepreneurship, it has proven problematic to develop theory that explores the ontological, epistemological and logical priority of the possible or potential in entrepreneurship over the actual or realised (e.g. Plummer et al 2007). We argue that it is in this movement between the potential for entrepreneurship and entrepreneurial outcomes that Bhaskar's conception of causal powers provides a framework for exploring emergence from opportunities. Understanding how possibilities, defined through the concept of causal powers in all their forms, are related to opportunity, how human creativity interacts with these un-exercised and exercised causal powers, how the novel outcomes of entrepreneurship might emerge during the process of opportunity exploitation and the role discovery plays in this process are all made possible through Bhaskar's conceptions of causal powers.

Causal powers, discovery and creativity

It is possible to unpack the relationship between opportunity, discovery and creativity through exploring the possibilities for new things inferred by these different types of causal power. Some causal powers contain the potential for new causal powers to come into being. These currently un-exercised causal powers can be brought into being through combination with other powers; for example when mobile communication and internet technology were combined with touch-screens and software applications, a new generation of mobile computing came into being. New causal powers can also be brought into being as the result of a process that requires no human intervention, such as the evolution of a new species. In addition to this, exercised causal powers can become active or actualized; for example when electricity was discovered the exercised causal power of metal to conduct electricity could become an exercised and actualised causal power, it could actually conduct electricity.

The ramifications of thinking about causal powers in this way has important implications for how we conceive of entrepreneurial creativity. For critical realism, when a

new thing is brought into being through human action an un-exercised causal power becomes exercised and, therefore, as well as bringing something into being we must also discover the possibilities for new things held within existing causal powers (e.g. Martin 2009). This is important for entrepreneurship theory because it suggests that discovery of possibility is important to explanations of creativity generally and, therefore, entrepreneurial creativity specifically.

For entrepreneurial opportunity theory this can reconcile the paradox of where novelty in entrepreneurship comes from. The existence of something new is predicated upon a natural and social world that lends itself to the emergence of new things from existing possibilities through human action and creativity. Within the context of entrepreneurship, it is a small step to label these existing possibilities as an opportunity. Subsequently, when the opportunity is defined as containing the potential for the newness in entrepreneurial outcomes (e.g. Dahlqvist and Wiklund 2012), or the set of circumstances that enable such outcomes (e.g. Shane 2012) then Bhaskar's realist work (1978/2008; 1993; 1998) provides theory with the ontological underpinning for claiming that aspects of opportunities (their causal powers) pre-exist entrepreneurial action and that opportunity development and exploitation through human creativity must always include a discovery of possibilities.

Put into other words, an idea for a new venture is the representation of the future possibilities contained within the existing causal powers of the world. When the idea is made sense of the creator is, in essence, discovering these future possibilities. This discovery need not be prior to the bringing into being of something new but it can be. Something may be made and then its significance made sense of, the potential for something may be theorised and then brought into being, or this process of discovery and bringing into being may happen simultaneously or develop iteratively. It is also possible that something can be brought into being and not have its significance recognised (hence the possibilities it contains remain undiscovered), or the discoveries themselves can remain unrecognised by significant others (e.g. Martin and Wilson 2014). Crucially, critical realism offers entrepreneurship theory the insight that discovery is part of the creative process in general, which means the specific claim that opportunity development (however this is defined) is, at least in part, reliant on discovery processes, can be supported.

Ontology and empirical investigation

Ontological justification for the role of discovery processes in opportunity development, whilst important, does not allow theory to advance unless new possibilities for empirical investigation or theoretical development are also enabled. Given the different types of causal power identified, it follows that different types of discovery might be necessary for each type of causal power. This makes it possible to analytically separate discovery processes through classifying the types of discovery (or discoveries) being made. Three types of discovery have been identified which can help with the analytical and empirical separation of discovery processes in entrepreneurial opportunity development: the discovery of latent powers; the discovery of countervailed powers; and the discovery of obscured powers.

The discovery of latent causal powers

For critical realism, the possibility of the novelty in entrepreneurial outcomes would be contained within existing causal powers in the form of un-exercised causal powers. For example, the motor car, prior to its existence, was dependent upon the existence of steel, the internal combustion engine, gasoline and so on. These other exercised and actualised causal powers preceded the existence of the car and also contained the potential (with appropriate combination) for a motor car.

Research to date has suggested that discovery of such latent powers is reliant upon the imagination (e.g. Gartner 2007), combinational thinking (e.g. Baughman and Mumford 1995; Molby Et al 1992), alertness (Tang et al 2012), experience (Westhead et al 2009), improvisation (e.g. Hmieleski and Corbett 2006), bricolage (Baker and Nelson 2005) and action of various actors including, but not limited to, entrepreneurs, inventors, scientists and technologists. Individuals and teams dealing with this type of discovery face difficulties because of the novelty they are facing (e.g. Blatt 2009) and because of the problems inherent in creative work generally (e.g. Skilton and Dooley 2010; Ward 2004) and creativity studies demonstrate that the path to new ideas is complex, iterative and can require many failures for a final success (Dimov 2007a; Litchfield 2008). This uncertainty also increases risk of failure as the outcome of a development process is not always predictable (Milliken 1987; Skilton and Dooley 2010). Empirically then, it is plausible that this category of discovery requires specific human capabilities in order for such discoveries to be made and developed. It is, therefore, vital for theory to analytically separate this type of discovery so as to identify which human, social, political and economic capabilities are required when such opportunities are being developed.

The discovery of countervailed causal powers

The analytical separation of causes from effects means that causal powers do not always act, or their effects can be hidden by the effects produced by other causal powers. An example of this is the causal powers that make up the drug aspirin. In its use as a painkiller, it has the exercised and actualised power to treat heart disease as it has a small effect on the vascular system of the body every time it is taken. However, for this causal power to produce the desired effect of reducing heart disease it is necessary to take aspirin consistently, otherwise the causal power remains exercised but not fully actualised. In practice, this meant this causal power of aspirin took time to be discovered. Discovering new effects of exercised causal powers can lead to new markets for existing products, in this case a new market for the common painkiller.

Empirical research can seek to determine whether this type of discovery requires different competencies and social conditions in order for the new markets to be identified, such as those suggested by Sternberg et al (2003) in their exploration of creative leadership. Ardichvilli et al (2003) also categorised four types of opportunity based on whether a market had been identified and/or a technology developed. The type of discovery suggested here applies to their category of technology transfer but we suggest their category can be subdivided into the identification of the possible, but hidden ef-

fects existing technology might be able to generate, as well as new markets for already known effects. Sources of information and how they are made sense of (e.g. Ozgen and Baron 2007; Shepherd et al 2012; Westhead, Ucbasaran, and Wright 2009) may well be important to this category of discovery however, there has been little exploration of this within entrepreneurial opportunity theory and therefore empirical work is required for theory to progress.

The discovery of obscured powers

This third type of discovery refers to causal powers that are exercised and actualised, generate their full outcomes consistently and empirically but our understanding of these outcomes, or the way in which we theorise and make sense of the outcomes, is not clear. In the previous category the causal powers of the thing are exercised but not always actualised; in this category, the full outcomes are actualised and generate observable events, but we still might not fully understand the causal power. In physics, this could refer to something like gravity. The causal powers of gravity and their effects have changed little over time but our understanding of gravity has shifted through recent history. We suggest opportunities within this type of discovery can be defined through such shifts in sense making (e.g. Cornelissen and Clark 2010). As new forms of understanding emerge, opportunities can accompany them, for example, through the development of management innovations (e.g. Birkinshaw et al 2008). The sense-making literature with its focus on shifts in human perception seems to have an important role to play in our understanding of this type of opportunity development, but it is important not to reduce all opportunities to such shifts.

One of the principles of critical realism is that the social world contains the potential (within its causal powers) for emergent phenomena to come into being, and these emergent phenomena are capable of interacting with existing ones in unthought-of ways (Archer 1995; 2000). For critical realism then, the social world is regarded as an unpredictable open-system, continually in a process of construction and reconstruction. Here, whilst we have analytically separated three types of discovery, it is entirely plausible that any given opportunity might contain any combination of these categories and that the type(s) of discovery may change as the process continues. The contribution of this work is not to suggest these discoveries are always separate or the outcomes predictable, rather that they can be identified and classified whilst being developed, and that this can guide empirical investigation and theory building.

For example, it is possible to classify whether someone is attempting to invent something new to history, trying to learn the new functions of an existing causal power, or trying to learn a new way of interpreting existing causes and events. Importantly, each of these categories of discovery can be identified before the outcome of the processes is known. Research can explore whether certain competencies, resources, networks and types of knowledge are more important to one type of discovery process and how shifts between these discovery types can change the resources required.

As the developed world is forced to open its eyes to the limits of capitalist accumulation (there is a growing pressure to innovate sustainably) one might suggest our need

to investigate the latter two types of discovery, in particular, is becoming increasingly acute. Finding out how to do more with what we already have is unquestionably an attractive, and realist entrepreneurial proposition. The entrepreneur's knowledge of (the existence of) countervailed or obscured powers, therefore, could provide an important first step in developing new entrepreneurship theory that re-unites the economic principle of scarce resources with the need for sustainable innovation.

In addition, proposing discovery as a defining feature of entrepreneurial creativity, whilst not offering a route for reconciling the differences between discovery and creation theories of opportunities, does suggest that creative process theorists need to take a second look at discovery processes and how they affect opportunity development. For example, Baker and Nelson (2005) recently addressed the question of how to make the most of restricted resources, and proposed the creative process of bricolage can enable such innovation. The entanglement they face when describing these bricolage processes as producing 'something from nothing' has echoes of the *ex nihilo* creation issues previously described, but the issue can be resolved. Understanding how something already in existence can, with human action, be revealed to contain entirely new causal powers, new effects for existing causal powers and new understanding for what is already operating, opens up the possibility of reconciling discovery processes with these wider creative process views of entrepreneurial behaviour.

Discussion

Received wisdom within psychological studies of creativity holds that creativity leads to discoveries, rather than the other way round (e.g. Tweney 1996). The arguments presented here challenge the assumption that this temporal sequence is the only way to understand the relationship. Something may be made and then its significance realised, discovered or made sense of, the potential for something may be theorised and then be made, or these things can happen simultaneously. Importantly, the fact that the outcomes of these processes cannot be known beforehand does not diminish the claim that discovery is a vital part of creative and entrepreneurial processes.

These insights can augment theories of opportunity development with an ontological justification for the claim that something is discovered and brought into being during the process of identifying, developing or exploiting opportunities (e.g. Vaghely and Julien 2010). This work also offers a resolution to the ontological paradoxes contained within discovery theory concerning what is discovered, what is new and the role of creativity. This enabled three new categories of discovery to be identified that can inform empirical investigation.

However, there are issues within opportunity theory not addressed within this work. It does not, for example, address the issue of when an opportunity exists and when it does not. Opportunities may be partly constituted by potentials or possibilities but clearly they involve more than this. For example, it is nonsensical to say there is an opportunity for an apple to fall off the tree when the wind blows, this would be better described as a possibility for the apple to fall. Opportunities, because they exist within the social realm, must be considered socially constructed, as to talk of opportunities

outside of this realm would be meaningless (Fletcher, 2006). In other words, an apple falling off a tree only becomes an opportunity if someone wishes to eat it.

Subsequently opportunities as social entities must have boundary conditions that span the exogenous structural conditions of the social world as well as the endogenous characteristics of the entrepreneurs attempting to develop them. For theoretical progress these wider structural and agential conditions that define when an opportunity exists, and when it does not, still need to be identified. For explanatory rigour, it is also important that the explanation of opportunities is not reduced to ‘everything is possible’. There are many things that individual human beings can’t do, due to institutional, structural, cultural or biological constraints (Nussbaum 2011). Ultimately however, despite the considerable degree of overlap in what entrepreneurship is considered to be (see Eckhardt and Shane, 2003; Shane and Venkataraman, 2000; Venkataraman, 1997), there is still a lack of agreement over what constitutes the boundary conditions of the opportunity. Before concluding however, we’d like to explore how this work and the ontology of critical realism more generally, can directly impact the practical advice offered to entrepreneurs.

For critical realism the social world is an unpredictable open-system, it therefore follows that entrepreneurial action must cope with the uncertainty this brings. This position is perfectly consistent with the discovery processes presented here, yet due to the origins of discovery theory within economic theory, it has been argued by several authors that discovery processes presuppose a very different social world (e.g. Alvarez and Barney 2007; Alvarez et al 2012). For example, Alvarez et al (2012) explore the similarities and differences in the implicit ontology of discovery and creation theory and suggest that these differences enable strategic advice to be offered to entrepreneurs depending on whether they are faced with a ‘discovery’ opportunity or a ‘creation’ opportunity.

When developing their advice, they used the metaphor of conquering Mount Everest to demonstrate opportunity objectivity and argued because opportunities are considered objective within discovery theory, they are similar to attempts to conquer the mountain: before it was conquered, the question of whether it will be climbed was not so much a question of if, but when (Alvarez and Barney 2007). They claim that entrepreneurs can employ a similar logic and use risk management strategies to exploit discovery opportunities because they are argued to have the same type of objectivity (and therefore certainty of outcome).

However, whilst this advice for entrepreneurs may be consistently derived from the logic and consequences of discovery theory generally, this does not mean it is the case for the discovery processes identified here. To class discovery processes as only certain or risk situations and creation processes as only uncertain situations is only true if the assumptions of objectivity within economic discovery theories are accepted. If these assumptions are replaced with a critical realist social ontology, then discovery processes must be assumed to operate in an objective world that is both uncertain and

subject to change. To advise the use of risk management strategies when faced with such discoveries would be inappropriate.

We would like to conclude this work by arguing that rather than suggest ontology should be ignored within theory (Mir and Watson 2000), or regard it as superfluous to the more pragmatic interests of entrepreneurship scholars (Powell 2003) the ontological examination of entrepreneurship is fruitful for identifying new types of empirical research, it can lead to theoretical development, and it can impact the practical advice offered to entrepreneurs. This work has helped tackle the problem of the ‘uncountable’ opportunity (Davidsson 2003) and follows recent work (e.g. Dahlgvist and Wiklund 2012) that re-examines the opportunity to identify the elements of it open to empirical investigation. For entrepreneurship theory then, we suggest: ontology matters.

REFERENCES

Alvarez, S.A. and Barney, J.B. (2007) Discovery and creation: alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 1(1-2), 11-26.

Alvarez, S. A., Barney, J.B., and Anderson, P. (2012). Forming and exploiting opportunities: The implications of discovery and creation processes for entrepreneurial and organizational research. *Organization Science Perspective*. Articles in advance, published April, pp. 1-17.

Amabile, T, M. (1996). *Creativity in Context*. Oxford, Westview Press.

Archer, M.S. (1995) *Realist social theory: the morphogenetic approach*, Cambridge University Press: Cambridge.

Archer, M. (2000). *Being Human: The problem of agency*. Cambridge University Press.

Ardichvili, A., Cardozo, R., and Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business Venturing*, 18 (1), 105-123.

Baker, T., and Nelson, R. E. (2005). Creating something from nothing: Resource constructions through entrepreneurial bricolage. *Administrative Science Quarterly*. 50, 329-366.

Baron, R. (2004). The Cognitive Perspective: A Valuable Tool for Answering Entrepreneurship's Basic "Why" Questions. *Journal of Business Venturing*. 19 (2), 221-239.

Baron, R. A. (2006). Opportunity recognition as pattern recognition: how entrepreneurs “connect the dots” to identify new business opportunities. *Academy of Management Perspectives*. 20, (1), 104–119.

Baughman, W, A and Mumford, M, D. (1995). Process-analytical models of creative

capacities: Operations influencing the combination and reorganisation processes. *Creativity Research Journal*, 8, 37-62.

Berglund, H. (2007) Opportunities as existing and created: A study of entrepreneurs in the Swedish mobile Internet industry, *Journal of Enterprising Culture*, 15, (3), 243-273.

Bhaskar, R. (1993). *Dialectic: The Pulse of Freedom*. London: Verso,

Bhaskar, R. (1998). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*. London: Routledge.

Bhaskar R (2000) *From East to West. Odyssey of a Soul*. London: Routledge.

Bhaskar, R. (1978/2008) *A Realist Theory of Science*, London: Verso.

Birkinshaw, J., Hamel, G., and Mol, M. J. (2008). Management Innovation. *Academy of Management Review*. 33, 4, 825–845.

Blatt, R. (2009). Tough love: how communal schemas and contracting practices build relational capital in entrepreneurial teams. *Academy of Management Review*. 34, 3, 533–551.

Boden, M. (2004). *The Creative Mind: Myths and Mechanisms*. London: Routledge.

Brazeal, D.V. and Herbert, T.T. (1999) The genesis of entrepreneurship, *Entrepreneurship Theory and Practice*, Spring, 29-45.

Casson, M. (1982). *The Entrepreneur: An Economic Theory*. Oxford, Edward Elgar.

Clark, PA, and Blundel, RK (2007) Penrose, critical realism and the evolution of business knowledge: a methodological appraisal. *Management and Organizational History*. 2, (1), 45-62.

Cooper, S. Y., and Park, J. S. (2008). The impact of ‘incubator’ organizations on opportunity recognition and technology innovation in new, entrepreneurial high-technology ventures. *International Small Business Journal*. 26, (1), 27-56.

Corbett, A.C. (2005). Experiential learning within the process of opportunity identification and exploitation. *Journal of Business Venturing*. 29, (4), 473–491.

Corbett, A.C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of Business Venturing*. 22, 1, 97–118.

Cornelissen J. P., and Clarke J. S. (2010). Imagining and Rationalizing Opportunities: Inductive Reasoning and The Creation and Justification Of New Ventures. *Academy of Management Review*. 35, 4, 539–557.

Dahlqvist, J. and Wiklund, J. (2012). Measuring the market newness of new ventures. *Journal of Business Venturing*. 27, 185-196.

Davidsson, P. (2003). The domain of entrepreneurship research: some suggestions, in: Katz J., and Shepherd S. (eds.), *Advances in entrepreneurship, firm emergence and growth*. Elsevier/JAI Press, Oxford, 315-372.

Dimov, D. (2007a). Beyond the single-person, single insight attribution in understanding entrepreneurial opportunities. *Entrepreneurship Theory and Practice*, September, 713-731.

Dimov, D. (2007b) From opportunity insight to opportunity intention: The importance of person-situation learning match, *Entrepreneurship Theory and Practice*. 31, (5), 713–731.

Dimov, D. (2011). Grappling With the Unbearable Elusiveness of Entrepreneurial Opportunities. *Entrepreneurship Theory and Practise*. 35, (1), 57-81.

Drucker, P. (1985). *Innovation and Entrepreneurship: Practice and Principles*. New York: Harper and Row.

Eckhardt, J.T., and Shane, S.A. (2003). Opportunities and entrepreneurship. *Journal of Management*. 29 (3), 333–349.

Edwards, P., Sengupta, S. and Tsai, C-J. (2010). The context dependent nature of small firms' relations with support agencies: A three-sector study in the UK. *International Small Business Journal*. 28, (6), 543-565.

Fiet, J. (1996). The informational Basis of Entrepreneurial Discovery. *Small Business Economics*. 8, 419-430.

Fiet, J. O. (2007). A prescriptive analysis of search and discovery. *Journal of Management Studies*. 44, 4, 592 – 611.

Fiet, J. O., Norton, W. I. Jr., Clouse, Van. G. H., (2012). Search and discovery by repeatedly successful entrepreneurs. *International Small Business Journal*. 0 (0), 1-24.

Fletcher, D. E. (2006). Entrepreneurial processes and the social construction of opportunity. *Entrepreneurship and Regional Development: An international Journal*. 18, 5, 421-440.

Gaglio, C. M., and Katz, J. A. (2001). The psychological basis of opportunity identification: Entrepreneurial alertness. *Small Business Economics*. Mar. 16, 2, 95 – 111.

Gartner, W.B. (2007) Entrepreneurial narrative and a science of the imagination, *Journal of Business Venturing*. 22, 613-627.

Gielnik, M. M., Frese, M., and Kampschulte, A. (2012). Creativity in the opportunity identification process and the moderating effect of diversity of information. *Journal of Business Venturing*. 27, 559-576.

Gilman, M. W., and Edwards, P. K. (2008). Testing a framework of the organization of small firms. *International Small Business Journal*. 26, (5), 531-558.

Gooding, D. C. (1996). Scientific discovery as creative exploration: Faraday's experiments. *Creativity research Journal*. 9, 2-3, 189-205.

Hayek, F. (1937). Economics and knowledge. *Economica*. 4, 33-54.

Hayek, F.A. (1945). The Use of Knowledge in Society. *American Economic Review*. 35, (4), 519-530.

Herron, L. and H. Sapienza (1992). The Entrepreneur and the Initiation of New Venture Launch Activities. *Entrepreneurship Theory and Practice*. 17, (1), 49-55.

Hmieleski, K. M., and Corbett, A. C. (2006). Proclivity for improvisation as a predictor of entrepreneurial intentions. *Journal of Small Business Management*. 44, 1, 45-63.

Kaish, S. and Gilad, B. (1991). Characteristics of Opportunities Search of Entrepreneurs Versus Executives: Sources, Interests and General Alertness. *Journal of Business Venturing*. (6), 45-61.

Kitching, J., Hart, M., Wilson, N. (2013). Burden or benefit? Regulation as a dynamic influence on small business performance. *International Small Business Journal*. 0 (0), 1-18. Kirzner, I. (1973). *Competition and Entrepreneurship*. Chicago and London: University of Chicago Press.

Kirzner, I. (1985). *Discovery and the Capitalist Process*. Chicago: University of Chicago Press.

Kizner, I. M. (1997) 'Entrepreneurial discovery and the competitive market process: An Austrian approach', *Journal of Economic Literature*. 35, 60-85.

Kirzner, I. M. (2009). The alert and creative entrepreneur: A clarification. *Small Business Economics*. 32, 145-152.

Klein, P. (2008). Opportunity discovery, entrepreneurial action, and economic organization. *Strategic Entrepreneurship Journal*. 2, 3, 175-190.

Krueger, Jr., N.F., and Brazeal, D.V. (1994). Entrepreneurial potential and potential entrepreneurs. *Entrepreneurship Theory and Practice*. 18, (3), 91-104.

Leca, B. and Naccache, P. (2006). A Critical Realist Approach To Institutional Entrepreneurship. *Organization*. 13, 5, 627 -651.

Lee, S.Y., Florida, R. and Acs, Z.J. (2004). Creativity and entrepreneurship: a regional analysis of new firm formation. *Regional Studies*. 38, (8), 879-891.

Litchfield, R. C. (2008). Brainstorming reconsidered: A goal based view. *Academy of Management Review*. 33, (3), 649–668.

Lumkin, G. T., and Lichtenstein, B. B. (2005). The role of organizational learning in the opportunity recognition process. *Entrepreneurship Theory and Practice*. 29, (4), 451-472.

Martin, L. D. (2009). Critical realism and creativity: a challenge to the hegemony of psychological conceptions. *Journal of Critical Realism*. 8, 3, 294-315.

Martin, L. D., and Wilson, N. (In press). Re-discovering Creativity: Why theory-practice consistency matters. *International Journal for Talent Development and Creativity*. 1 (3).

Manimala, M. (2009) 'Creativity and entrepreneurship', In Rickards, T., Runco, M.A. and Moger, S. (eds) *The Routledge companion to creativity*, Routledge: London, Chapter 11, 119-131.

Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect and response uncertainty. *Academy of Management Review*. 12, 1, 133 – 143.

Mir, R. and Watson, A. (2000). Strategic management and the philosophy of science: The case for a constructivist methodology. *Strategic Management Journal*. 21, 941–953.

Mises, L. (1996). *Human action: a treatise on economics*. Fourth ed. Fox and Wilkes, San Francisco, Available at www.mises.org.

Molby, M. I. Doares, L. M., and Mumford, M. D. (1992). Process analytic models of creative capacities: Evidence for the combination and reorganisation process. *Creativity Research Journal*. 5, 125-155

Mole, K.F. and Mole, M. (2010) Entrepreneurship as the structuration of individual and opportunity: A response using a critical realist perspective. Comment on Sarason, Dean and Dillard, *Journal of Business Venturing*. 25, 230-237.

Morris, M.H. and Kuratko, D.F. (2002) *Corporate Entrepreneurship*, Mason, OH: South Western College Publishers.

Nussbaum MC (2011) *Creating Capabilities The Human Development Approach*. Boston MA: Belknap, Harvard University Press.

Ozgen, E., and Baron, R. A., (2007). Social sources of information in opportunity recognition: Effects of mentors, industry networks, and professional forums. *Journal of Business Venturing*. 22, 174– 192.

Perkins, D (1998) ‘The possibility of Invention’. In *The Nature of Creativity*, ed Robert Sternberg, Cambridge: CUP, 1988, 362-385

Perkins, D. N. (1994). *Creativity: Beyond the Darwinian paradigm*. In Boden, M. A. (ed) *Dimensions of creativity*. London. Bradford Book.

Plummer, L. A., Haynie J. M., and Godesiabois, J (2007). An Essay on the Origins of Entrepreneurial Opportunity. *Small Business Economics*. 28, 363–379

Powell, T.C. (2003). Strategy without ontology. *Strategic Management Journal*, 24, 285–291.

Ramoglou, S. (2013). Who is a ‘non-entrepreneur’?: Taking the ‘others’ of entrepreneurship seriously. *International Small Business Journal*. 31, (4), 432-453.

Rosenbusch, N., Brinckmann, J. and Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SME’s. *Journal of Business Venturing*. 26, 4, 441-457.

Rothenberg, A. (1995) Creative cognitive processes in Kekule’s discovery of the structure of the benzene molecule. *American Journal of Psychology*. 108, 419-438.

Rothenberg, A. (1996). The Janusian process in scientific creativity. *Creativity Research Journal*. 9, (2-3), 207-231.

Runco, M. A., and Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*. 24, (1), 92-96.

Sarasvathy, S. (2001). Causation and Effectuation: Toward A Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency. *Academy of Management Review*. 26, (2), 243-288.

Sararvathy, S., Dew, N. Velamuri, R. and Venkataraman, S. (2003). Three views of entrepreneurial opportunity. In Z. Acs and D. Audretsch (eds.), *Handbook of Entrepreneurship*. Boston, MA: Kluwer. 141-160.

- Sarasvathy, S.D. (2008) *Effectuation*, Edward Elgar: Cheltenham.
- Shane, S. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science*. 11, (4), 448-469.
- Shane, S. (2003). *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*. Aldershot: Edward Elgar.
- Shane, S. (2012). Reflections on the 2010 AMR decade award: delivering on the promise of entrepreneurship as a field of research. *Academy of Management Review*. 37, 1, 10-20.
- Shane, S., and Venkataraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*. 25, (1), 217-226.
- Shepherd, D. A., Haynie, J. M., and McMullen, J. S. (2012). Confirmatory search as a useful heuristic? Testing the veracity of entrepreneurial conjectures. *Journal of Business Venturing*. 27, 637-651.
- Skilton, P. F. and Dooley, K. J. (2010). The effects of repeat collaboration on creative abrasion. *Academy of Management Review*. 35, 1, 118-134.
- Stein, M. I. (1974). *Stimulating Creativity*. Vol. 1. Academic Press, London.
- Sternberg, R. J., Kaufman, J. C. and Pretz, J. E. (2003). A propulsion model of creative leadership. *The Leadership Quarterly*. 14, 455-473.
- Tang, J., Kacmar, K. M., and Busenitz, L. (2012). Entrepreneurial alertness in the pursuit of new opportunities. *Journal of Business Venturing*. 27, 77-94.
- Tweney, R. D. (1996). Presymbolic processes in scientific creativity. *Creativity Research Journal*. 9, (2-3), 163-172.
- Vaghely, I. P., and Julien, P-A. (2010). Are opportunities recognized or constructed? An information perspective on entrepreneurial opportunity identification. *Journal of Business Venturing*. 25, 73-86.
- Venkataraman S (1997) The Distinctive Domain of Entrepreneurship Research. In: Katz J(ed) *Advances in Entrepreneurship, Firm Emergence and Growth*. Greenwich CT: JAI Press, Vol. 3, 119-138.
- Venkataraman, S., Sarasvathy, S. D., Dew, N., and Forster, W. R. (2012). Reflections on the 2010 AMR decade award: Wither the promise? Moving forward with entrepreneurship as a science of the artificial. *Academy of Management Review*. 37, 1, 21-33.

Ward, T.B. (2004) Cognition, creativity, and entrepreneurship, *Journal of Business Venturing*. 19, 173-188.

Westhead, P., Ucbasaran, D., Wright, M (2009). Information search and opportunity identification: The importance of prior business ownership. *International Small Business Journal*. 27, (6), 659-680.