THE CREATIVE ADVANTAGE OF DIVERSE CITY-REGIONS:
LOCAL CONTEXT AND SOCIAL NETWORKS

By

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Department of Geography
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Abstract

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Local diversity is often credited with being a driver of creative economic activity. Comparative research on this topic is often however highly structural in nature and does little to address questions of agency. This work seeks to link the traditional regional science approach to questions of potential advantages of local diversity with a more bottom-up view of the creative process. From a theoretical perspective this involves incorporating the social psychology literature on the creative process as well as concepts from social network analysis with more aggregated spatial notions of creativity and diversity. More specifically, it addresses how different knowledge is connected through social interaction and how this fuels the creation of new ideas and ultimately creative economic activity.

A number of empirical innovations are made in order to test these theoretical constructs beginning with an agent-model/simulation which illuminates how social networks form and evolve over space and time. These artificial networks suggest how agents embedded in diverse local contexts have a creative advantage by possessing greater access to a variety of knowledge. Subsequent statistical analysis of large secondary datasets seeks to provide external validity to the agent-model. The first demonstrates a strong relationship between local diversity and the concentration of
creative economic activities across 140 Canadian city-regions. A key implication of this finding is that local diversity is more closely associated with certain types of economic activity, rather than overall economic performance. The second statistical analysis uses the Canadian General Social Survey to compare the social network characteristics of individuals. This analysis shows that people engaged in creative industries and occupations tend to have larger, more dynamic, and more diverse sets of social relations than any other category of worker. The dissertation concludes with a model that suggests policy interventions should focus on developing local environments that provide the necessary conditions in which creative activity can thrive, rather than attempting to intervene directly in the creative process itself.
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Chapter 1
CREATIVITY AND DIVERSITY: A RELATIONAL APPROACH

1.1 Introduction

The main theme of this dissertation is creativity. No doubt this is a topic that is elusive to define and broad in scope. Yet its importance is hard to deny. If creativity is essentially the process by which new ideas are formulated and accepted, then it is a fundamental instrument of wider social change and progress. More tangibly, creativity is seen as a vital mechanism of economic advantage within a system that demands constant adaptation. With this in mind the aim of this dissertation is to contribute to our understanding of the creative process and in particular further develop theory and evidence of how social variation between local contexts affects levels of creative activity.

The connection between diverse environments and creative activity is one that has long been recognized. Despite this general recognition however, empirical evidence of the link is inconsistent. Hence, the contribution this dissertation seeks to make has more to do with research approach than novel hypothesis. More specifically, at issue is the regional science tradition of investigating localized diversity and creativity. This approach tends to treat creativity as an implicit source of regional economic growth rather than making direct observations of the creative process. The result is an underappreciated sense of how diversity actually ‘works’ in terms of how it affects human behaviour. In theory, diversity is supposed to provide greater opportunities for different people to interact and thereby generate novel combinations of knowledge. The regional science approach does little, however, to illuminate these micro-foundations. There needs to be more attention given to agency and in particular the relationships between actors. Thus,
one of the main intentions of this dissertation is to propose a relational approach to the study of the creative process.

A second major point of departure from the typical approach that this dissertation takes relates to underlying assumptions of motivation. From an orthodox economic perspective creativity occurs because it is a competitive strategy driven by market conditions. This view however, is contradictory to the prevailing social psychology research on the creative process that suggests that the motivation to ‘be creative’ is primarily intrinsic. Individuals are constantly presented with decisions of whether to conform or dissent. They can either change in order to obey expectations or they can attempt to change conventions. These decisions are not fundamentally economic in nature although they often have economic implications. The key distinction is treating creativity as emergent from the economy and treating the economy as emergent from creativity.

Certainly such causality can work in both directions, but this dissertation argues the latter. This approach has significant implications for research design. Thinking of creativity in more than just economic terms means understanding the connections between geography and social activity first and economic performance outcomes second. These are often conflated in that creativity is equated with growth. Instead, the suggestion here is that creativity should be thought of as change, which in some instances generates growth.

The remainder of this chapter provides an overview of creativity research. The aim is to identify key literatures from other disciplines that can provide important lessons for economic geography research on creativity. This leads to a more in depth discussion of how creativity research in geography can benefit from moving away from a regional
science approach towards a relational perspective. It concludes with an outline of the subsequent chapters.

1.2 An Overview of Creativity Research

Creativity research has certainly been ascendant in the economic geography literature in recent years. Much of this expansion in interest can be traced to an extension of work on the role of ‘knowledge’ in economic development and change. Specifically, the escalation in use of the term ‘creativity’ in economic geography discourse can largely be credited to Florida’s (2002b) work on the ‘creative class’. While this work has gained wide popular acceptance, particularly amongst policy makers, it has also garnered a great deal of criticism from the academic community. A portion of this criticism is aimed at the specific methods and subsequent findings of Florida’s research (Glaeser 2005), while the more intense denunciations take exception to the ‘creative class’ discourse and its political economy implications (Peck 2005). This dissertation does not seek to enter directly into either of these debates as they tend to lose sight of more fundamental questions about what creativity is, why it matters, and how and where it happens.

Part of the problem with the current debates about creativity in the economic geography literature is a deficit of connections to creativity research in other disciplines. Psychology in particular has a long history of creativity research. This fits with the common notion of creativity essentially being about the workings of exceptional minds embodied by the mythical ‘lone genius’. While there are certainly biological and cognitive aspects to creativity, there is a growing recognition, particularly in social psychology, that the creative process is fundamentally social in nature. The key implication is that if context matters to the creative process, then levels of creativity are
bound to vary as contexts vary. Understanding context is a particular strength of geographers, and thus represents an area where we can make a significant contribution to creativity research. At issue however is precisely how the various components of a wider creativity literature fit together across disciplines and sub-topics.

A significant proportion of the creativity literature in psychology deals with differences between individuals, while the geography literature tends to focus on the differences between contexts (i.e. firms, industries, occupations, cities). Clearly there are certain strengths of each discipline that are ontological in nature. Psychologists tend to have a deeper understanding of how individuals make specific choices while geographers tend to have a better understanding of how specific contexts enables or constrains choice. There is an opportunity to join these perspectives together which will not only help further creativity research, but also better our understanding of how individual action and context can influence one another in general. This section outlines the various branches of the creativity literature (please see Figure 1). The purpose of this is to provide a basic overview of the entire literature and make basic connections between them rather than deeply explore any one aspect. Each of the literatures explored are examined from a perspective of how they may relate to the geography literature.
Figure 1.1: Map of Various Creativity Literatures

Creativity (gen./def.)
- Novelty & Value/usefulness
- Recombination

Nature
- Individual biology
- Some brains ‘wired’ for novelty

Nurture
- Individual traits & characteristics
- Based on personal development

Social Process
- Social environment affects learning
- Diversity (openness & access)

Management
- Micro/firm level policy
- How to affect levels of creativity

Creative Cities
- Macro/city level policy
- Impact of larger environment

Creative Industries
- Products that demand creativity
- Specific organization & geography

Creative Workers
- Jobs that demand creativity
- Specific organization & geography

Innovation
- Science-based knowledge
- Specific organization & geography
Before delving into particular sub-topics of creativity research it is important to acknowledge that there is a general literature concerned with identifying and defining what creativity is. A great deal of creativity literature begins with at least a basic definition of what constitutes creativity. This is a sure sign that no single definition can be assumed. Thus, a significant amount of work exists on this very basic first step. Most definitions of creativity pay service to two key concepts: novelty and value. Each of these terms comes with debates of their own. For instance, Boden (1994) asks whether novelty must be ‘new’ to the individual who thinks it or ‘new’ to the world in general. Others prefer to define creativity as being ‘divergent’ (Hochevar 1981) rather than novel, thereby stressing change rather than growth. The concept of ‘value’ is also questioned as it is a highly subjective term itself. For example, Sternberg and Lubart (1999) prefer the expression ‘appropriate’ as it conveys a more specific sense of context. Others favour ‘useful’ (Unsworth 2001) which emphasizes that creativity has purpose. These debates do not tend to differ substantively and so are mainly questions of preference.

Notions of creativity begin to vary significantly when nuances are added to the basic novelty and value definition. These nuances tend to discriminate between types of novelty and value. For example, Amabile (1996) makes a distinction between ‘heuristic’ and ‘algorithmic’ knowledge production, whereby the former involves socially constructed norms and values and the latter does not. Sternberg and Lubart (1996) make a similar distinction between novelties that are generated in response to ‘open’ versus ‘closed’ problems. They contend that ‘closed’ problems involve a single solution that must be figured out as opposed to ‘open’ problems that involve a degree of subjective input from the creator. Unsworth (2001) builds on these ideas by proposing four types of
creativity based on two axes: open/closed problems and specific/discovered problems.

The specific/discovered axis relates to whether the problem at hand is originated internally or externally. Further distinctions are made according to subject matter. For example, Fiest (1999) separates ‘artistic creativity’ from ‘scientific creativity’. Those working in psychology are not the only ones having such debates. Santagata (2004) differentiates between ‘creativity’ and ‘innovation’ by claiming that creativity is ‘non-utilitarian’ and ‘non-cumulative’ and innovation is ‘utilitarian’ and ‘cumulative’. Asheim and Gertler (2005) (See also: Asheim et al 2007) are developing a framework for different types of industries based on three different types of knowledge production: symbolic, synthetic, and analytic. They associate symbolic knowledge, which involves a high degree of cultural norms and values, most closely with the creative processes and products. The common thread that permeates these more nuanced definitions of creativity is that there are different types of novelty. Specifically, novelty that is based on subjective norms and values is more closely associated with the term ‘creativity’ than new knowledge that is based on objective facts and observations. In this sense novelty and value cannot be treated separately as creativity involves novelties that are evaluated as being valuable according to the norms of their context. This is an important point that will be returned to later in this chapter.

From a non-expert perspective the bulk of the psychology literature on creativity can be divided into three broad categories: nature, nurture, and social. The first two are mainly concerned with explaining the creative abilities of individuals, while the third addresses the importance of social context in a more direct manner. Research on the ‘nature’ of creativity tends to focus on the biology of the brain and the specific areas
responsible for formulating creative thought. The ‘nurture’ perspective deals with

cognitive and personality differences between people of varying creative ability. The

social psychology approach tends to view creativity as a process that involves multiple

actors and institutions. While these three approaches provide varying opportunities for

geographers, it is important to build at least a rudimentary understanding of each in order
to construct a more complete overview of creativity research.

Discussions of the biology of creativity often begin with the question of whether

there is something unique in the biological evolution of *homo sapiens* that has enabled it
to generate more creative thought than any other species (for example see: Findlay and

Lumsden 1988). The evolutionary perspective of a human cultural genesis clearly clashes

with many deeply embedded religious beliefs about the beginnings of humanity. Hence,
the study of ‘human creativity’ has been seen at times as blasphemy (Albert and Runco

1999). More recent studies however, have made direct observations of which parts of the

brain are mainly responsible for creative activity (for examples see: Carlsson et al. 1999;
Razoumnikova 2000). Others make connections between brain abnormalities (particularly

schizophrenia) and creative abilities (for examples see: Richards et al. 1988; Weinstein

and Graves 2002). Such literature offers little opportunity for connections with geography
as such biological traits are generally assumed to be normally distributed across the

population and are therefore inherently aspatial.

One of the fundamental questions about creativity is whether it is a singular

personality trait or a combination of personal attributes and situations. A portion of the

psychology literature on creativity examines the differences in creative abilities of

individuals. In some cases researchers attempt to develop tests that measure creative
ability (for overviews see: Barron and Harrington 1981; Simonton 2000), while others focus their attention on individuals who have been recognized by their peers for having made extraordinary creative contributions to a particular field (Gardner 1993). In both cases attempts have been made to find correlations between creative ability and other individual traits (for example see: King et al. 1996). One of the most commonly explored questions is whether a link exists between intelligence and creativity (for example see: Gardner 1993). Another frequently studied personality trait is openness to new experience (for examples see: Dollinger et al. 1996; George and Zhou 2001). This point in particular offers some opportunity for connections to geography as ‘new experiences’ often involve individuals experiencing ‘new places and spaces’. Another topic that provides possible links to geography is creativity and lifecycle. This research explores the evolution of individuals’ careers and the points at which they produced their most creative works (Csikszentmihalyi 1996). General findings suggest that on average people are most creative in early-to-mid career. A potentially interesting geographic implication of this is the connection between agglomerations of youth and creative output.

The literature that holds the most promise for integration with geography is the growing body of creativity research from a social psychology perspective. This literature tends to stress creativity as a dynamic process that is embedded within a social context (for an overview see: Lubart 2001). From this perspective social context is important as it affects what the creator knows and largely determines the worth of any novelty produced. Thus, particular patterns of social relations have a significant bearing on creative ability (Perry-Smith and Shalley 2003; Burt 2004). Further to this point, social psychology research on creativity tends to evaluate situations rather than individuals in terms of
creative output. A common finding of this research is that diverse social contexts enhance creative activity (for example see: Milliken and Martins 1996). There are a number of explanations of the causality involved in this relationship. One is that dissent is less risky in diverse settings (De Dreu and West 2001; Nemeth and Nemeth-Brown 2003). A second is that diversity increases idea generation due to the greater number of possible novel connections (Paulus and Yang 2000). The importance of diversity is a well established idea in the geography literature, which is often traced back to the work of Jacobs (1969). What the social psychology literature provides however, is more detailed work on how diversity works at the micro-level. The prospect exists to further creativity research by making stronger connections between the micro-level mechanisms of diversity and an understanding of broader contextual differences.

A further important strand of the social psychology literature on creativity focuses on motivation (Ambrose and Kulik 1999). One of the key findings of this research is that motivation to ‘be creative’ is primarily intrinsic (Amabile 1996). In other words, people cannot normally be enticed or coerced into being ‘more creative’. Instead, people tend to be more or less creative in response to the social environment that they inhabit. The implication is that in order to stimulate creative activity optimal conditions must be established. There is also the recognition that creativity does not just benefit the individual who produces it, but that it is important to the wider group. Thus, a great deal of creativity research is applied to improving creativity enhancing conditions within certain environments. The next three sub-sets of literature discussed deal with how creativity research is applied to fostering creativity in educational, organizational, and jurisdictional settings.
The recognition that creativity is a positive personal attribute naturally extends to the notion that it should be cultivated in children. There is a significant body of literature on creativity and childhood development with particular reference to educational settings (for example see: Torrance 1965; Amabile 1989). Much of this literature stems more from the individual rather than the social perspective of creative ability and looks for connections between personal traits and attributes (Schiever 1985; Runco 1987). The potential value of this literature to the economic geography perspective is the linkage it makes between education and economic development. While much of the economic geography literature and research on education and economic development have to do with the amount of education there is certainly scope to examine more closely the types of education, with particular reference to systems geared to fostering creativity in individuals.

Management of creativity within firms and organizations is probably the primary application of the psychology of creativity research. This work tends to focus on optimizing organizational conditions that encourage creative activity (for examples see: Woodman et al. 1993; Amabile et al. 1996; Amabile 1998). Of particular interest are issues of leadership (Redmond et al. 1993), knowledge management (Moorman and Minor 1997), the role of consumer demand (Hirschman 1980), and in particular team demographics. The latter point is frequently linked to the role of diversity in generating creative activity (Ashton 2003; Schneider and Northcraft 1999). This literature follows the same line of argument discussed earlier with respect to social psychology, but does so in somewhat more tangible settings. The reality of these settings illuminates various problems associated with managing diverse teams. For example, more diversity can make
communication more difficult and limit cohesiveness (Ancona and Caldwell 1992). While this literature certainly has much in common with the geography literature, particularly with respect to the broad recognition of the importance of creativity to economic performance, it is also somewhat disconnected from endogenous factors of creativity. There is little discussion of wider environmental influences on creativity within the management literature.

There is generally very little connection between the psychology literature on creativity and the economic geography literature (and vice versa), yet the topic of ‘creative cities’ receives a significant amount of attention from geographers (for examples see: Scott 1997; Hall 2000; Florida 2002b). Instead, geographers tend to borrow from economics when examining the localisation of creative activity. Marshall (1890) often provides the underlying foundation for such work which extends to the creative benefits of agglomeration (Fujita and Thisse 1995; Quigley 1998) and industrial clustering (Porter 1998; Maskell 2001; Malmberg and Maskell 2002). Central to geographer’s claim on the topic of creativity is the recognition that face-to-face interaction is an important element of the creative process (Gertler 2003; Storper and Venables 2004) and the rejection that advancements in information and communication technologies have eliminated the need for physical proximity and diminished the role of local institutions (Morgan 2004). Furthermore, there has been a direct engagement with policy making that is concerned with creative cities (Scott 2006) and regional innovation systems (Morgan 1997; Asheim and Gertler 2005). The general motivation driving this engagement is an agenda of local competitiveness that acknowledges the role of creativity in the evolution and sustainability of regional economies. As some have
questioned the particularities of such policies as divisive and potentially regressive (Malanga 2004; Peck 2005) there is a growing conviction that creativity should not come at the expense of equality.

Generally, the literature on creative cities tends to take a structuralist or institutionalist perspective. This is understandable given that much of the discussion takes place at the regional level and perhaps explains the lack of connection to the psychology literature on creativity. Such connections are however a two-way-street: Csikszentmihalyi (1996: 140) illuminates the view from the other side of the divide as he states,

> most of us cannot do a great deal about the macroenvironment. There is not much that we can do about the wealth of the society we live in, or even about the institutions in which we work. We can, however, gain control over the immediate environment and transform it so that it enhances personal creativity.

This seems to capture the attitude of the psychology literature towards larger contextual influences – it matters, but the details are for someone else to deal with. The lack of integration between the geography and psychology creativity literatures provides both communities with an opportunity to further their respective research agendas. The psychology literature offers insights on the micro-foundations of the creative process while the geography literature tends to be more effective at illuminating the impact of variations of local context.

The final set of literature discussed is based on creativity as an outcome, particularly one that is economic in nature. More specifically this literature examines products that are deemed to be ‘creative’ in nature and how they are made (Caves 2000). Furthermore, a subset of this literature examines people who are engaged in highly ‘creative’ work (Florida 2002a). The basic distinction is between creative industries and
occupations. In both cases there is an essential recognition that creative products and processes are markedly different from other products and processes and thus worthy of special attention. For example, creative industries are often organized on the basis of projects and temporary alliances (Grabher 2002). This research is also inherently geographic in nature as creative industries and workers are understood to be highly localized (Florida 2002b; Drake 2003). Further to this point there is a strong connection between creativity and culture (Rudowicz 2003), which highlights local characteristics of creativity vis-à-vis the notion of economic activity as embedded in social relationships (Granovetter 1985; Gertler 1995). As this literature deals with particular economic activities and agents a necessary requirement is delineating which activities are deserving of the ‘creative’ label. There are a number of approaches to this dilemma ranging from highly systematic (Flew 2002) to more implicit notions of creative activities. It is in this area where the creative industries and creative work literature could benefit from a closer examination of the psychology literature. For all the research on creative economic activity there is precious little agreement on what constitutes ‘creativity’.

The totality of creativity research is quite expansive. In some instances there are fruitful amalgamations of research between fields. The application of the literature on the psychology of the creative process to management studies is one such example. However, there seems to be a wider gulf between the economic geography literature and creativity research from other fields, and psychology in particular. The causes of this schism can perhaps be attributed to the broad ontological differences between the two disciplines. The psychology literature favours a starting point of individual action even though it readily accepts the vital importance of context. Conversely, the economic geography
literature tends to begin with context as a way of highlighting differences in individual behaviour. It would seem that there is ample opportunity for these literatures to coalesce in a mutually reinforcing manner, but there are other theoretical concerns that are somewhat incongruent. One of these is the underlying motivation behind creativity activity. The geography literature tends to view creativity as an economic process and thus motivation is often assumed to be based on an economic rationale. This notion clashes with the widely held view in psychology that creativity is predominantly intrinsically motivated. Further to this point, an economic perspective on creativity treats it as an outcome while the psychology perspective favours seeing creativity as a process. When viewing creativity as a process it is apparent that it is not always economic in nature. A logical extension of this point is that if creativity is not always economic, then it is not fundamentally economic. Rather, it can be characterized as a wider process of social adaptation that often has economic causes and consequences. The key point is that the underlying economic assumptions about how and why creativity occurs need to be critically scrutinized. One of the broad goals of this dissertation is to address the inconsistencies between the economic and psychology perspectives on creativity. Specifically, it will examine the interconnections between creativity as an individual action, the specifics of context, and how the two influence each other over time and space.

1.3 Research Approach

The main concern of this dissertation is to develop a better understanding of the creative process with a particular focus on the influence of social context. This is certainly a fairly broad aim considering the multidimensional nature of the creative process. One layer of complexity involves the role of agency versus the role of structure.
Novel ideas are ultimately formulated in the minds of individuals, yet the creative process is inherently social as inspiration and evaluation are a collective endeavour. The contextual nature of the creative process implies that there is a ‘geography of creativity’ as contexts are locally specific. A further complexity is the notion that creativity is a dynamic process that occurs over time. As creativity is fundamentally about change it is an illusive target. As creativity occurs it changes the context in which it happens as novelty ripples across social and spatial relationships. In short, the creative process is framed by an intricate set of relationships between agency and structure over time and space. No one of these dimensions can effectively be isolated from the others, yet studying each simultaneously is undoubtedly a difficult task for the researcher. This dissertation attempts to examine these dimensions in concert and so is seeking to develop generalizable theory and empirics that bind the various aspects of the creative process.

This research approach has certain congruencies with recent developments in the economic geography literature.

The localization of creativity is not a new topic in economic geography. A significant amount of research has been devoted to understanding the connections between local diversity, creative activity, and economic growth (for recent examples see: Glaeser 1992 et al.; Feldman and Audretsch 1999; Desrochers 2001). The work of Jacobs (1969) is often a theoretical starting point for such investigations. However, in reviewing the overall product of this research Glaeser (2003: 92) finds that it is somewhat inconsistent, “different time periods and different samples give different results which suggest that there is no universal truth on this topic”, and suggests that there are underlying methodological issues to be worked out by, “investigating the actual hard
evidence on innovations, we will be able to assess the relative importance of idea combinations and the role of diversity and concentration”. This dissatisfaction is largely rooted in a regional science approach that tends to treat creativity as an implicit cause of local growth. In this respect such studies tend to employ measures of diversity as the main independent variable and indicators of regional growth as the dependent variable. It is assumed that diversity leads to creativity which leads to growth, but creativity is often not directly observed. Research that incorporates the use of patent data is somewhat of an exception, but it too is essentially a proxy for innovation (for examples see: Jaffe et al. 1993; Breschi 2000). A further problem that tends to permeate this research is that diversity is almost exclusively measured using calculations of industrial variety. This assumes that only knowledge of products and production plays a role in the generation of novel ideas and belies the importance of other forms and sources of knowledge such as culture (for a notable exception see: Ottaviano and Peri 2006). Glaeser’s main criticism addresses general methodology, not the underlying theory. From this perspective then, new approaches to examining the links between localized diversity and creativity are required.

Of the dimensions of the creative process past research tends to focus on structure and space. Time is often used to compare static measures, but does not often deal directly with process. Agency is probably the most neglected aspect. In particular, the patterns of interaction between agents are a crucial element that is often taken for granted. This is curious as theory of diversity entails the interaction and mixing of difference. Thus, one of the main propositions of this dissertation is that research into diversity and creativity needs to take a more relational approach. This view has gained momentum with recent
calls for a ‘relation turn’ in economic geography, which Boggs and Rantisi (2003) characterize as, “a theoretical orientation where actors and the dynamic processes of change and development engendered by their relations are central to the analysis”. They argue that such an approach directly engages with tensions between agency-structure, micro-macro, and local-global analytical perspectives. A relational economic geography means moving away from a regional science approach (Bathelt and Gluckler 2003). It is also a turn away from a neo-classical economic perspective and the assumptions of human behaviour that underpin it. Instead, the impetus is behind an evolutionary approach whereby change and its mechanisms are the focus of study (Boschma and Frenken 2006). The calls for a more relational and evolutionary approach to economic geography are highly appropriate for the study of creativity as the creative process is essentially about social interaction and change.

While these broad shifts are generally beneficial to the study of the creative process, they can also be perceived to be somewhat constraining in terms of specific methodologies. A strength of the regional science approach is that it allows for theoretical generalizations to be made. Detailed case studies, which seem to be the preferred methodology of the relational turn, are effective at highlighting differences and exceptions and so are limited when it comes to transferring insights between various studies. As Scott (2004) suggests, “small and unassuming concepts are meaningful and legitimate whereas large and ambitious concepts are necessarily irrational”, which in turn, “has an unfortunate chilling effect on high-risk conceptual and theoretical speculation”. With this in mind, it needs to be stressed that the goal here is to make generalizations, but not propose ‘universal laws’. Harvey (1996: 2) articulates this point by stating that, “the
task of critical analysis is not, surely, to prove the impossibility of foundational beliefs (or truths), but to find a more plausible and adequate basis for the foundational beliefs that make interpretation and political action meaningful, creative, and possible”.

Furthermore, this can be achieved using quantitative techniques, but ones that differ substantially from the tools of orthodox economics (Plummer and Sheppard 2006).

Two of the key methodologies employed in this dissertation have a relatively short history, particularly in geography. One is social network analysis, which is an inherently relational tool. It is particularly effective at illuminating the patterns of interaction between individuals and the subsequent knowledge flows. The main explanatory power that it offers is revealing how different knowledge and similar knowledge are connected via social interaction. A drawback however is that network analysis is often static and thus not wholly congruent with an evolutionary perspective. In order to address this shortcoming a second methodology, agent-based modeling, is incorporated into the analysis. As it involves a significant amount of computing power it is a relatively new tool. It is one however that addresses some of the broad theoretical questions of agency-structure and time-space (Sheppard 2003). Furthermore, as agent-based models simulate social action in a stochastic and contextual manner they are particularly effective at making theoretical generalizations that can subsequently be tested with other methodologies (Fowler 2007). A further advantage is that knowledge and creativity are highly intangible and thus difficult to observe directly. By simulating the creative process knowledge flows and creative activity can be measured and analyzed. These tools are used in conjunction with some traditional regional science methods in a way that seeks to improve and advance previous research rather than supplant it entirely. The aim is to first
improve our general understanding of the creative process in order to subsequently improve our understanding of it in specific settings.

1.4 Dissertation Outline

The bulk of this dissertation is comprised of four papers that are intended to be published independently, yet maintain a consistent theoretical framework that is centred on the connections between localized diversity and the creative process. The first paper presents the detailed theoretical framework; the second animates the framework using an agent-based model; and, the third paper analyses secondary data that links the social network characteristics of workers with creative activity. The final chapter discusses some of the policy implications of the findings and proposes directions for future research.

Chapter 2 constructs an argument of how localized diversity fuels the creative process. It is organized around four interrelated themes: creativity, diversity, proximity, and economic activity. It begins by formulating a definition of creativity by adopting elements of the psychology literature on the creative process. This begins with the common notion that creativity involves the production of knowledge that is both novel and valuable. It then adds the idea that creativity involves a particular type of knowledge that is culturally based as opposed to scientifically or technologically based. The discussion of diversity focuses on the notion of recombinant knowledge and connecting difference through networks. The role of proximity is framed as a question: if diversity is important to creativity, then why does it matter if it is local. This is addressed in relation to the how both physical and cognitive distance act to constrain knowledge flows. A key point is that non-local knowledge flows tend to be between people with relatively low levels of cognitive distance, the implication being that connecting higher levels of
cognitive distance is facilitated by localized diversity. The paper concludes by discussing the economic implications. In this respect it departs from the neo-classical treatment of creativity as a source of growth and instead treats creativity as a source of change. Practically, this means that creativity should not be equated with growth, but instead with certain types of economic activity, which do not necessarily provide immediate economic advantage. In summary, the chapter hypothesizes that higher levels of local diversity will help boost creativity, resulting in the spatial concentration of highly creative economic activities.

Chapter 3 presents an agent-based model that illuminates how social position can affect creative potential and how physical location can affect social position. The model is comprised of 250 agents that populate 10 locations. The goal of the agents is to create new combinations of knowledge and then spread this knowledge as widely as possible. They accomplish this goal through four types of action: social interaction, learning via interaction, creation of new knowledge, and migration. The results of the model suggest that larger, more diverse places have a distinct creative advantage over smaller, less diverse places. Additionally, it highlights how more creative locations may grow and less diverse locations decline. Four additional scenarios are run in addition to the original (neutral) model. One of the goals of these scenarios is to give locations agency so that the role of heterogeneous local institutions can be evaluated. These scenarios introduce initial inequalities into the model in order to test: diversity versus specialization, nature versus nurture, the effect of ‘educational’ institutions, and, the effect of talent attraction and retention strategies. As the model does not input ‘real world’ data into the original design
there are clearly questions of external validity. These issues are addressed in chapters 4 and 5.

As the third chapter simulates the interplay of agency and structure in relation to the creative process, chapter four provides a degree of external validity to the structural dimension with a quantitative analysis of the relationships between levels of diversity in Canadian city-regions and the local concentration of creative economic activities. Similar theoretical arguments are presented as in chapters 2 and 3 in order to develop the hypothesis that local diversity fosters higher levels of local creativity. A significant departure from previous literature is the notion that the dependent variable should in some way try and capture the level of local creativity rather than economic performance in general (which assumes underlying creative activity). In order to test this argument two sets of regression models are presented. These models contain the same group of independent variables which feature indicators of both economic and cultural diversity. The first model demonstrated a fairly weak correlation between local diversity and economic performance when measured by employment growth. No statistical relationship was found when economic performance was measured by income growth. The second model demonstrates that local diversity has a strong and significant relationship with the local concentration of creative economic activities. A key methodological innovation is the manner in which creative economic activities are identified. A classification system is used that segments industrial sectors based on two dimensions of their constituent work forces: the percentage of workers with post-secondary qualifications; and, the field of study of the qualifications. With regards to the latter fields of study are grouped into three categories: a) arts, humanities, and social sciences; b) engineering and applied sciences;
and c) natural sciences and mathematics. These categories are intended to differentiate industries by their knowledge-bases with the first category representing ‘creative’ industries.

In the manner that chapter 4 provides external validity to the structural dimensions of the third chapter, the fifth chapter examines the role of agency by identifying quantitative relationships between the characteristics of individuals’ social networks and creative activity. Following similar theoretical arguments in the previous chapters an emphasis is placed on finding parallels between theories of local structural diversity and its relationship with creativity and the social network analysis literature on relational diversity. With this framework in mind an attempt is made to apply social network analysis techniques in an attempt to instil a greater degree of agency into the local diversity versus specialization debate. Data from the General Social Survey is analysed in two ways. The first is a regression model that demonstrates a correlation between the number of weak ties individuals have and higher incomes. While this finding is congruent with past research on the economic benefits of weak ties, an argument is made that past interpretations of this correlation have generally overlooked the possibility that increased levels of creativity is a component of this relationship. In order to test this notion the social network characteristics of individuals are analysed in relation to their main economic activity. A clear pattern is evident in the data that those working in creative and cultural occupations and industries tend to have the largest, most dynamic, most diverse social networks of any category of worker. While no direct causal link can be established from this level of analysis, an argument is made that in order for research on the impact
of local diversity to move forward there needs to be better data collected that connects
differences in social network characteristics with place-based characteristics.

The concluding chapter presents a model which summarizes the main elements of
the overarching arguments made in the first five chapters.
Chapter 2
THE CREATIVE ADVANTAGE OF DIVERSE CITY REGIONS

2.1 Introduction

This paper is about four things: creativity, diversity, proximity, and economic activity. The combination of these concepts may be familiar to economic geographers in terms of how they relate to the literature on urbanization economies, and particularly in relation to the work of Jacobs (1969). Where this paper mainly differs is how creativity is addressed, which in turn affects the discussion of diversity, proximity, and economic activity. In the economic geography literature creativity is often treated as a component of the economy. That is that creativity emerges from economic activity in response to demand for novelty. This approach is somewhat incongruent however with prevailing theory of creativity from the field of psychology which generally has a more extensive history on the topic. A key contention is that motivation to ‘be creative’ is primarily intrinsic (Amabile 1996). Research on motivation suggests that people cannot normally be either coerced or enticed into ‘being more creative’. Instead this research suggests that creativity occurs with greater frequency in environments where people feel they have the ability to produce positive change as well as the necessary resources to do so. A second key element of this work is the understanding that the creative process is inherently a social process and not just something that happens in some brains more than others. The implication is that social context has a significant impact on the creative process. Differentiating between contexts is a particular strength of geographers and therefore represents the main contribution that we can make to the study of creativity.

In this respect, diversity of the social environment is perhaps the pre-eminent condition for creative activity. There have been many attempts to make an empirical
connection between levels of local diversity and creativity, but on a whole these attempts have bourn precious little fruit (Glaeser 2003). An important point this paper attempts to make is that traditional regional science methods do not adequately square with the theories they purportedly test. Diversity is often measured by the mix of local industries, while creativity is often inferred from measures of economic performance and growth. These metrics however, do not capture the complexity of either and the static nature of such analysis does little to explain the mechanisms involved. In order to better understand the impact of diversity it needs to be conceived as something that affects the behaviour of individuals. This paper explores two aspects of how diversity ‘works’. One builds on the notion that novelty is derived from recombining existing knowledge in new ways. Diverse contexts increase the range of accessible knowledge and thus increase the number of possible new combinations. The second influence of diversity is that it enables dissent. Homogeneity can lead to greater conformity and groupthink, while heterogeneity can decrease pressures to conform.

If diversity is seen as essential to the creative process, the fundamental question with respect to geography is: why does it matter if diversity is local? The geography of knowledge flows is a topic that is ascending in the literature. A key aspect of this discussion concerns the local/non-local dimensions of interaction and learning in the context of advances in information and communication technologies. A significant amount of evidence has been presented that claims non-local knowledge flows are increasing and that ‘communities of practice’ are not necessarily locally concentrated (Wenger 1998). However, this does not undermine the argument that local diversity matters as the central claim is that non-local interaction occurs between cognitively
similar actors. The importance of local diversity is that it helps connect cognitively
different actors. Therefore, if cognitive distance and physical distance are dual constraints
to knowledge flows, and connecting difference is important to creativity, then regions
that are highly diverse have a ‘creative advantage’ over more homogeneous places.

The final question is concerned with how local diversity and the creative process
affect economic activity. First of all this question is posited in this order for a particular
reason. As it is argued that economic activity is emergent from creative activity and that
creative activity is emergent from a diversity of social relationships. Clearly, causality
can work in both directions, but the focus of this paper is the one that is stated above.
With this in mind the general hypothesis of this paper is that economic activities that
involve a high amount of creativity will be more prevalent in diverse environments. This
is not to say that diverse environments produce better economic performance (although
they may over the long-term), but that the relative homogeneity/heterogeneity of places
affect the spatial concentration of particular economic activities. This hypothesis and its
constituent elements are expanded upon in the remainder of the paper.

2.2 Creativity

The basic definition of creativity typically contains two components: novelty and
value. For instance, Sternberg and Lubart (1999) define creativity as, “the ability to
produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful,
adaptive concerning task restraints)”. Similarly, Unsworth (2001) states that the usual
definition of creativity is akin to, “the production of novel ideas that are useful and
appropriate to the situation”. Other terms and phrases can be substituted for novelty (e.g.
“divergent” - Hochevar 1981) and value (e.g. “transformative” – Boden 1994), but the
core ideas remain fairly constant. Creativity is a process of producing new knowledge that is deemed to have worth by some group or audience.

2.2.1 Types of Knowledge Production

This definition is quite broad in scope in that it encapsulates all knowledge production. While this satisfies some, others take a more nuanced view in the belief that creativity is only one type of knowledge production. Santagata (2004) for instance, claims that creativity is “non-utilitarian” as opposed to innovation which is driven by a logic of specific and measurable improvement. Sternberg and Lubart (1996) make a distinction between ‘open’ and ‘closed’ problem solving whereby ‘closed’ problems have specific answers while ‘open’ ones do not. Amabile (1996) makes a similar distinction between heuristic knowledge production and algorithmic knowledge production, whereby the former can only be truly considered ‘creativity’. The key difference is that heuristic knowledge production is based on the subjective values of both the creator and the evaluators, while algorithmic knowledge production is observable and repeatable by others who should come to the exact same conclusions. Little if any knowledge production can be purely subjective or objective, but these two ideal types can prove useful as ends of a conceptual spectrum of knowledge production. For example, Feist (1999) employs such a framework when examining the differences in the personality traits of highly respected artists and scientists.

There are some parallels with the heuristic/algorithmic dichotomy and the tacit/codified distinctions (Dosi 1988; Gertler 2003; Amin and Cohendet 2004) that are more familiar in the economic geography literature. By definition tacit knowledge cannot be articulated in a formulaic manner, while codified knowledge is precisely that. What
the heuristic/algorithmic distinction speaks to more directly than the tacit/codified framework is subject matter. Heuristic knowledge production is based on personal/cultural values and norms and so directly relates to subjects of human experience. Algorithmic knowledge is based on observable/repeatable phenomena and so primarily concerns subjects of the material world. The important element of the difference between heuristic and algorithmic knowledge production is that with the former knowledge is truly ‘created’ as it is a product of one’s experience and interpretation, while with the latter a specific answer is ‘discovered’. A human experience/material world distinction cannot be thought of as an absolute binary as all knowledge production surely involves a degree of each. Thus, the label ‘creativity’ is more often associated with the interpretation of human experience, while the term ‘discovery’ is more frequently linked with scientific pursuits (See Figure 2.1 and Table 2.1).

An additional distinction between the ends of this spectrum is the nature of how new knowledge is produced in relation to what has come before. In general, creativity can be considered more evolutionary and discovery can be thought of as more expansionary. What this means is that there is more destruction involved with the creative process as for something to achieve greater value it often has to displace what has come before. For example, while fashion trends may be influenced by precedents those precedents are often cast aside for what is considered ‘in’ at the moment. Scientific discovery differs somewhat in that existing knowledge is a clear stepping stone to the production of new knowledge. In this sense knowledge of a particular material world phenomenon becomes increasingly refined and more detailed and so knowledge of a particular subject expands.
Innovation is a third term that is often used in connection (often seemingly synonymous) with creativity. This third term can be placed in the intersection between creativity and discovery, or in other words, a hybrid of human experience and the material world. There is a clear association with the terms ‘innovation’ and ‘technological’ which suggests that innovation can be thought of as applying knowledge of the material world in order to better human experience. There is certainly a significant amount of overlap between these three types of knowledge production as the value of discoveries are generally determined through social processes and human experience takes place in the material world. The point however, is that there are certain tendencies that make them somewhat different from one another. Furthermore, if the type of knowledge differs then it is likely that the creative process also differs somewhat from the processes of innovation and discovery.
Figure 2.1: Three Types of Knowledge Production

Evolution  Improvement  Expansion
Subjective  Objective
Interpretivism  Positivism
Heuristic  Algorithmic
Change  Growth
The Human Experience  Informing Applying  The Material World
Art & Culture  Technology  Natural Science
Table 2.1: Google.ca ‘Hits’ for Pairs of Terms

<table>
<thead>
<tr>
<th>“…creativity”</th>
<th>“artistic…”</th>
<th>“technological…”</th>
<th>“scientific…”</th>
</tr>
</thead>
<tbody>
<tr>
<td>“…innovation”</td>
<td>70,000</td>
<td>2,020,000</td>
<td>212,000</td>
</tr>
<tr>
<td>“…discovery”</td>
<td>32,200</td>
<td>16,700</td>
<td>1,370,000</td>
</tr>
</tbody>
</table>

Source: google.ca – August 23, 2007

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1 This table was generating by running nine separate google.ca searches (one for each pairing of terms). While the results could be considered an artefact of semantic construction, the message is that there is on some level of collective consciousness a distinction between the terms ‘creativity’, ‘innovation’, and ‘discovery’ that relate primarily to the nature of the subject matter.
2.2.2 Different Subjects, Different Processes

There have been many models developed that seek to describe the basic elements of creativity. Lubart (2001) identifies Guildford’s (1950) 4-stage model as the common starting point in this discussion, which are “traditionally identified as (a) preparation, (b) incubation, (c) illumination, and (d) verification”, but he argues that more sophisticated and less-linear models are emerging. Models of the process of innovation have gone through similar evolution from simple linear models to more complex and iterative ones (Nelson and Winter 1982; von Hippel 1988; Rothwell, 1994), while others have developed specific models of scientific discovery (Kulkarni and Simon 1988).

Santagata (2004) proposes that one of the key distinctions between creativity and innovation is that the former mode of knowledge production is “non-cumulative” in nature. This suggests that while all knowledge production can be thought of as path dependent in some way, development follows different patterns. Knowledge that is primarily derived from human experience is classified in a highly personal manner. New information and experience is processed in relation to an individual’s past experience. As everyone has had a unique set of experiences, knowledge of this sort requires interpretation. In societal terms, a sense of proportion and advocacy lead to the development of norms and subsequent institutions that propagate them. With new experiences and learning however, these norms and institutions evolve. The very set of filters that help classify novelty constantly change.

With knowledge that is primarily concerned with the physical world this is less the case. Classification of knowledge is often universal in nature. Elements and species are categorized in specific ways and provide a foundation that anyone with the requisite
knowledge can build upon. New details are discovered and then verified by others which lead to an expansion of the existing framework. In some cases new discoveries can uncover fatal flaws in previously accepted knowledge which can lead to radical change. For example, a Newtonian understanding of fundamental physics was undone by relativity and quantum mechanics. Cases such as this however are the exception, not the rule. In this sense, discoveries of material properties and processes lead to an expansion of scientific knowledge, as opposed to the more evolutionary nature of human creativity.

2.2.3 Different Processes, Different Contexts

Creativity, innovation, and discovery are all social processes which differ in some respects. As they are social in nature they are affected by social context, but in different ways. Creativity is evolutionary in nature – it thrives when differences collide and beget more difference. There is also a greater degree of destruction involved as current fashions and trends replace the previous ones. Scientific discovery is expansionary – it tends to build incrementally and methodically. While there is some degree of destruction, more often knowledge is added-on to what is already known. In this sense existing knowledge becomes refined rather than put aside. The implication is that anyone who thinks or acts in a divergent manner can be creative, but in order to make a significant discovery one needs to spend years learning a specific field before being in a position to add to it. While it is generally true that producing a major creative contribution that has a significant transformative influence requires mastering a field (Amabile 1996), it is the cumulative social experiences that tend to provide the system of evaluation. Additionally, the direction of scientific endeavours may be influenced by broad societal values, but the knowledge production itself occurs within a much more select community. In short,
creativity can be thought of as communal in a much broader sense. Everyday human interaction can either directly lead to creative outcomes or inspire others to do so (Runco and Bahleda 1986). The key implication is that creativity is likely to flourish in contexts that provide greater degrees of difference. Discovery on the other hand, requires specialized communities that can speak with precision about very particular knowledge. The following section outlines how diverse environments can stimulate creativity in greater detail.

2.3 Diversity

To this point creativity has been described as a fundamentally social process, one that is motivated by an intrinsic desire to alter (to varying degrees) prevailing norms, values and conventions. Fischer (2005) asserts that, “creative activity grows out of the relationship between individuals and their work, as well as from the interactions between individuals. Creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a socio-cultural context”. This section outlines contextual mechanisms that fuel the creative process. It builds from the view that creative activity occurs when existing knowledge is recombined in novel ways. This leads to the general premise that diverse contexts offer more possible combinations and thus stimulate the creative process.

2.3.1 Recombinant Knowledge Production

The idea that recombining old knowledge produces new knowledge and ultimately leads to growth is not new. Jane Jacobs (1969) can be considered a seminal advocate of this view. This theory has continued to be explored and expanded upon (For examples see: Weitzman 1998; Desrochers 2001). One of the most pertinent recent developments in
recombinant theory is Nooteboom’s (2000; 2001) work on ‘cognitive distance’ which he explains, “indicates that people do not just have different thoughts, but that they have different abilities of perception, interpretation and evaluation, and thereby see the world differently, as a function of their experience” (Nooteboom 2000). This applies to recombination theory as he believes, cognitive distance yields both an opportunity and a problem. The opportunity is that contact with others gives us an opportunity to escape from the myopia of our personal cognitive construction. A problem, however, is that the greater the distance, i.e. the less people share cognitive categories, the more difficult it is to cross it, i.e. to understand the actions and expressions of a partner. Thus there is some optimal cognitive distance: large enough for partners to tell each other something new, and small enough for comprehension.

(Nooteboom 2001)

This has two clear implications for our understanding of creativity. First, if creativity involves producing new and valuable combinations of knowledge, then knowledge can be considered the key input into the creative process. Furthermore, in order to produce novel outputs, novel inputs are required. Nooteboom contends that there is an optimal, rather than maximum, level of novelty. The optimal level of novelty is the point at which it intersects with the ability to comprehend new information or the individual’s ‘absorptive capacity’ (Cohen and Levinthal 1990). The second key implication is that acquiring new knowledge is a social process. This line of reasoning suggests that acquiring new knowledge is mainly the result of interacting with new and different people.

2.3.2 Networks, Weak Ties, and Structural Holes

Granovetter’s (1973) enduring ‘strength of weak ties’ hypothesis provides an apt framework for examining how knowledge at optimal cognitive distance is obtained. The
basic idea of Granovetter’s hypothesis is that the people with whom one has less frequent and less intensive contact (weak ties) are more valuable sources of knowledge. The reason for this is that the more frequently and intensively two people interact, the more they learn from one another, and so they tend to share a significant amount of redundant knowledge. Or in other words, cognitive distance tends to decrease between two people as the frequency and intensity of their interaction increases. This means that people who are not part of one’s core network are more likely to be sources of novel knowledge.

While Granovetter tends to emphasize the strength of connections between people, others such as Burt (1992) focus more on the cognitive distance between groups, which he refers to as ‘structural holes’. This line of work also tends to accentuate second-order ties, meaning that it is essential to understand not just the ties between two people but also how their networks connect with one another. The important concept here is redundancy. A weak tie is not valuable if others in one’s core network also have weak ties to the same group. If there are multiple paths for the same information, then each path is less valuable. Conversely, if someone is the only ‘bridge’ between two groups, then they are in an advantageous network position. In terms of creativity, this means that if access to a variety of knowledge is an important component of the creative process, then network position is a significant factor. Those who are in a position to bridge structural holes should have a creative advantage as their access to differentiated knowledge is elevated.

2.3.3 Homophily

The bridging of structural holes tends to require instrumental action. That is to say people are more likely to choose to interact with those with whom they have more in common. Cognitive distance is a constraint on forming new relationships. A consequence
of this is a feedback loop whereby similar people tend to interact with one another, which in turn leads to them growing ever more similar. This principal is known within the network analysis literature as ‘homophily’. MacPherson et al. (2001) explain that, contact between similar people occurs at a higher rate than among dissimilar people. The pervasive fact of homophily means that cultural behavioral, genetic, or material information that flows through networks will tend to be localized. Homophily implies that distance in terms of social characteristics translates into network distance, the number of relationships through which a piece of information must travel to connect two individuals. It also implies that any social entity that depends to a substantial degree on networks for its transmission will tend to be localized in social space and will obey certain fundamental dynamics as it interacts with other social entities in an ecology of social forms.

The concept of homophily suggests that there are social constraints to bridging structural holes in networks. In such a situation instrumental action is necessary in order to achieve bridging. The motivation for such action can be derived from the recognition that there is value in learning new and different things. If this value is understood then one will seek to interact with those who are different. An implication of this is that creativity can be enhanced by the recognition of the value of difference. An important caveat is that access to differentiated knowledge is not necessarily uniform.

### 2.4 Proximity

The principle of homophily suggests that cognitive distance acts as a constraint on social interaction. A key question for geographers is whether physical distance acts in a similar manner. Some such as Cairncross (1997) have argued that ‘the death of distance’ is occurring whereby advances in information and communications technologies are rendering geographical proximity increasingly irrelevant. This hypothesis has elicited a spirited response from geographers (For example see: Martin 1998; Morgan 2004) who counter that information and communications technologies have inherent limitations and
therefore physical proximity will continue to matter. This position has typically been framed by the tacit versus codified knowledge paradigm. The basic argument is that information and communications technologies are effective at facilitating the transmission of codified knowledge but are ineffective when it comes to tacit knowledge. For this reason the importance of face-to-face contact has been emphasized when examining the transmission of tacit knowledge (Storper and Venables 2004). Others have rebutted this position by demonstrating that non-local actors are indeed important sources of new knowledge (Grotz and Braun 1997; Britton 2004). In addition, face-to-face contact need not be limited by location when the movement of people is considered (Maskell, Bathelt and Malmberg 2004).

In order to incorporate this debate into the framework of this paper the emphasis needs to be shifted in a number of ways. The first is that there is a tendency in the literature to ask if/how physical proximity affects the transmission of knowledge. An appropriate adjustment to this question in the context of this paper is to instead ask how physical proximity affects the formation of networks. By doing this, the notion of instrumental action is incorporated which leads to more specific questions such as: why would someone seek non-local interaction; how would someone seek non-local interaction; and, what (if any) are the difficulties with such action?

A second tendency of the literature is to focus on the qualitative differences between technologically intermediated interaction and face-to-face contact. Often overlooked is the relative amount of face-to-face interaction versus non-face-to-face interaction which can be lost when looking at specific cases of local versus non-local networks and knowledge flows. On a larger scale however it becomes apparent that the
majority of social interaction occurs via face-to-face interaction and therefore more knowledge in transmitted locally than non-locally. This implies that there is an inherent connection between cognitive distance and physical distance.

Both cognitive distance and physical distance constrain the formation of networks, as people are more likely to interact with similar people as well as people who they can see face-to-face on a daily basis. This would imply that non-local network connections are more likely to be formed between partners who have a low level of cognitive distance between them (Amin and Cohendet 2004). For example, it would be more likely for an inter-regional relationship to exist between two people in the same industry or profession than between two people in unrelated industries or professions. A further implication is that there are relatively lower network constraints to accessing knowledge of moderate cognitive distance locally rather than non-locally. Many of the examples cited in the literature of inter-regional networks and knowledge flows deal with connections within the same industry or community of practice. This suggests that non-local networks are facilitated by a relatively lower level of cognitive distance. The inverse of this is that networks bridging higher levels of cognitive distance are facilitated by lower levels of physical distance. For this reason it can be proposed that it is relatively easier to access knowledge of moderate cognitive distance locally rather than non-locally. A crucial caveat to this proposition is that local availability of such knowledge varies in amounts between places.

2.4.1 Localized Cognitive Diversity

It is recognized within the psychology literature that ‘cognitive diversity’ within groups is an important factor in producing creative outcomes (Milliken, Bartel and
The term ‘cognitive diversity’ is essentially the sum total of all cognitive distance between the members of a group. So for example, a group of like-minded individuals would have less cognitive diversity than a group of clearly distinct individuals. Research in this area tends to be limited to testing specific group-dynamics in controlled environments, but the general theory can be extrapolated to a larger scale. The general hypothesis of this paper is that regions that contain higher amounts of cognitive diversity will have a creative advantage over places that do not.

This is not a particularly novel idea as the connection between diversity and development in urban areas has been proposed with some frequency in the past. In his classic essay Urbanism as a Way of Life, Wirth (1938) explains that the city has,

historically been the melting-pot of races, peoples, and cultures and a most favorable breeding ground of new biological and cultural hybrids. It has not only tolerated but rewarded individual differences. It has brought together people from the ends of the earth because they are different and thus useful to one another, rather than because they are homogeneous and like-minded.

The notion that diversity itself is valuable rather than something that is merely ‘tolerated’ is an important insight. Diversity is a necessary ingredient of the creative process, as more differentiated knowledge means that there are a greater number of possible new combinations of knowledge. Thus, the probability of creativity emerging in diverse environments is higher.

Jacobs (1969) has also examined the role of diversity in cities in relation to new knowledge production. She takes a decidedly labour focused view of the process as she states that, “kinds of work literally multiply, not by any economic ‘spontaneous generation’ but rather as one thing leads explicitly to another. The greater the sheer number and varieties of divisions of labour already achieved in an economy, the greater
One of the many important insights of Jacobs’ work is that cities are not simply the result of economic development but a key mechanism driving economic development forward. A virtuous cycle exists whereby growing cities generate diversity, which leads to the generation of new ideas, which in turn leads to more growth and more diversity.

In some contrast to Jacobs’ labour-focused approach, Fischer (1982) offers a network-based theory as to why there is more cognitive diversity in larger cities. This theory is centred on the notion that people who live in larger metropolitan areas tend to have denser and more homogeneous networks than people who live in smaller towns. This may seem at first inspection to run counter to the arguments made in this paper, yet it is this phenomenon that creates places with greater cognitive diversity. It is only when places reach a critical mass that distinct subcultures can form. As people tend to interact with others who are similar to them, in larger urban areas it becomes possible to choose to interact only with similar people. Thus there is greater network ‘density’ whereby members of social networks tend to have more things in common. For example, in large cities there are many police officers and so it is possible for both work and leisure networks to overlap. Conversely, in a small town there may only be one police officer and so leisure activities must be done with those of different occupations, resulting in fewer distinct networks. The overall pattern is that more distinct networks tend to exist in larger urban areas than in small towns. The connection to the theory of this paper is that larger places will have more cognitive diversity as a result of having more distinct networks even if it is less common for people to bridge disparate networks. It is the
people who are able to connect to a multitude of these networks who will have the
greatest access to differentiated knowledge, and thus a heightened creative potential.

It must be noted that scale alone does not determine the degree of cognitive
diversity within a region. Cities are dynamic entities that experience continual change.
They also do not exist in isolation as they experience constant inflows and outflows of
people, goods, and information. This dynamism can also have an impact on the level of
cognitive diversity within a region as new networks and new knowledge are introduced to
the local area. An important caveat to cognitive diversity is that it cannot be sustained
without continual refreshment. Cognitive diversity decreases with time as previously
disconnected networks converge through interaction and subsequent knowledge exchange.
Higher levels of interaction reduce cognitive distance. Therefore it is necessary that new
networks and the knowledge contained within them be introduced into the local
environment. There needs to be a constant and continual turnover or ‘churn’ of people,
networks and knowledge in order for cognitive diversity to be sustained. This relates to
the idea of ‘local buzz and global pipelines’ (Bathelt, Malmberg and Maskell 2004)
whereby new knowledge is accessed non-locally and circulated locally.

The notion that inflows and outflows of people are important may be somewhat
contrary to the more common economic development argument that stresses not only
human capital attraction but also retention. While attraction is certainly of vital
importance, perhaps retention is not. In fact it could even be construed negatively, as
certain networks and knowledge may become entrenched, thereby acting to stifle new
ideas. It is fairly well understood that regional economies can suffer from a ‘lock-in’
effect whereby a local specialization becomes obsolete and large-scale change is difficult
to achieve (Saxenian 1994; Maskell and Malmberg 1999). A parallel in the psychology of creativity literature is the notion of ‘groupthink’ whereby ideas become entrenched as a mentality of ‘majority rules’ takes over (Nemeth and Nemeth-Brown 2003). In this case it is not just a dearth of alternate ideas that leads to ‘lock-in’ but also a social resistance to them. An implication of this is that diversity is not only important as providing the raw materials of creativity but it also plays a role in the motivation to attempt creative acts. Every act of creativity is also to some degree an act of dissent as new knowledge has the potential to change existing norms and beliefs. Networks are not just about access to information but they also provide the basis for social support (Pearlin 1989). A part of more frequent and intensive interaction is that expectations and obligations rise which are backed by the threat of sanctions when not met (Coleman 1988). Sanctions can involve the withdrawal of social support and ultimately lead to one becoming ostracized from a network. When someone’s network is characterized by a prevalence of weak ties they will tend to feel less pressure to conform to a single ‘way of doing things’ than if strong ties were to predominate. This general notion can also be extrapolated to the larger environment. Once again Wirth (1938) addresses this as he explains that characteristically,

urbanites meet one another in highly segmented roles. They are, to be sure, dependent upon more people for the satisfactions of their life-needs than are rural people and thus are associated with a greater number of organized groups, but they are less dependent upon particular persons, and their dependence upon others is confined to a highly fractionalized aspect of the other’s round of activity. This is essentially what is meant by saying that the city is characterized by secondary rather than primary contacts. The contacts of the city may indeed be face to face, but they are nevertheless impersonal, superficial, transitory, and segmental. The reserve, the indifference, and the blasé outlook which urbanites manifest in their relationships may thus be regarded as devices for immunizing themselves against the personal claims and expectations of others.
There is less risk associated with acts of creativity in diverse urban environments as there is less overall pressure to conform to specific norms. The more patterns of behaviour that exist the more likely new ones will be accepted. Large cities offer a relative sense of anonymity that smaller places do not, thus relieving certain forms of social pressure while increasing others (Simmel 1969). Therefore, while the presence of local diversity may not increase the motivation to be creative, it can reduce disincentives to creative activity.

In summary, the presence of a greater degree of cognitive diversity in a place can foster higher levels of creativity due to factors of ‘access’ as well as ‘openness’. As creativity involves recombining existing knowledge into new and valuable outputs, access to a wide range of inputs provides an advantage. Additionally, diverse environments can mitigate social pressure to conform to specific norms, which can ultimately lead to fewer restrictions on creativity.

### 2.5 Economic Activity

Many studies of localized diversity (particularly in regional science) employ it as an independent variable in order to explain economic performance. This approach generally infers that creativity is the source of growth rather than making direct observations of the creative process (For example see: Rosenthal and Strange 2004). But as Glaeser (2003: 92) observes, “different time periods and different samples give different results which suggest that there is no universal truth on this topic”. Perhaps the main issue with this type of approach is that the link between creativity and economic performance has not been adequately explained, as opposed to the connection between diversity and creativity which is generally more effectively articulated. The creative process is inherently
inefficient and disruptive. Many novelties are rejected before one with significant value emerges. Value also can take a long time to develop or be appreciated (Simonton 1976). History is full of examples of artists who died penniless and unappreciated, whose work later became widely acclaimed. The key lesson is that change does not necessarily lead directly to increased economic value. Instead the focus can be more aptly directed towards the spatial distribution of economic activities that involve high levels of creativity.

Fujita and Thisse (1996: 345) state that, “in order to understand how an agglomeration occurs when Marshallian externalities are present, it is useful to divide human activities into two categories: production and creation”. While they are talking about knowledge production in the broader sense, their point that not all economic activities derive equal advantage from proximate sources of knowledge is well taken. Activities that involve mainly routine procedures (production) are more likely to benefit from externalities that are “pecuniary” in nature. The agglomeration of people who are primarily engaged in knowledge production has become increasingly recognized as a principal source of economic advantage. There are many different labels and definitions employed that attempt to capture this group. Examples include, “knowledge workers” (Drucker 1992), “symbolic-analysts” (Reich 1992); and “creative class” Florida (2002). These classification systems are generally operationalized by using occupational categories or levels of educational attainment. They also tend to be binary in that they attempt to identify those who are explicitly responsible for producing knowledge as a function of their daily activities (and by implication, those who are not). There does not
tend to be any distinction however, between types of knowledge production in terms of the subject nature of the knowledge in question.

There are a growing number of examples of classification systems that attempt to isolate economic activities that are particularly ‘cultural’ and ‘creative’ in nature. Some parse industries in order to identify economic activities that involve the production of ‘cultural’ goods and services (Caves 2000). Others utilize occupational categories to identify workers who produce knowledge that has distinct aesthetic or symbolic characteristics (Florida 2002; Markusen and King 2003). The broad rationale for making such classifications is the recognition that the underlying processes and institutions of ‘creative and cultural’ economic activities have distinct characteristics. There is a growing collection of case study research that is beginning to illuminate these characteristics in greater detail (For example see: Power and Scott 2004). If there is a general shortcoming of such work is that it often does not make direct comparisons between ‘creative and cultural’ economic activities and ones that are not.

Ashiem and Gertler (2005) have begun to address this issue by developing a classification system that accounts for an entire spectrum of economic activities according to specific types of knowledge production (See also: Asheim et al 2007). They propose three types of knowledge on which industries are based: analytic, synthetic, and symbolic. Analytic knowledge is typically associated with the natural sciences whereby the process of generating new knowledge involves algorithms and formal models. Synthetic knowledge is associated with engineering activities in which new knowledge is derived from using new combinations of existing knowledge in order to solve specific problems. Symbolic knowledge is described as being culturally and aesthetically based,
as it tends to rely on subjective norms and values. An advantage of utilizing such a framework is that industries can be compared in relation to one another according to these criteria instead of just examining ‘creative and cultural’ industries in isolation. An important implication behind this work is that there are different types of knowledge production that involve different types of processes. Subsequently, as these processes differ, the spatial-relational logics will also differ.

2.5.1 Operationalizing a Comprehensive Economic Activity Typology Framework

Operationalizing an economic activity typology framework is bound to involve producing somewhat false boundaries. While the precise lines that are drawn will always be in some way subjective, these judgements are necessary for further empirical research. To this end the proposal here is to present a framework for categorizing economic activity using two dimensions: knowledge intensity and knowledge type. Knowledge intensity can be gauged by measures of educational attainment. The percentage of the constituent workforce that hold higher education qualifications is a well accepted metric. There are fewer precedents for quantifying the second dimension. There are examples of research that specifically looks at particular fields of study, often favouring science and technology degrees, but they tend to focus on the profiles of whole regions rather than particular economic activities (Chapple et al. 2004). Within social science teaching we have little problem discussing the epistemological differences between fields of study and so it seems somewhat odd that we do not tend to have equivalent discussions when it comes to economic activities that depend on the production of knowledge. With this in mind there is an opportunity to transfer how we classify knowledge production within higher education to economic activity.
The second dimension can be operationalized by segmenting the post-secondary degree holders in the workforce by field of study. Applying this to the three types of knowledge production discussed earlier (creativity, innovation, and discovery), fields of study can be grouped according to the underlying subject matter of human experience (fine arts, humanities, social sciences, etc.), technology (engineering, applied sciences, etc.), and maths and basic sciences (physics, chemistry, biology, etc.). The point of utilizing field of study data in order to classify economic activities is not that the precise knowledge obtained during studies is necessarily important, but rather that it reflects the foundational knowledge and the ways in which new knowledge is absorbed and produced. A further advantage of such an approach is that it can be applied in the same manner to both underlying industrial and occupational classification systems whenever such data is cross-tabulated with detailed educational attainment figures.

Segmenting economic activities by type of knowledge production adds a third perspective on their basic underlying characteristics. In the way that industry classification systems are based on products, and occupational categories capture functional differences, types of knowledge production attempt to gauge general variations in the social dynamics of creativity, innovation, and discovery. It is these variations that present an opportunity to further develop the theory of agglomeration based on the social-relational characteristics of particular economic activities. If such an agenda is going to be advanced, future research will need to focus more carefully on the characteristics of relationships within varying knowledge production processes.
2.6 Conclusions: The Creative Advantage of Diverse City-Regions

The main contention presented in this paper is that localized cognitive diversity stimulates the creative process. However, the creative advantage that diversity presents is not necessarily immediately ‘better’ overall economic outcomes, but rather the agglomeration of highly creative economic activities. A key distinction between creativity and scientific discovery is the scope of who can directly participate in the production of knowledge. If creativity is about producing knowledge of human experience then by definition everyone can to some degree contribute to social change. Conversely, if scientific knowledge is mainly expanded from an existing codified base, then only those with the prerequisite knowledge can contribute to its growth. The notion that everyone is creative should not however be interpreted to mean that everyone is equally creative. Conformity and dissent are choices that are made to varying degrees between individuals. Key influences are specific to life histories, but also crucially, social environments. Certain places provide more openness to change and provide more opportunities for generating divergent thought. Diversity is a key mechanism that mitigates the impact of dominant, inflexible paradigms while also enabling a greater range of new possibilities.

For research to move past the current debate about the role of local diversity (versus specialization) new approaches to theory and research will need to be taken. From a theoretical point of view this means expanding the range of literatures used to support arguments for the creative advantages of diverse environments. And in particular, it means concentrating on the micro-processes that are affected by the relative level of local diversity. Traditional regional science based methods typically use some measure of local
diversity to explain levels of economic growth. The underlying assumptions are that firstly, there is more mixing of people with different knowledge sets in diverse environments, secondly, that more creativity occurs as a result of this mixing, and thirdly, that this creativity leads to economic growth. The theoretical discussion of this paper constitutes an attempt to provide a more detailed explanation of these assumptions.

These assumptions also need to be empirically tested and it would seem that traditional regional science data and methods are not well equipped to address the questions raised. This does not mean however, that case-study work can achieved this either as there is still a significant structure dimension to the problem that can only be effectively addressed with comprehensive and comparable data that can be linked back to the relative levels of local diversity. To this end the next three papers present different empirical elements that work separately but are essentially each part of a larger argument. The next chapter present an agent based model of creativity and agglomeration that seeks to demonstrate the role of local structure in the formation of social networks. More specifically, it shows how those residing in diverse local environments are more likely to develop and maintain diverse social networks. As this model is abstract and does not incorporate and outside data sources the findings must be verified with additional statistical analysis. The next two chapters attempt to do this from different scalar perspectives. Chapter 4 is top-down in that it takes a more traditional regional science approach, but instead of linking local diversity with economic performance it demonstrates a correlation between diversity and the geographic concentration of creative economic activities. Chapter 5 takes a bottom-up view by examining the social network characteristics of workers. The findings show that individuals working in creative and
cultural occupations and industries tend to have larger and more diverse social networks than any other category of worker. Despite these findings it is clear that if research on the role of diversity in the creative process is to move forward there is a significant need for relational data to be collected on a geographic basis so that stronger connections can be made between local socio-economic structure and the structure of social networks.
Chapter 3
CREATIVE ECONOMIES OF SCALE:
AN AGENT-BASED MODEL OF CREATIVITY AND AGGLOMERATION

3.1 Introduction

Over the past decade there has been increased attention given to ‘creativity’ in the economic geography literature (Scott 1997; Florida 2002b). This body of work is an extension of research on the ‘knowledge economy’ more generally, and is based on the notion that economic well-being relies to a significant extent on the talents of the local labour force and in particular their capacity to adapt and learn (Foray and Lundvall 1996). While the breadth and complexity of this research generates many interesting avenues of research it also presents many difficulties. The highly intangible nature of knowledge makes direct observation of learning and creativity quite challenging. As creativity is such a fundamental process to the evolution of societies it receives attention from a wide range of academic disciplines. Much of the psychology literature on creativity focuses on correlating the creative abilities of individuals with other personal traits and characteristics (Gardner 1993; Csikszentmihalyi 1996; Dollinger et al. 1996; King et al. 1996; George and Zhou 2001). The social psychology literature extends outward to incorporate the immediate social context into the analysis, often by studying well defined groups such as firms or in controlled experiments (Amabile et al. 1996; Milliken and Martins 1996; Perry-Smith and Shalley 2003). Sociology contributes to the topic vis-à-vis social network analysis which helps to illuminate the social dynamics of learning and knowledge flows (Granovetter 1973; Burt 1992). A common approach to the subject in the economic geography literature is to study certain ‘creative’ industries or occupations and the local contexts in which they operate (Grabher 2001; Markusen and King 2003).
Each of these approaches has certain strengths as they focus on particular aspects of the creative process and subsequent outcomes yet due to the highly complex nature of the subject an overall picture that span the aspects of time/space and agency/structure presents an elusive goal (for a general discussion of these issues see Plummer and Sheppard 2006). Furthermore, research on knowledge and its production and its transfer is difficult due to its highly intangible qualities which make direct observation and measurement quite problematic (Krugman 1991).

This paper proposes that an agent-based model approach can provide insights to the various facets of the creative process, from individual traits and actions, to social contexts and patterns of inequality. In general, such simulations can help illuminate how individual actions may affect larger structures and in turn how these structures may affect individual action over time and space. They can be effective tools for demonstrating how socio-economic inequalities theoretically form and persist between individual agents, groups, and locations (Fowler 2007). A further advantage is that knowledge and knowledge flows can be an explicitly incorporated in such models thereby negating problems of direct observation and quantification.

Specifically, the model presented in this paper seeks to explore particular notions of the socio-spatial dynamics of the creative process. For example, the model tests whether relatively more diverse local environments provide a creative advantage to its constituents. It also used to investigate the relative importance of individual traits versus social context with regards to the propensity of agent creative activity. A further advantage of the agent-based model approach is that it provides the ability to perform normative experiments. Initial conditions can be altered in order to test various scenarios.
One intriguing manner in which this can be done is to give various locations in the model the ability to have unique policies which in turn have an affect on the likely actions of its inhabitants. Such scenarios are used to test various strategies of talent attraction and retention as well as education within an artificial setting.

3.2 Theoretical Foundations of the Creative Process

Before getting into the specifics of the model it is important to first cover some basic theoretical and methodological ground. To begin with a brief discussion of defining ‘creativity’ itself is required. Two key concepts are included in virtually every definition of creativity: novelty and value. Both of these concepts require clarification in their own right. For instance, Boden (1994) asks whether novelty must be ‘new’ to the individual who thinks it or ‘new’ to the world in general. Others prefer to define creativity as being ‘divergent’ (Hochevar 1981) rather than novel, thereby stressing change rather than growth. The concept of ‘value’ is also questioned as it is a highly subjective term itself. For example, Sternberg and Lubart (1999) prefer the expression ‘appropriate’ as it conveys a more specific sense of context. While others favour ‘useful’ (Unsworth 2001) which emphasizes that creativity has purpose. Notions of creativity begin to vary significantly when nuances are added to the basic novelty and value definition. These nuances tend to discriminate between types of novelty and value. For example, Amabile (1996) makes a distinction between ‘heuristic’ and ‘algorithmic’ knowledge production, whereby the former involves socially constructed norms and values and the latter does not. Sternberg and Lubart (1996) make a similar distinction between novelties that are generated in response to ‘open’ versus ‘closed’ problems. They contend that ‘closed’ problems involve a single solution that must be figured out as opposed to ‘open’
problems that involve a degree of subject input from the creator. Unsworth (2001) builds on these ideas by proposing four types of creativity based on two axes: open/closed problems and specific/discovered problems. The specific/discovered axis relates to whether the problem at hand is originated internally or externally. Further distinctions are made according to subject matter. For example, Fiest (1999) separates ‘artistic creativity’ from ‘scientific creativity’. Santagata (2004) differentiates between ‘creativity’ and ‘innovation’ by claiming that creativity is ‘non-utilitarian’ and ‘non-cumulative’ and innovation is ‘utilitarian’ and ‘cumulative’. Asheim and Gertler (2005) offer a framework for different types of industries based on three different types of knowledge-bases: symbolic, synthetic, and analytic. They associate symbolic knowledge, which involves a high degree of cultural norms and values, most closely with the creative process.

A further crucial aspect of the creative process is the view that novelty is derived from making new combinations of existing knowledge (Jacobs 1969; Weitzman 1998). An extension of this notion is that possessing a wider variety of knowledge increases the possible number of new combinations and therefore enhances the probability of creative activity. Perhaps the most important implication of this idea is that it highlights the social aspects of the creative process in that it stresses the role of learning and networks (Powell et al, 1996). The significance of ‘weak ties’ is particularly apparent when it is considered that access to a variety of knowledge requires access to a variety of people from a variety of backgrounds and communities. This line of reasoning can be extended to incorporate geography by factoring in the extent of local diversity and variety of immediately accessible learning opportunities (Desrochers 2001). Existing knowledge is in a sense the
raw material of the creative process and thus places with an abundant variety of knowledge possess a creative advantage over places that are relatively more homogenous.

A final relevant facet of the literature on the creative process deals with motivation (Ambrose and Kulik 1999). From an economic geography perspective it may be tempting to take the view that creative activity has an economic function and thus is driven by economic rationales, much research from the psychology literature suggest that motivation to ‘be creative’ is primarily intrinsic (Amabile 1996). In other words, people cannot normally be enticed or coerced into being ‘more creative’. Instead, people tend to be more or less creative in response to the social environment that they inhabit. The implication is that in order to stimulate creative activity optimal conditions must be established. In this respect an economic geography perspective is quite apt in that context is a primary driver of the creative process and notions of ‘creative cities’ (Scott 1997; Hall 2000) are an important component of the wider range of creativity literature.

3.3 An Overview of the Agent-Model Approach

As agent-based modelling is still an emerging method it is important to first provide an overview of the basic principles of ABM before getting into the details of the specific model presented in this paper. Agent-based models are essentially simulations of human processes. Page (2007) provides an example of how ABMs can be used to model creativity in social settings. Axtell and Florida (2001) demonstrate their application to simulating agglomeration and the development of urban structures. The general approach of this paper is to combine these two applications in order to examine the connections between agglomeration and the creative process.
As the name suggests ABMs model the actions of individual agents within the parameters established by the model builder. The name however, can also give a somewhat false impression that agency is privileged over structural considerations, when in fact structure is an essential component of any ABM. One of the most compelling aspects of the ABM approach is that they are able to demonstrate how agency and structure affect one another. This is possible due to the stochastic nature of ABMs whereby the characteristics of agents and structures evolve from the beginning of a model to the end. In this respect the processes within ABMs involve a certain degree of path dependency in that the actions of agents are not only affected by their previous actions but by the previous actions of all other agents in the model. It is important to note that more advanced ABMs are not deterministic but instead incorporate probabilities of certain actions. These probabilities are often dynamic in that the relatively likelihood of certain events change in response to previous events. A benefit of this is that ABMs can be effective at demonstrating how socio-economic inequalities tend to build and persist between individuals as well as between groups and locations.

One of the challenges of the ABM approach is that due to their non-deterministic character each run of the model produces a different set of actions and outcomes. Thus, analysis of results is not a straightforward exercise. This requires that the model be run multiple times and the basis of analysis is derived from finding patterns between the set of results. In other words, the researcher seeks to make generalizations based on tendencies of outcomes rather than by a single optimal formula as is common in other types of modelling. A further challenge stems from the abstract nature of such models which provoke questions of external validity. As such models can only incorporate fairly
general aspects of decision making and decision making environments they cannot claim to precisely replicate ‘real’ situations. Instead, it is crucial that the results of such models are found to be generally congruent with outcomes found by complimentary research approaches. This point is discussed in more detail at the conclusion of this paper.

3.4 Model Outline

The model presented in this paper attempts to simulate the social dynamics of the creative process over space and time in order to broadly investigate such things as: local diversity versus specialization; individual versus social views of creativity; the role of city size; as well as the potential effects of local policies. The goal of the agents in the model is to produce novel ideas and distribute these ideas as widely as possible. As there are discrete locations built into the model this creative activity occurs in certain places and so it is also the goal of locations to foster local creative activity. In order to achieve this goal agents repeatedly perform four types of action: social interaction; learning; creativity, and; migration (Please see Figure 3.1). These actions are framed by specific criteria (outlined in detail in the following section) that establish the probabilities of certain actions and outcomes.
Figure 3.1: Cycle of Agent Actions and Guiding Factors

**Social Interaction**
- FACTORS:
  - Cognitive Distance
  - Physical Distance
  - Previous Interaction
  - Total Knowledge

**Migration**
- FACTORS:
  - Learning Opportunities
  - Previous Relationships (location)
  - Amount of Knowledge (agent)

**Learning**
- FACTORS:
  - Type of Interaction (F2F/Non-F2F)
  - Cognitive Distance

**Creativity**
- FACTORS:
  - ‘Mastery’ of >1 category
  - Diversity of Knowledge
In the initial scenario² there are 250 agents equally distributed between 10 locations. At the outset the agents have possess single ‘unit’ of knowledge. At the outset of the model there are 10 nominal categories of knowledge (labelled 0-9). In the first scenario the 10 categories of knowledge correspond with the 10 locations and so each location contains 25 homogeneous agents. Thus, each location and agent begins from an equal position with the only differences being qualitative (category of knowledge). The ultimate goal of the agents is to combine two of these categories of knowledge, thereby ‘creating’ new knowledge. Throughout the course of the simulation agents interact with other agents and learn from these encounters. Agents become increasingly differentiated as a result of unique patterns of interaction and learning. This heterogeneity takes on an increasingly quantitative dimension as time passes as particular agents and locations develop more or less favourable network positions that in turn produce unequal distribution of (knowledge) resources. Each run of the model is the same length. This duration is derived from the general point in time when all possible new combinations have been created and diffused to some degree. The following section outlines in more detail the specific mechanisms built into the model and provides supporting theory for each type of action.

3.4.1 Social Interaction

With each cycle of the model every agent has the opportunity to interact with every other agent. However, interaction between some agents is more likely than between others. The likelihood of interaction is broadly based on the principle of ‘least effort’ (Zipf 1949). This means that the probability of interaction rises as the impediments are

² Further scenarios, discussed later in the paper, insert initial inequalities into the model in order to gauge their impact.
reduced and vice versa. Two forms of distance act as the main constraints to interaction in the model: cognitive distance and physical distance.

The concept of homophily suggests that people tend to choose to interact with others who are similar to them (McPherson, Smith-Lovin and Cook 2001). Therefore, the less two agents have in common the less likely they are to interact. Cognitive distance is based upon a comparison of the knowledge profiles of every possible pair of agents. As agents can ‘know’ any amount of the 10 nominal categories of knowledge, their profiles differ over time as they learn from their social interactions. Thus, agent pairings with lower ‘cognitive distance’ (measured by similarity of knowledge profiles) are more likely to lead to an interaction.

Despite the existence of communication technology, local interaction remains more common than non-local interaction. Interaction facilitated by communication technology most often reinforces relationships that also have a significant face-to-face dynamic (Brown and Duguid 2000). Physical distance is represented as a simple binary with local (same location) interactions being more likely than non-local interactions. In the model locations are conceived as places whereby face-to-face contact would regularly take place.

By adding the two main interaction constraints together, the most probable interactions are between similar agents who share the same location. Conversely, the least probable interactions are between agents with little in common who do not share the same location. Somewhere in between are interactions involving agents who have much in common but do not share the same location and interactions involving agents with little in common who do share the same location.
There are also two secondary factors (weighted less) that influence the probability of interaction: frequency of previous interaction, and; total (knowledge) resources. The more two agents have interacted in the past the more likely they are to interact in the future. Essentially a degree of trust is built up between agents who are familiar with one another. Additionally, agents with a greater amount of knowledge have higher probabilities of interaction as they are in higher demand. The more knowledge an agent has, the more every other agent can learn from them. This will be discussed in greater detail in the next section on agent learning.

3.4.2 Learning

The model seeks to isolate a certain type of learning, that being learning that results from social interaction. Thus, knowledge in the model is purely socially constructed, as opposed to knowledge derived from sensory encounters with a material world (which is explicitly omitted from the model). Following on from the previous section, agents in the model have an opportunity to learn each time they interact with another agent. However, not all interactions bring the same degree of learning opportunity. For every interaction there are 20 possible learning opportunities as there are two agents and 10 nominal categories of knowledge. A probability is calculated for each of these possibilities. These probabilities depend on whether or not the interaction is face-to-face as well as how much knowledge each agent possesses of each category of knowledge. Thus, there is a greater likelihood of learning when two agents interact face-to-face and have similar knowledge profiles.

This stage of the model is concerned with the interactions which were identified by the previous stage. The first step determines whether each identified interaction occurs
face-to-face or not face-to-face. If the two agents in the interaction are in the same location then there is a much higher probability of them interacting face-to-face than if they are in different locations. Non-local interactions that are face-to-face are meant to represent instrumental short-term travel for the purpose of meeting directly. Such action is considered much less common than regular local face-to-face relationships.

Learning occurs as a result of the interaction. Precisely what is learned depends upon what the two agents already know. Agents are more adept at both learning and teaching what they already know best. This relates to Nooteboom’s (2000) notion of cognitive distance whereby knowledge is more easily transferred when it is closely related to what is already known. As each agent knows a certain amount of each of the 10 categories of knowledge, they know some things ‘better’ than others. They are more effective at learning and teaching each category of knowledge according to rank order. Essentially, the probability of teaching/learning decreases on a scale of 1 to 10. This is a combination of both agents’ knowledge category rankings in order to reflect one agent’s ability to teach and the other’s ability to learn a particular category. These probabilities are reduced across-the-board if the interaction is determined to be non-face-to-face. This reflects the idea that face-to-face contact enhances the learning potential of interaction (Gertler 2003; Storper and Venables 2004). Once it has been determined that learning has occurred for certain categories of knowledge in each direction between the two agents, the learning agent gains a fraction (1/100) of what the other agent knows. So if agent ‘x’ is determined to have learned knowledge category ‘a’ from agent ‘y’, agent ‘x’ gains 1/100 of what agent ‘y’ knows of ‘a’. As agents learn from each interaction their
knowledge profile grows and changes. This will then affect their probabilities of future interaction and learning.

3.4.3 Creativity

As the agents learn from their interactions they acquire more and different knowledge. When the agents interact with similar agents they tend to increase the amount of knowledge of what they are already most familiar with. When they interact with agents that are less similar they likely learn less overall, but what they learn is more likely to be different from what they already know. Learning across knowledge categories sets up the possibility of agents ‘creating’ whole new categories of knowledge. This is based on the notion of knowledge production from recombining existing knowledge (Weitzman 1998). Thus, creativity occurs in the model when an agent combines two of the existing categories of knowledge. For example, by combining knowledge category ‘a’ and ‘b’ an agent ‘creates’ category ‘ab’. Since there are 10 initial categories, there are 45 possible new combinations (as order does not matter: e.g. ab = ba). Once an agent has created a new category they are ‘credited’ with that creation. No other agents can then make the same combination as it ‘has already been done’. In order to be in a position to make a new combination an agent has to learn a certain amount of two categories of knowledge. This is based on the view that people must ‘master’ particular fields in order to develop them further (Simonton 2000). In the model there is no possibility that an agent will be creative until they have crossed the ‘mastery’ threshold of two categories. The probability of an agent creating a new category increases as their knowledge grows past the threshold levels.

3 It is possible that a new category can be created by more than one agent simultaneously. In such a case credit is equally divided between the agents.
Once a new category of knowledge is created it can then be learned and taught by other agents. Learning and teaching second generation knowledge (new categories) is very similar to how first generation is taught and learned in that it is based on agents’ existing knowledge profile. The key difference is that it is based on the relative existing knowledge of the two components of the new combination. For example, an agent is more likely to learn ‘ab’ if they have a relatively high level of knowledge of both ‘a’ and ‘b’. Therefore, agents are more accepting of new knowledge that has some degree of familiarity to them.

### 3.4.4 Migration

The fourth action that agents can perform is migration. Agents can decide to ‘reside’ in any one of the 10 locations for each cycle of the model. As with the other forms of action, certain location outcomes are more likely than others. Probabilities are calculated for the likelihood of each agent residing in each location. The two key factors that affect location probabilities are: the potential learning opportunities in each location, and; the location of an agent’s recent (previous cycle) relations. These are often competing factors as they tend to relate to seeking either weak-ties which provide greater learning opportunities (Granovetter 1973; Burt 1992) or strong-ties which provide community (Nelson 1989). Specifically, locations that offer the greatest learning opportunities are defined by the average amount of knowledge that each currently residing agent has. This signals that the agents have previously done the most learning, but also that they now have the most to teach. These locations also tend to have the larger populations. Alternately, agents are apt to reside in locations where they have had the most interaction. These locations will tend to have more similar agents (due to frequent
interaction and learning) and thus they provide a higher degree of certainty that further connections will be made and maintained. Moving to a new location with which an agent has had less previous interaction increases the risk that they will not form local relationships.

An additional factor of migration in the model is the amount of knowledge that an individual agent has. Agents that have more knowledge are more likely to move. This is based on the notion that people with more resources (particularly human capital) are more mobile. The amount of knowledge an agent has essentially acts as a multiplier to each probability. As probabilities are calculated for each location it is possible that more than one location will be selected. In these cases the tie results in no movement. It therefore takes a significant confluence of factors in order to bring about agent migration.

3.4.5 Model Summary

The four sets of actions generate an iterative process whereby agents learn from their interactions with one another. This learning sets the context for further interaction and learning from which agents can ultimately create new knowledge. As local contexts affect patterns of interaction agents can decide to change locations in order to change their personal network characteristics. Figure 3.2 provides an outline of how the model functions by describing the interplay between the four dimensions of agency/structure and space/time. The primary direct connection between agency and space relates to how agents migrate between locations. As the model progresses the populations in each location become heterogeneous both qualitatively and quantitatively. In the context of the model this means that locations are structurally different from one another. This provides geographically varying opportunities for learning as networks are strongly influenced by
face-to-face interaction. Agents have the ability to change and adapt, but the actions of other agents influence their chances of success. Inequalities in learning, and ultimately creative activity, are largely (but note solely) the result of the evolution of these geographic (dis)advantages. While these spatial-structural inequalities are not totally deterministic in character they do tend to be ‘sticky’ and highly path dependent over time. These outcomes are discussed in more detail in the following sections.
Figure 3.2: Modelled Interrelationships between Agency/Structure and Space/Time

<table>
<thead>
<tr>
<th>SPACE</th>
<th>AGENCY</th>
<th>STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F2F interaction; 'buzz'; 'being there'</td>
<td>Agglomeration</td>
</tr>
<tr>
<td></td>
<td>Migration</td>
<td>Regional (dis)advantage</td>
</tr>
<tr>
<td>TIME</td>
<td>Learning</td>
<td>Path dependency</td>
</tr>
<tr>
<td></td>
<td>Creating</td>
<td>'Sticky' inequalities</td>
</tr>
</tbody>
</table>

Network position

Power in numbers

Evolutionary geography
3.5 Model Metrics

It is said that agent based modeling represents a ‘third way’ of doing social science in that it involves a combination of deduction and induction (Judd and Tesfation 2006). Deductive assumptions are built into the model yet there is a great deal of uncertainty as to what the results will be due to the stochastic and probabilistic nature of ABMs. Thus, the resulting data must be analyzed inductively. A key step in this process is the construction of indicators. As the primary goal of this paper is to help explain the creative process, and particularly how local context affects the creative process, the main dependent variables derived from the model are concerned with the levels of creativity of individual agents but also the levels of creativity occurring within each location. Furthermore, as meaningful results can only be obtained from analyzing multiple runs of the model, differences in macro-level patterns can also be examined. For example, different runs produce different distributions of population across the 10 locations and so each run can be examined in order to determine such things as whether having one dominant location tends to produce more (or less) overall creativity.

3.5.1 Dependent Variables: Novelty and Creativity

Basic definitions of creativity typically involve two key elements: novelty and value. The production of novelty does not guarantee value. Novelty is only as creative as it is judged in some way valuable by others. Value presupposes novelty. With this in mind two indicators are constructed, one that signifies the generation of novelty, and a second that incorporates value in order to measure creativity. Novelty is measured by the number of new knowledge combinations made, while the measure of creativity includes how much a new combination has been learned by the agent population.
Generating these indicators for individual agents is fairly straightforward. When an agent produces novelty they receive credit for it. Subsequently their level of creativity is determined by how thoroughly accepted that novelty has become by the end of the model. Agents are capable of producing more than one new combination of knowledge. Additionally, new combinations can be produced by more than one agent simultaneously. In these cases the agents are credited with a corresponding fraction of both the novelty and the creativity.

Generating these indicators for locations is more complicated. This is due to the fact that agents migrate between locations. So for example, if agent ‘x’ produces novelty in location ‘y’ but then moves to location ‘z’ which location is credited with the agent’s novelty and creativity? This problem is partially addressed by producing two types of location indicators: embodied and disembodied. Embodied indicators assign novelty and creativity to individual agents and so which ever location they reside in gets credit for their action. Conversely, disembodied indicators assign novelty and creativity to the location in which the novelty occurred. If the agent then moves to another location the original location maintains credit. Additionally, these indictors are constructed in a cumulative manner in that they count the total amount of activity in each location over an entire run of the model. Thus, location indicators take into account the entire ‘history’ and not just a snapshot at the conclusion of a run. So for example, a location’s ‘cumulative disembodied novelty’ counts how many new combinations of knowledge were produced locally over the course of one run of the model.

In addition to generating indicators for individual agents and locations, indictors can also be produced for each run of the model. As there are a finite number of new
combinations of knowledge, the same amount of novelty is produced in each run. However, the overall level of creativity varies between runs as novelty is taught and learned at different overall rates. These variations are mainly due to differing overall levels of social interaction which in turn are primarily caused by differing patterns of population distribution.

3.5.2 Independent Variables: Knowledge, Ties, and, Flows

As with the dependent variables, the independent variables can be assigned to three scales: agents, locations, and runs. While the key indicators at each level may vary, they are all typically derived from aggregating the individual actions and characteristics of agents. They also tend to be associated with amounts of knowledge, interaction, and flows of knowledge (teaching/learning). Amounts of knowledge can be divided into the categories of knowledge or used in aggregate. Differing levels of knowledge can also indicate relative inequality. Interaction can be divided into different types based on a set of dualities: local versus non-local; face-to-face versus non-face-to-face, and; intra-group versus inter-group (groups of agents are identified according to predominant knowledge category). Thus, there are eight types of interaction. Differing patterns of interaction between agents, locations, and even runs, can lead to different outcomes. Knowledge flows are also categorized in this manner, but it is important to keep in mind that the pattern of interaction does not equal the pattern of knowledge flows as different interactions result in different amounts of learning.

3.6 Analysis

Each run of the model produces its own ‘history’. While no two of these ‘histories’ are exactly the same, running the model multiple times reveals certain patterns of
behaviour and outcomes. This section first describes what typically happens in each run of the model. It also explains why some agents are more creative than others despite starting from equal positions. Particular attention is paid to why location matters to the creative process. Subsequently, the traits of locations are scrutinized in order to explain why certain contexts are more conducive to creativity.

### 3.6.1 Creative Behaviour

As there are only 45 possible new combinations of knowledge and 250 agents, only some agents will produce novelty in any given run of the model. Comparing the individual histories of ‘creative’ agents and ‘non-creative’ agents over multiple runs of the model can illuminate certain patterns of behaviour that enhance the likelihood of individual creative action.

The agents that are ‘creative’ are the ones that manage to ‘master’ more than one category of knowledge and then are the first to combine them. Clearly this means that these agents have managed to learn differentiated knowledge by bridging two or more groups. The key to understanding why certain agents manage to be creative depends on understanding the most effective way in which previously unconnected knowledge is brought together. The answers lie in the patterns of interaction and learning of creative agents. First of all, and somewhat surprisingly, it was found that the overall geographic pattern of relationships did not tend to vary significantly (Please see Table 3.1). For example, creators had roughly the same ratio of local-to-non-local interactions than non-creators. One difference was that creators tended to have slightly more interactions than non-creators. The majority of this difference is explained by the fact that creators tended to be in larger places and therefore had more local network possibilities. While the sheer
number of interactions was found to be important, the single most important factor that led to agents being creative was their probability of direct local contact with other agents from different groups. In other words, the agents that had the most local bridging opportunities were the ones that were most likely to be creative. These agents typically had wider social networks. Building wider social networks was also found to be facilitated by migration, and so creative agents were more likely to have moved between locations than non-creative agents.
Table 3.1: Differences in the Patterns of Interactions of Creators and Non-creators

<table>
<thead>
<tr>
<th></th>
<th>Local F2F</th>
<th>Local Non-F2F</th>
<th>Non-Local F2F</th>
<th>Non-Local Non-F2F</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Creators</strong></td>
<td>153</td>
<td>153</td>
<td>2</td>
<td>153</td>
<td>461</td>
</tr>
<tr>
<td></td>
<td>16.0%</td>
<td>16.1%</td>
<td>0.2%</td>
<td>16.1%</td>
<td>48.4%</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>80</td>
<td>3</td>
<td>328</td>
<td>492</td>
</tr>
<tr>
<td></td>
<td>8.4%</td>
<td>8.5%</td>
<td>0.4%</td>
<td>34.4%</td>
<td>51.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>233</td>
<td>234</td>
<td>5</td>
<td>481</td>
<td>952</td>
</tr>
<tr>
<td></td>
<td>24.5%</td>
<td>24.5%</td>
<td>0.5%</td>
<td>50.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Non-Creators</strong></td>
<td>152</td>
<td>152</td>
<td>1</td>
<td>135</td>
<td>441</td>
</tr>
<tr>
<td></td>
<td>17.6%</td>
<td>17.6%</td>
<td>0.2%</td>
<td>15.6%</td>
<td>50.9%</td>
</tr>
<tr>
<td></td>
<td>62</td>
<td>62</td>
<td>3</td>
<td>299</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>7.2%</td>
<td>7.2%</td>
<td>0.3%</td>
<td>34.5%</td>
<td>49.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>214</td>
<td>214</td>
<td>4</td>
<td>434</td>
<td>866</td>
</tr>
<tr>
<td></td>
<td>24.7%</td>
<td>24.7%</td>
<td>0.5%</td>
<td>50.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
3.6.2 Creative Economies of Scale

Local context was the most important factor in influencing individual creative activity so it was no surprise to find clear patterns of geographic creative advantage. The locations in which more creative activity occurred tended to have two distinct characteristics: they were larger, and; they had more diversity. The starkest finding of this analysis was that for every percent increase in share of population, locations had a three percent increase in share of novelty (Please see Figure 3.3). However, it was not size alone that mattered, as local diversity (i.e. agents from different groups/primary knowledge categories) was found to be significant. It was these two factors in conjunction that tended to lead to more creative outcomes. Larger places were more likely sites of local bridging between groups and thus more likely to contain creative activity.

The relationship between location size and diversity should not be viewed as coincidental as size was found to be necessary in sustaining diversity and vice versa. Locations with more agents could sustain diversity because they were more likely to have multiple members of various groups. Agents could maintain their intra-group ties locally while maintaining their original affiliation (to their original knowledge category). In smaller locations, if a significantly ‘different’ agent had a fairly high level of local contact their knowledge profile became more similar to their physical neighbours over time. Conversely, if that agent did not manage to make very many local connections (due to their difference) they were likely to move back to their previous location. Larger locations were also able to maintain their size by attracting in new migrants who had pre-existing contacts to the various groups. Since smaller locations had less diversity they had
fewer intra-group non-local linkages that facilitated in-migration. These factors produced a self-reinforcing relationship between size and diversity which in turn significantly affected creative outcomes.
Figure 3.3: Creative Economies of Scale

\[ y = 3.056x - 0.2066 \]

\[ R^2 = 0.7865 \]
One final related set of analyses concerns the differences in the overall levels of creativity between runs of the model: specifically, how the overall pattern of population distribution between locations affected creative outcomes. The results show that there was a positive relationship between the size of the largest location and overall levels of creativity. In other words, the overall level of creativity tended to be higher when the most populous location was significantly larger than in other runs. The main explanation for this was that there ended up being less divergence of agent knowledge profiles, or in other words one category of knowledge became highly dominant when there was a highly dominant location. The diversity that helped spur novelty eventually gave way to homogeneity from higher levels of local interaction. This homogeneity then meant that there tended to be less overall cognitive distance and therefore increased levels of interaction and learning. So while diversity facilitated the generation of novelty, homogeneity helped facilitate the diffusion of novelty. It must be said however, that if the model were extended to include further combinations (i.e. 3-digit, 4-digit, etc.) the runs with greater homogeneity could eventually falter.

At each level of analysis the importance of context to the creative process is quite evident. Agents are more likely to be creative if they reside in locations with larger numbers of bridging opportunities. Locations are more likely to generate creative activity if they are large and diverse. More overall creativity is likely when there is a single dominant location. The common reasoning between these findings is that if creativity occurs when previously unconnected knowledge is combined and inter-group interaction is facilitated by physical proximity, then locations that provide the greatest opportunity for local bridging will generate more creative activity.
3.7 Scenarios

One of the distinct advantages of using agent-based modeling is the ability to perform normative experiments. The following section outlines four scenarios in which the initial assumptions of the model are either changed or added to in order to alter the outcomes of the model. The first two scenarios alter the initial assumptions in a manner that affects the individual behaviour of the agents. The latter two scenarios add organizational assumptions about locations and their ability to regulate activity.

3.7.1 Scenario 1: Diversity versus Specialization

The first scenario tests theories about the relative advantages of diversity versus specialization (for recent overviews see: Feldman and Audretsch 1999; Glaeser 2003). While the initial model setup included homogeneous populations in each of the ten locations, this scenario began with five homogeneous locations and five heterogeneous locations. What this means is that five of the locations each had five groups (differentiated by category of knowledge) of five agents while the other five locations had 25 homogeneous agents. Otherwise the model was exactly the same as the original.

The results of this scenario show very clear differences between the outcomes of originally diverse locations and specialized ones. More novelty (new combinations) was generated in diverse locations (60% share). However, despite producing less novelty, specialized locations displayed a much greater propensity to derive value (diffusion of new combinations) from the novelty they produced. In total 83.8% of all creativity occurred in specialized locations. The reason for this was that in some cases single new combinations became very widely adopted. This occurred in certain runs of the model as the specialized locations were more likely to become highly dominant and therefore able
to project their paradigm to the other locations. However, in roughly half (54%) of the
runs a diverse location ended up as the largest location, but did not end up as dominant
because it did not begin with a clear identity. Overall, there was 4.3 times more creativity
in this scenario than there was in the original model. This was due to earlier connections
between categories of knowledge due to the initial local mixing of groups.

In summary, the results of this scenario do not suggest that diversity or
specialization is inherently ‘better’ than the other. Instead they suggest that each has
certain advantages. The diverse locations were better for generating novelty while the
specialized locations were better for communicating novelty. This finding is generally
congruent with past debates about diversity versus specialization and weak ties versus
strong ties.

3.7.2 Scenario 2: ‘Nature versus Nurture’

The second scenario tests theories concerning how much of individual creativity is
the result of innate ‘natural’ ability versus social context (Martindale 1999). In this
scenario agents are given ‘natural’ abilities in addition to their knowledge profile. There
are three distinct abilities that correspond with three of the forms of action. Each acts as a
multiplier on the probabilities generated by the initial model. The multipliers are
normally distributed above and below 1 with a standard deviation of 0.25. The first
ability either enhances or suppresses social interaction. It can be thought of as emotional
intelligence or charisma. The second ability impacts agents’ learning capacity while the
third affects their ability to make new combinations of knowledge once they are in a
position to do so.
The results of this scenario show that having greater ‘natural’ abilities increases the chances of being creative, but that social context remained the pre-eminent factor. Creators were found to have higher levels of natural ability than non-creators (Please see Table 3.2). Furthermore, a greater ability to learn was the most influential of the three. Conversely, an innate ‘creative’ ability proved to be the weakest. This can be explained by the fact that it is the last step in the production of novelty, as being in a position to be creative presupposes learning by interaction.

A logistic regression analysis indicated that the factors from the initial model proved to be stronger influences in determining which agents produced novelty. In other words, being in a large diverse location was more important that the natural abilities of the agents. Additionally, this scenario only produced roughly three times the amount of creativity as the original model. Adjusting the initial social environment assumptions (scenario 1) had a greater overall impact than adjusting the assumptions about the individual agents (scenario 2). The findings of this scenario generally support the notion that creativity is primarily a social process rather than an individual one.

3.7.3 Scenario 3: ‘Education’ Systems

The third scenario is the first of two that introduce organizational level assumptions to the model. In these scenarios each location is able to affect the behaviour of its resident agents. Thus, the analysis is concerned with the location-level outcomes in order to make normative assessments of various regulatory activities. In this scenario each location can help ‘educate’ agents by boosting their ‘natural’ abilities from the previous scenario. Each location allots their resources differently. Some locations focus on one of the abilities over the others (increase of 15%) while others spread them across all three
(increase 5% each). Also some locations focus on agents who are above the median while other focus on agents who are below the median on the ability in question. Two of the locations do not implement any policy (Please see Table 3.3).

All of the locations in this scenario were found to produce the most creativity some of the time, however certain ‘education systems’ did so more often. The most common ‘winner’ was the location that chose to focus its resources on boosting the ‘emotional intelligence’ of its resident agents that were already above the median (on emotional intelligence). The likely explanation for this is that social interaction is the first step in the process and so by intervening early a greater impact was achieved. It is also interesting to note that the ability that appears to matter most for the group (emotional intelligence) differs from the ability that mattered most to individuals (learning – from scenario 2). This suggests that the whole can be greater than the sum of the parts particularly when more interaction occurs. This point of this scenario is not necessarily to propose that jurisdictions implement education systems that focus on emotional intelligence, but rather that by finding ways to connect their citizens (particularly between different groups) they may be able to enhance local creative activity.
Table 3.2: Effect of Location ‘Education Systems’ on Agent Abilities

<table>
<thead>
<tr>
<th>Location</th>
<th>Emotional</th>
<th>Learning</th>
<th>Creative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 0</td>
<td>Above Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 1</td>
<td>Below Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 2</td>
<td>Above Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 3</td>
<td>Below Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 4</td>
<td>Above Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 5</td>
<td>Below Avg. +15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 6</td>
<td>Above Avg. +5%</td>
<td>Above Avg. +5%</td>
<td>Above Avg. +5%</td>
</tr>
<tr>
<td>Location 7</td>
<td>Below Avg. +5%</td>
<td>Below Avg. +5%</td>
<td>Below Avg. +5%</td>
</tr>
<tr>
<td>Location 8</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Location 9</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
3.7.4 Scenario 4: ‘Incentives-based’ Talent Attraction and Retention Strategies

Whereas the previous two scenarios altered the probabilities associated with the first three forms of action in the model (interaction, learning, and, creativity), this scenario enables locations to affect the probabilities of the fourth form of action: agent migration. Essentially, this scenario gives locations the ability to attract and retain agents by offering incentives. Similar to the previous scenario, locations are able to focus their resources on particular agents that they target. A key difference is that the agents do not have to reside locally in order to be affected by each location’s policy. Each TAR strategy involves boosting the location probability of targeted agents. The initial probabilities are calculated in the same manner as the original model. As in the previous scenario locations target agents based on their ‘natural’ abilities. Some locations focus on agents who have above average abilities while other locations focus on elite ‘stars’ (top 25 agents). Furthermore, certain locations can spread their resources across all three abilities aimed at either above average or star agents. Once again two locations had no policy (Please see Table 3.4).
Table 3.4: Effect of Location ‘Talent Attraction and Retention Strategies’ on Agent Abilities

<table>
<thead>
<tr>
<th>Location</th>
<th>Emotional</th>
<th>Learning</th>
<th>Creative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 0</td>
<td>Stars +30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 1</td>
<td>Above Avg. +6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location 2</td>
<td></td>
<td>Stars +30%</td>
<td></td>
</tr>
<tr>
<td>Location 3</td>
<td></td>
<td>Above Avg. +6%</td>
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<tr>
<td>Location 4</td>
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<td></td>
<td>Stars +30%</td>
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<tr>
<td>Location 5</td>
<td></td>
<td></td>
<td>Above Avg. +6%</td>
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<tr>
<td>Location 6</td>
<td>Stars +10%</td>
<td>Stars +10%</td>
<td>Stars +10%</td>
</tr>
<tr>
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<tr>
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</tr>
<tr>
<td>Location 9</td>
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<td>None</td>
<td>None</td>
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</tbody>
</table>
All of the locations were successful in becoming the largest and most creative location some of the time, but again some were ‘successful’ more often than others. The location that chose to focus their resources on attracting and retaining agents with above average learning ability ‘won’ roughly 20% of the time. The location that used its resources to attract agents with above average ‘emotional intelligence’ ability was most successful approximately 15% of the time. All other locations ‘won’ 10% of the time or less and so gained no advantage. What this suggests is that allocating resources more broadly was somewhat more successful. Also focusing on learning (the most important individual ability) and emotional intelligence (the most important collective trait) was more important than focusing on agents with higher ‘creative’ ability.

One further important point is that including TAR policies did not increase overall levels of creativity as much as including ‘education’ policies did. Part of the explanation for this is that TAR is essentially a zero sum game. Although it did boost migration somewhat and by extension increased inter-group interaction, it did not have the same overall impact. Also, people can only be swayed so much by incentives. If the opportunities and ties do not exist, then incentives are unlikely to be effective. Instead jurisdictions are likely better off focusing on these underlying conditions.

3.8 Discussion

This paper has two aims, the first of which is to contribute to the development of theory of ‘the geography of creativity’, and secondly to test the viability of agent-based modelling as a method for examining the creative process. In terms of the second point, it was found that the process of constructing the model was a highly enlightening task for the researcher in that it forces very detailed and specific theoretical connections to be
made. Perhaps the most significant advantage of using an ABM approach was the ability to tackle all dimensions of agency/structure and space/time at once. Clearly, economic geographers have traditionally excelled at analysis of the spatial dimension of economic activities and have probably been historically somewhat more focused on structure than on agency. The ABM approach provides a method for dealing with each of these dimensions, but also crucially with the dimension of time, the importance of which is expressed in recent calls for an ‘evolutionary’ approach to economic geography (Boschma and Frenken 2006). In some respects time is the dimension that grounds the others. Time acts as the constant that enables the researcher to demonstrate the interconnections between agency, structure, and space.

The ABM approach however, was not without problems. In particular, it was difficult to incorporate a wide range of theoretical guidelines without any single input becoming dominant as was the case with earlier prototypes. These earlier models did not produce interesting results as they tended to be predicable. However, once a balance was found between the various foundations of the model, the results became so numerous and varied that many of them could not be accommodated in this paper. For example, the model highlights many issues of power and inequality (as opposed to simply ‘successful’ outcomes) that were not discussed in this paper. This point highlights one of the most challenging aspects of using an ABM approach in that while the process is very enlightening for the researcher it is difficult to communicate the full extent of the findings as the process of building the model itself proved to be as instructive as the results. This is particularly true with respect to codifying the results in a paper as opposed to presenting the model in a face-to-face presentation (an irony not lost on this researcher).
especially in instances when the model can be actively demonstrated. An encouraging aspect to this is that ABMs may prove to be effective as teaching instruments. Preliminary attempts to use this and other ABMs in the classroom have so far bourn this out.

Despite the difficulties associated with communicating the findings of ABMs there are still many useful points of discussion generated by the model presented in this paper regarding theories of the creative process in a socio-spatial context. Generally, the model reaffirms the fundamental view of creativity as a broad social process rather than one that is confined to the minds of a select few. This is congruent with recent calls for a more relational approach to economic geography research (Bathelt and Gluckler 2003; Boggs and Rantisi 2003). Specifically, the model demonstrates the importance of local diversity to the creative process in that a wider range of locally available knowledge increases the likelihood of novel ideas being formulated. Scale is also vital in a couple of ways. First, diversity is only able to persist in large centres as assimilation forces are greater in smaller, less diverse places. Secondly, scale is important to the inter-regional transfer of novel ideas as more ‘pipelines’ tend to be available. Beyond these structural influences the model also demonstrates that local institutions matter. The last two scenarios incorporate local ‘policies’ not so much as to try and predict which policies might be most appropriate in the ‘real’ world, but to show that they can have a positive impact on the creative process. The lesson is that a laissez-faire attitude to creativity is not necessarily the most effective stance.

A final note on which to conclude combines the viability of the ABM and the results that are generated. As with any model that is abstract in nature the biggest
question mark is the external validity of the findings. It is thusly crucial to demonstrate significant linkages to research that make tangible observations of the processes simulated in the model. Practically, this can be accomplished in two ways. First, many attempts have been made at establishing clear statistical relationships between local diversity and local economic performance. In such attempts it is often the case that ‘creativity’ is the theoretical underlying mechanism that is credited with driving economic growth. It is not common, however, to find examples that try and make more direct measurements of ‘creative’ activity. Instead, the typical approach employs structural variables while assuming that certain micro-processes are taking place. Chapter 4 attempts to accomplish this by demonstrating that local diversity is a much stronger predictor of the concentration of highly creative industries than it is of overall local economic performance. The second manner in which to connect the model to more tangible research deals with the dimension of agency. The model suggests that having wider and more diverse social networks increases the creative potential of individuals. To this point analysis in chapter 5 indicates that people working in highly creative occupations and industries tend to have larger, more diverse, and more dynamic social networks than any other category of worker. A further important step in this research will be to demonstrate how the characteristics of the local environment affect the composition of peoples’ social networks. By doing so it will help further our understanding of how place affects how people learn, and ultimately generates creative activity.
Chapter 4
DIVERSITY AND THE CONCENTRATION OF CREATIVE ECONOMIC ACTIVITY IN CANADIAN CITY-REGIONS

4.1 Introduction

An enduring debate in the regional economic development literature concerns the relative merits of local diversity versus local specialization (for overviews please see: Feldman and Audretsch, 1999; Glaeser et al 1992). The persistence of this debate can be partially attributed to each position being supported by equally plausible theoretical foundations. On a very basic level the hypothetical advantage of local diversity is that the presence of difference facilitates economic dynamism via the mixing of talent and subsequent recombination of knowledge. The parallel argument for specialization is that relative uniformity is inherently more efficient and therefore produces superior economic outcomes. The continuing existence of these opposing views is not due to a lack of theorizing, but to inconsistent evidence. Glaeser (2003: 92) finds that, “different time periods and different samples give different results which suggest that there is no universal truth on this topic”, and suggests that there are potential methodological issues that need to be addressed as he continues that, “investigating the actual hard evidence on innovations, we will be able to assess the relative importance of idea combinations and the role of diversity and concentration”. Following these observations one of the main intentions of this paper is to address the underlying issues with the very question of local diversity versus specialization and the traditional methodologies employed in pursuing it.

Perhaps the most essential problem with the debate is that it is overly general in nature. It is difficult to attribute regional economic well-being to a single factor, which in this case is local economic structure. Regional economies are highly complex systems
that respond to both internal and external influences. While statistical models are typically designed to control for these additional factors, establishing clear causality is always problematic. This is especially true with attempts to quantify the impact of local diversity and specialization. One of the main reasons for this is that from a theoretical standpoint both diversity and specialization are supposed to facilitate certain outcomes (more dynamism/greater efficiencies) which in turn strengthen the local economy, yet many models tend to assume the underlying social mechanisms while only measuring the structural outcomes. Specifically they tend to utilize overall economic performance measures as the main dependent variable instead of making attempts to make more directly observations of creative activity. There are two fundamental problems with this approach. One is that they tend to gloss over the micro-foundations of how the local economic structure affects relationships between economic agents. As a result the very concept of relative local diversity or specialization is often under scrutinized. Debate is often technical in nature, addressing statistical methods, rather than exploring more deeply the nature of difference and how it influences decision making. A second problem with the traditional approach is that it assumes a universal model of regional economic competitiveness. The theoretical outcomes of both diversity and specialization tend to be seen as inherently positive, yet they are treated as mutually exclusive when it comes to quantifying overall economic performance. In this sense the debate is not really about diversity versus specialization but is instead a debate about the relative merits of the specific outcomes of diversity (dynamism) or specialization (efficiency). This represents a potential explanation for the inconsistency of empirical studies on the subject in that diversity and specialization are supposed to facilitate different outcomes neither of which
is inherently more suited to generating economic growth. The aim of this paper is to address these fundamental problems by ultimately reformulating the basic question of whether local diversity or specialization provides superior regional economic outcomes. Instead, a revised hypothesis is proposed whereby diversity and specialization are understood to foster different patterns of interaction and learning, neither of which is seen as universally superior, but rather as beneficial to particular types of economic activities. Specifically, this paper provides a theoretical framework that outlines how the presence of local diversity may influence social network formation, subsequent learning opportunities, and consequently how this may benefit certain types of economic activity more than others. The empirical component of this paper shows that the relative degree of local diversity has a much more significant impact on local economic structure than on overall economic performance.

4.2 Theoretical Framework

Contemporary theory on regional economies supposes that knowledge is the main source of advantage. In short, knowing how to produce goods and services that others do not is a key factor of success. This contrasts with notions of local advantage that focus on being able to produce goods and services at the lowest cost. An important implication of this shift is that the complexity of knowledge-based economies requires strong local institutions and investment, particularly in human capital (Morgan 1997). As Lundvall and Johnson (1994) suggest, the ultimate source of regional economic advantage is not simply derived from the possession of knowledge, but the ability to consistently produce new knowledge. In other words, it is not simply the possession of knowledge that matters but the ability to constantly learn and produce new knowledge. Modern economies are
characterized by a proportional decrease of materiality as services account for a greater share of overall economic activity. Knowledge itself is a traded good. Issues of ownership however, are more complex as knowledge is highly intangible. Despite patents, trademarks, and copyrights most knowledge is not proprietary, and so capturing value can be challenging. An effective response to this challenge involves staying ‘one step ahead’ through continual learning and developing novel ideas.

4.2.1 Learning as a Social Process

A central theme of the literature on learning is the notion that it is fundamentally a social process (Foray and Lundvall 1998). This idea has strong connections to the recently proposed ‘relational turn’ in economic geography (Bathelt and Gluckler 2003; Boggs and Rantisi 2003) and the social sciences in general. In this sense the traits and characteristics of individuals and groups are not so much the subject of study but rather the connections between them. From this perspective it is the exchange of knowledge between agents that defines the learning process. A second important theme of the literature is that new ideas are produced from novel combinations of existing knowledge (Jacobs 1969; Weitzman 1998). This process requires previously unconnected ideas coming together. When conceived as a social process this means an exchange of information between agents who possess knowledge that the other does not. In the social network literature this is commonly expressed as ‘bridging’ groups or ‘structural holes’ (Burt 1992) whereby interaction occurs between agents who normally occupy disparate networks. It is important to note however, that such social interaction is atypical, as the concept of homophily (McPherson et al 2001) suggests that people tend to choose to interact with people who share similar traits and experiences. This has the effect of
reinforcing norms and values within relatively well-defined social networks. And so it is the uncommon behaviour of interacting between groups that facilitates the intersection of differentiated knowledge. This type of learning process is a necessary step in the formation of novel ideas derived from the recombination of existing knowledge.

### 4.2.2 Social Interaction as a Local Process

The spatial dimension of social interaction and knowledge exchange is an important concern in the geography literature that relates to learning. More specifically, there is an emphasis on the differences between direct face-to-face interaction and interaction that involves communication technologies. Storper and Venables (2004) argue that interaction and knowledge exchange that is mediated by technology is often less effective than face-to-face interaction. A key point they make is that communication involves much more than language, but that people express themselves with body language, tone, inflection, and other such devices. A great deal of meaning can be inferred from such queues, and so the suggestion is that face-to-face interaction facilitates the transfer of tacit knowledge in ways that technologically mediated interaction does not. An additional aspect of this discussion is the recognition that the majority of non-F2F interactions are an extension of F2F relationships rather than a substitute (Nohria and Eccles 2004). The implication is that the majority of interaction has a distinctly local characteristic. As people interact more frequently with those who are physically near to them their cognitive distance is also reduced, and so a locally recursive relationship is formed between social interaction and institutions.

### 4.2.3 Places as Learning Opportunities
The relative strengths of face-to-face interaction are largely responsible for knowledge and institutions having a locally distinctive character. Recently developed conceptions of this include ‘being there’ (Gertler 1995) and ‘local buzz’ (Bathelt, Malmberg and Maskell 2004). As relationships and institutions evolve over time, regions develop distinct identities. Differences in economic structure represent one aspect of local identity as particular strengths emerge in the course of a region’s development. Local variations in knowledge mean that different places provide different learning opportunities. While development trajectories define qualitative differences in local knowledge profiles, they also generate quantitative differences in local learning opportunities. Larger places are often characterized by a multitude of local communities and economic activities. That is to say larger places are often more diverse places. Scale is important in this respect as larger places can contain a multitude of distinct networks that have relatively little overlap with other local networks. As a result larger places can contain a diverse set of groups that differ in what they collectively know. This is in contrast to smaller places where a relative lack of scale means that fewer distinct networks are able to form (Fischer 1982). For example, in a larger region there may be many people of a particular occupation with whom they tend to interact and socialize, thereby producing a distinct community based on shared knowledge and experiences. Yet in a smaller place there may not be a critical mass of people engaged in a particular type of work and so a distinct network cannot be produce locally. Instead, relationships form across categories and identity is shaped as much by place as by any ascribed trait. Thus, scale and diversity are closely connected, whereby larger numbers allow people the choice to interact with those with whom they have some sort of affinity and relatively
smaller numbers reduce choice and thus reduce overall distinctiveness. An important implication is that different places provide qualitatively and quantitatively different learning opportunities. A greater amount of local cognitive diversity not only means that there is a wider range of knowledge potentially available, but also a wider set of possible new combinations of existing knowledge. Thus, large and diverse places can be said to have a creative advantage over relatively smaller and more homogeneous places.

4.2.4 Multiple Epistemologies

The notion that new ideas are produced from novel combinations of existing knowledge is a fairly well established concept in the literature (Jabobs 1969; Weitzman 1998). Certain details of this process are however, less well understood. A particular aspect of knowledge recombination that has begun to receive more attention concerns optimal levels of difference. Nooteboom (2000) argues that there is an optimal ‘cognitive distance’ in the process of knowledge recombination. The logic of this argument is that different bodies of knowledge that are highly related will not likely produce significant novelty and knowledge that are highly unrelated are incongruent and therefore cannot be combined at all. And so, there is an optimal level of cognitive distance whereby knowledge is related enough that it can be readily combined, but sufficiently different that it can generate ideas that are truly novel. Frenken, Van Oort, and Verberg (2007) extend similar reasoning to the regional level by examining the potential effects of related and unrelated industrial variety. A question that these works raise however is whether there is a single optimal level of diversity in all cases of knowledge production. Within the academic setting there is little discomfort in recognizing that knowledge is produced in different ways across different fields and disciplines. Yet this idea is rarely applied to
the study and differentiation of economic sectors despite the understanding that
knowledge production is an important source of advantage. A notable recent exception is
provided by Asheim, Cohen, and Vang (2007) who categorize knowledge-intensive
economic activities into three types: analytical, synthetic, and symbolic. These
distinctions are based on the knowledge-base that underpins the core production of an
industry. They explain the differences with the following,

The analytical knowledge base comprises (predominantly scientific) knowledge that is
g geared to understanding and explaining features of the (natural) world. The synthetic
knowledge base refers to the (predominantly engineering) knowledge involved in the
design and construction of solutions to human problems which is often instrumental,
context specific, and practice related. The symbolic knowledge base deals with the
creation of cultural meaning through transmission in an affecting sensuous medium. (pp
660-661)

A key implication of this is that the process of generating knowledge differs
depending on the type of knowledge in question. Others have noted this kind of
distinction in discussing the differences between creativity and other forms of knowledge
production. To Amabile (1996) one of the most significant features of creativity is that it
is ‘heuristic’ in nature rather than ‘algorithmic’ meaning that creativity involves a degree
of subjectivity in judging the appropriateness of new ideas. Similarly, Santagata (2004)
expresses that creativity is both “non-utilitarian” and “non-cumulative” in nature. In other
words, creativity is central to the evolution of social norms and values rather than
expanding the understanding of the material world (scientific discovery) and adapting it
to meet human wants and needs (technological innovation). Creativity involves a high
degree of social construction whereas scientific discovery tends more towards an
objectivist ontology. To this point Sternberg and Lubart (1996) make a distinction
between ‘open’ and ‘closed’ problem solving whereby ‘closed’ problems have precisely
defined answers while ‘open’ ones do not. Scientific knowledge has fairly well-defined frontiers that are expanded by people with highly specialized knowledge. Creativity on the other hand is much more evolutionary in that while there is a degree of path-dependency, the direction of change is difficult to predict and is therefore dependent on a much wider range of influences and inputs.

The main point of relevance of these distinctions is that the processes of scientific discovery and creativity differ. And crucially, as they are social processes, the social dynamics involved also differ. The final piece of logic in this reasoning is that as social environments differ by place certain places provide advantages to certain types of knowledge production, and by extension provide advantages to certain types of economic activity. This leads to the hypothesis of this paper: places with higher levels of cognitive diversity offer a ‘creative advantage’ over less diverse places. The notion that localized diversity is important to the creative process has long been recognized (see for examples: Wirth 1938; Jacobs 1969). Often however, creativity is used as a catch-all phrase synonymous with the production of all novel ideas. The key distinction made here is that creativity is but one type of knowledge production, and crucially, that it is the most responsive to cognitively diverse environments. The following section tests these ideas empirically by developing news ways to measure local diversity and identify highly creative economic activities.

4.3 Methods

This paper takes issue with the central premise of the local diversity versus specialization debate, that one or the other can be said to be a superior driver of economic competitiveness. Instead, it is suggested that both local diversity and specialization can
provide economic benefits albeit in different ways. While the focus of this paper is on the effects of local diversity on creative activity, it is not intended as an indictment of specialization, but rather aims to illuminate the underlying mechanisms that local diversity may encourage and identify the outcomes that may occur as a result. More specifically, the hypothesis is that higher levels of local cognitive diversity provide an advantage for specific economic activities, namely ones that rely on human creativity.

This section of the paper tests this idea with two related statistical models. The first model tests the relationship between levels of local diversity and overall economic performance of city-regions in Canada while the second model tests the relationship between diversity and the local concentration of highly creative economic activities. In assembling these models there are two significant innovations from more traditional models, one concerns the independent variables and how diversity is measured, and the second deals with the dependent variable and how ‘creative’ industries are identified.

4.3.1 Data Sources and Units

The models presented in this paper use data from the 1996 and 2001 Census of Population. While the relatively short timeframe is not ideal for testing growth hypotheses, it was necessitated by the need to maintain identical variables and congruent geographical units. The units of analysis are Census Metropolitan Areas (CMAs) and Census Agglomerations (CAs). There are 135 city-regions in the first model and 140 in the second model. Both are defined by commuting flows and thus represent labour market areas. CMAs have a core population of at least 100,000 while CAs have core populations of over 10,000.

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4 The discrepancy is due to differences between the 1996 Census and 2001 Census.
4.3.2 Dependent Variables

The main argument made in this paper is that higher levels of local diversity are a benefit to specific types of economic activity rather than economic activity as a whole. Thus, the two models presented in this paper use similar sets of independent variables in order to test two hypotheses. The first model tests the relationship between local diversity and economic growth between 1996 and 2001. The two specific variables are percent change in total employment and the percent change in average employment income. The second model tests the relationship between local diversity and the local concentration of highly ‘creative’ industries. There is no single classification system that identifies highly ‘creative’ industries. Such an exercise typically involves relying on the knowledge and experience of the investigator(s) rather than an explicitly systematic approach. One of the key contributions that this paper endeavours to make is the development of such a system.

The system classifies industries$^5$ (4-digit NAICS) according to two dimensions: a) the percent of the constituent labour force with post-secondary qualifications; and b) the most common type of qualification based on fields of study (please see Table 4.1). The purpose of the first dimension is to divide industries into two types, as Fujita and Thisse (1996) suggest that when discussing externalities, it is “useful to divide human activities into two categories: production and creation”. Industries that have above average levels of post-secondary graduates are classified as the latter. The second dimension also employs post-secondary education data but instead differentiates by field of study. The purpose of this measure is to gauge the primary type of knowledge on which certain economic activities are based and is akin to the knowledge-bases identified by Asheim.

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$^5$ Public sector industries are excluded from the analysis as this paper is primarily concerned with market driven location rationales.
and Gertler (2005). It is not meant to suggest that the particular knowledge obtained during post-secondary studies is necessarily of high importance, but rather indicative of the basic type of knowledge and knowledge production processes involved. The original data consists of 10 categories which are then grouped together into three categories: creative (fine arts, humanities, and social sciences), innovative (engineering and applied sciences), and discovery (natural sciences and mathematics). In total this framework classifies industries into six categories. The location quotients for each of these categories are used as the dependent variables in the second model.
Table 4.1: Knowledge Production Industry Classification System

<table>
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<tr>
<th>Percent of Work Force with Post-Secondary Qualifications</th>
<th>Most common subject of qualifications</th>
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<tr>
<td>Above Average (52%)</td>
<td>‘Creative’ Industries</td>
</tr>
<tr>
<td>Below Average (52%)</td>
<td>‘Innovative’ Industries</td>
</tr>
<tr>
<td></td>
<td>‘Discovery’ Industries</td>
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</tbody>
</table>

- Fine Arts, Humanities & Social Sciences
- Engineering & Applied Sciences
- Natural Sciences & Mathematics

- Cultural Goods & Services
- Manufactured Goods & Services
- Natural Resources Goods & Services
Table 4.2: Model 1 Correlation Matrix

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<tr>
<td>Employment Growth 1996-2001</td>
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<tr>
<td>Income Growth 1996-2001</td>
<td></td>
<td>0.58</td>
<td>0.43</td>
<td>0.29</td>
<td>0.15</td>
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<td>Industrial 1996</td>
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<td>0.41</td>
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<tr>
<td>Occupational 1996</td>
<td>0.29</td>
<td>0.15</td>
<td>0.38</td>
<td>0.40</td>
<td>0.97</td>
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<tr>
<td>Place of Birth 1996</td>
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<td>0.16</td>
<td>0.45</td>
<td>0.42</td>
<td>0.76</td>
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<td>Mother Tongue 1996</td>
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<td>0.40</td>
<td>0.97</td>
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<tr>
<td>Population 1996</td>
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<td>0.20</td>
<td>0.45</td>
<td>0.42</td>
<td>0.76</td>
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<td>Affordability 1996</td>
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<td>0.60</td>
<td>0.48</td>
<td>0.26</td>
<td>0.17</td>
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Table 4.3: Model 2 Correlation Matrix

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<tr>
<td>Creativity LQ</td>
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<tr>
<td>Innovation LQ</td>
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<tr>
<td>Discovery LQ</td>
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<tr>
<td>Industrial 2001</td>
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<td>0.43</td>
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<td>0.40</td>
<td>0.86</td>
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<td>Field of Study 2001</td>
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</tr>
<tr>
<td>Mother Tongue 2001</td>
<td>0.59</td>
<td>-0.01</td>
<td>0.24</td>
<td>0.35</td>
<td>0.40</td>
<td>0.39</td>
<td>0.97</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Religion 2001</td>
<td>0.33</td>
<td>-0.15</td>
<td>-0.09</td>
<td>0.10</td>
<td>0.14</td>
<td>0.24</td>
<td>0.50</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ethnicity 2001</td>
<td>0.46</td>
<td>-0.06</td>
<td>-0.01</td>
<td>0.11</td>
<td>0.23</td>
<td>0.34</td>
<td>0.72</td>
<td>0.79</td>
<td>0.88</td>
<td></td>
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<td></td>
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<tr>
<td>Economic Index</td>
<td>0.66</td>
<td>-0.21</td>
<td>0.43</td>
<td>0.94</td>
<td>0.98</td>
<td>0.55</td>
<td>0.40</td>
<td>0.40</td>
<td>0.13</td>
<td>0.19</td>
<td></td>
<td></td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Cultural Index</td>
<td>0.47</td>
<td>-0.08</td>
<td>0.00</td>
<td>0.15</td>
<td>0.24</td>
<td>0.34</td>
<td>0.74</td>
<td>0.80</td>
<td>0.93</td>
<td>0.99</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population 2001</td>
<td>0.62</td>
<td>0.00</td>
<td>0.39</td>
<td>0.41</td>
<td>0.38</td>
<td>0.41</td>
<td>0.78</td>
<td>0.74</td>
<td>0.14</td>
<td>0.38</td>
<td>0.42</td>
<td>0.39</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>Post-Sec Quals. 2001</td>
<td>0.59</td>
<td>0.04</td>
<td>0.18</td>
<td>0.17</td>
<td>0.42</td>
<td>0.91</td>
<td>0.36</td>
<td>0.34</td>
<td>0.43</td>
<td>0.47</td>
<td>0.36</td>
<td>0.47</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>Affordability 2001</td>
<td>0.39</td>
<td>-0.44</td>
<td>0.25</td>
<td>0.53</td>
<td>0.42</td>
<td>0.12</td>
<td>0.30</td>
<td>0.25</td>
<td>0.09</td>
<td>0.14</td>
<td>0.48</td>
<td>0.15</td>
<td>0.23</td>
<td>-0.05</td>
</tr>
</tbody>
</table>
4.3.3 Independent Variables

It is common practice to measure local diversity by assessing the distribution of local economic activities across standard systems of industrial classification. Two common methods of gauging diversity and specialization are the Herfindahl index and entropy measures. These measures and variations of them are based on similar principles which typically assess the distribution of employment across (usually traded) industries. Although Glaeser (2003) states a preference for the Herfindahl index the method chosen for this paper is the numbers equivalent entropy measure as used by Beckstead and Brown (2003) as it is a direct measure of diversity rather than concentration as is the case with the former. While performing the analysis for this paper it was found the entropy measure better captures the ‘length of the tail’ or in other words the number of smaller categories that are only found in select places. The importance of this becomes more important when gauging the levels of alternate types of local diversity.

While the typical empirical approach to the diversity versus specialization debate is confined to measures of industrial diversity this does not sufficiently cover the theoretical arguments made earlier in this paper which focus on the knowledge recombination aspect of the impact of local diversity. The nearly singular focus on industrial diversity (for a recent exception see Ottaviano and Peri 2006) can be at least partially attributed to the historical context of the debate which was more prevalent in the 1960s and 1970s, when many of the methods were developed. Since this period however, much has been written about the embeddedness of economic activity in social relations (Granovetter 1985) and the recognition that there is more to knowledge and its production than can be captured by systems of industrial classification. Notions of ‘tacit’ knowledge, for example, can be
attributed to ‘cultural’ rather than ‘economic’ foundations (Gertler 1995). Progress has also been made in recent decades in understanding the role of culture in local economic production (Scott 1997). An important implication is that knowledge production can occur by forming new connections between groups other than industrial categories. In short, different ways of delineating knowledge require different ways of assessing cognitive diversity.

In order to gauge cognitive diversity in a wider sense, seven different measures of local diversity were constructed (Please see Tables 4.2 and 4.3). Three of these variables can be broadly classified as indicators of economic diversity and the other four can more aptly described as indicators of cultural diversity. The indicators of local diversity measure the distribution of the labour force across three methods of classification. The first is the standard approach which uses industry of employment (4 digit NAICS), the second uses occupational categories (3-digit SOC), and the third focuses on the segment of the labour force that holds post-secondary qualifications and uses field of study to categorize the population. In addition to the ‘economic’ measures of diversity, four ‘cultural’ diversity indicators are produced using classifications of ethnicity, mother tongue, place of birth, and, religion. Due to the high degree of correlation within the two sets of diversity indicators, indices of ‘economic’ diversity and ‘cultural’ diversity are derived by averaging the individual indicators (equally weighted). The independent variables for the first set of models use data from the 1996 Census and are somewhat limited. Thus, the economic diversity index is comprised of the industrial and occupational diversity indicators and the cultural diversity index is generated from the mother tongue and place of birth indicators.
4.4 Data Analysis

When industrial sectors are reclassified according to the knowledge typologies outlined in Table 4.1 a number of interesting geographical patterns are evident. Table 4.4 shows the top 25 locations for ‘creative’, ‘innovative’, and ‘discovery’ industries according to their location quotients (LQ). One trend that is immediately apparent is that ‘creative’ and ‘discovery’ industries are highly spatially concentrated while ‘innovation’ industries are more geographically diffuse. The ‘creative’ industries are overrepresented (LQ > 1) in a mere 12 of the 140 city-regions and the ‘discovery’ industries are overrepresented in 17. By Contrast the ‘innovative’ industries have a location quotient greater than 1 in 53 city-regions. At first inspection it seems that the ‘creative’ industries tend to be highly concentrated in larger regional centres. The ‘discovery’ industries appear to be most prevalent in cities that also have a university (true for 18 of the top 25). In terms of performance measures and industrial characteristics at the national level the ‘innovative’ industries have the highest average income at $46,696 (in relation to ‘creative’ industries at $41,253 and ‘discovery’ industries at $43,968) while ‘discovery’ industries expanded at the fastest rate between 1997 and 2004 with a compound annual growth rate of 5.1% (‘creative’ = 3.3% and ‘innovative’ = 3.1%). A notable characteristics of ‘creative’ industries is that the average firm size is 11.1 employees (‘innovative’ = 13.3 and ‘discovery’ = 21.1). A smaller average firm size may be an indication of a greater amount of self-employment and project-based work in these industries, which in turn has implications for the nature of knowledge circulation in terms of how differentiated knowledge is obtained. The following section attempts to explain

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6 A location quotient is calculated by dividing an industry’s % share of total local employment by its % share of total national employment. An LQ greater than 1 means that an industry is more common locally than it is nationally.
the spatial patterns of these industrial groupings in a more systematic manner by focusing on the role of local diversity.
Table 4.4: Industrial Location Quotients for Canadian City-Regions (2001)

<table>
<thead>
<tr>
<th>'Creative' Industries</th>
<th>'Innovation' Industries</th>
<th>'Discovery' Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top 25 Locations</strong></td>
<td><strong>LQ</strong></td>
<td><strong>Top 25 Locations</strong></td>
</tr>
<tr>
<td>Toronto</td>
<td>1.58</td>
<td>Kitimat</td>
</tr>
<tr>
<td>Vancouver</td>
<td>1.41</td>
<td>Labrador City</td>
</tr>
<tr>
<td>Calgary</td>
<td>1.25</td>
<td>Wood Buffalo</td>
</tr>
<tr>
<td>Regina</td>
<td>1.23</td>
<td>Baie-Comeau</td>
</tr>
<tr>
<td>Montréal</td>
<td>1.22</td>
<td>Thompson</td>
</tr>
<tr>
<td>Halifax</td>
<td>1.15</td>
<td>Sept-Îles</td>
</tr>
<tr>
<td>Yellowknife</td>
<td>1.09</td>
<td>Estevan</td>
</tr>
<tr>
<td>Ottawa - Hull</td>
<td>1.05</td>
<td>Chicoutimi - Jonquière</td>
</tr>
<tr>
<td>Kelowna</td>
<td>1.04</td>
<td>La Tuque</td>
</tr>
<tr>
<td>Whitehorse</td>
<td>1.02</td>
<td>Timmins</td>
</tr>
<tr>
<td>London</td>
<td>1.01</td>
<td>Fort St. John</td>
</tr>
<tr>
<td>Victoria</td>
<td>1.01</td>
<td>Rouyn-Noranda</td>
</tr>
<tr>
<td>Winnipeg</td>
<td>0.99</td>
<td>Calgary</td>
</tr>
<tr>
<td>Kitchener</td>
<td>0.97</td>
<td>Powell River</td>
</tr>
<tr>
<td>Hamilton</td>
<td>0.97</td>
<td>Granby</td>
</tr>
<tr>
<td>Oshawa</td>
<td>0.97</td>
<td>Shawinigan</td>
</tr>
<tr>
<td>Moncton</td>
<td>0.96</td>
<td>Alma</td>
</tr>
<tr>
<td>Rimouski</td>
<td>0.96</td>
<td>Brockville</td>
</tr>
<tr>
<td>Barrie</td>
<td>0.94</td>
<td>Lloydminster</td>
</tr>
<tr>
<td>St. John's</td>
<td>0.93</td>
<td>Sarnia</td>
</tr>
<tr>
<td>Nanaimo</td>
<td>0.93</td>
<td>Lachute</td>
</tr>
<tr>
<td>Edmonton</td>
<td>0.92</td>
<td>Sorel-Tracy</td>
</tr>
<tr>
<td>Québec</td>
<td>0.92</td>
<td>Trois-Rivières</td>
</tr>
<tr>
<td>Parksville</td>
<td>0.91</td>
<td>Prince Rupert</td>
</tr>
<tr>
<td>Stratford</td>
<td>0.91</td>
<td>Bathurst</td>
</tr>
<tr>
<td>Ottawa - Hull</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaberry-de-Valleyfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Québec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brockville</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montréal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherbrooke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hawkesbury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guelph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saint-Hyacinthe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charlottetown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saskatoon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brantford</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancouver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kingston</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saint-Jean-sur-Richelieu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brandon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lethbridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lethbridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moncton</td>
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<td></td>
</tr>
<tr>
<td>Kelowna</td>
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</tr>
<tr>
<td>Winnipeg</td>
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<td>Trois-Rivières</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oshawa</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Census of Population 2001
4.4.1 Models

The first set of models investigates the statistical relationship between local diversity and regional economic performance while the second examines the relationship between local diversity and regional economic structure. As the two sets of models use two different base years an attempt has been made to maintain as much consistency as possible between the diversity variables.

In addition to the diversity indicators, control variables are included in both sets of models including population (scale)\(^7\), affordability (% households paying > 30% of income on housing), and the proportion of the adult population with post secondary qualifications. The post-secondary qualifications variable is excluded from the second set of models as it is a direct component of the dependent variables.

The results from the first set of models show a significant yet weak statistical relationship between local diversity and employment growth (please see Table 4.5) and no statistical relationship between local diversity and income growth. More specifically the economic diversity index has a significant relationship with employment growth while the cultural diversity index does not. None of the control variables are significant in either case.

The results from the second set of models show a strong and statistically significant relationship between local diversity and the local concentration of highly ‘creative’ industries (please see Table 4.6). Both economic diversity and cultural diversity have a significant positive relationship with the local concentration of ‘creative’ industries, as

\(^7\) Scale is an important variable particularly when considered in conjunction with local diversity in that it indicates the amount of possible connections that exist locally rather than simply the range of possible connections (diversity).
does scale. The model demonstrates a significant yet weak statistical relationship with the local concentration of ‘innovative’ industries, with neither of the diversity variables being significant. In this case only affordability has a significant relationship\(^8\). A significant but weak relationship is evident for the local concentration of ‘discovery’ industries. For this set of economic activities, economic diversity and scale have positive and significant relationships while cultural diversity has a significant inverse relationship with the dependent variable. The model shows weak statistical relationships with the three remaining sets of industries.

\(^8\) An inverse relationship with the affordability variable implies that regions with higher levels of affordability are also places with higher concentrations of ‘innovative’ industries.
Table 4.5: Summary of Results for Economic Performance Models

<table>
<thead>
<tr>
<th>Standardized Coefficients (Beta)</th>
<th>Employment Growth</th>
<th>Income Growth</th>
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<tbody>
<tr>
<td>Adjusted R Square</td>
<td>.113***</td>
<td>.024</td>
</tr>
<tr>
<td>Economic Diversity Index</td>
<td>.306***</td>
<td>.161</td>
</tr>
<tr>
<td>Cultural Diversity Index</td>
<td>.080</td>
<td>.001</td>
</tr>
<tr>
<td>Scale (Population)</td>
<td>.001</td>
<td>.117</td>
</tr>
<tr>
<td>Affordability</td>
<td>.061</td>
<td>-.010</td>
</tr>
<tr>
<td>Post Secondary Qualifications</td>
<td>-.008</td>
<td>.031</td>
</tr>
</tbody>
</table>

Significance: <.01***; .01 to .05**; .05 to .1*
Table 4.6: Summary of Results for Economic Structure Models

<table>
<thead>
<tr>
<th>Above Average Post-Secondary Qualifications</th>
<th>Below Average Post-Secondary Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Arts, Humanities &amp; Social Sciences</td>
<td>Fine Arts, Humanities &amp; Social Sciences</td>
</tr>
<tr>
<td>Engineering &amp; Applied Sciences</td>
<td>Engineering &amp; Applied Sciences</td>
</tr>
<tr>
<td>Natural Sciences &amp; Mathematics</td>
<td>Natural Sciences &amp; Mathematics</td>
</tr>
<tr>
<td>'Creative' Industries LQ</td>
<td>'Innovative' Industries LQ</td>
</tr>
<tr>
<td>'Discovery' Industries LQ</td>
<td>'Discovery' Industries LQ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjusted R Square</th>
<th>.619***</th>
<th>.186***</th>
<th>.258***</th>
<th>.240***</th>
<th>.035*</th>
<th>.054**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardized Coefficients (Beta)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic Diversity Index</td>
<td>.438***</td>
<td>-.047</td>
<td>.315***</td>
<td>.079</td>
<td>-.035</td>
<td>-.101</td>
</tr>
<tr>
<td>Cultural Diversity Index</td>
<td>.239***</td>
<td>-.063</td>
<td>-.205**</td>
<td>-.222***</td>
<td>.107</td>
<td>.252***</td>
</tr>
<tr>
<td>Scale (Population)</td>
<td>.324***</td>
<td>.145</td>
<td>.330**</td>
<td>-.005</td>
<td>-.208***</td>
<td>-.161*</td>
</tr>
<tr>
<td>Affordability</td>
<td>.073</td>
<td>-.442***</td>
<td>.052</td>
<td>.435***</td>
<td>.084</td>
<td>-.064</td>
</tr>
</tbody>
</table>

Significance: <.01***; .01 to .05**; .05 to .1*
The two sets of models demonstrate that there is a stronger relationship between local diversity and local economic structure than between local diversity and overall local economic performance. Specifically, there is a strong relationship between local diversity and the local concentration of highly ‘creative’ industries. This suggests that local diversity provides advantage to specific types of economic activities rather than to economic activity as a whole. While causality and underlying mechanisms are always subject to interpretation with such analysis, the apparent implication is that different types of knowledge are produced in different ways and that underlying processes are aided by certain environments. In particular, the production of knowledge that involves a higher degree of subjectivity, values, and human experience may be enhanced in economically and culturally diverse environments, as combining difference is arguably the central mechanism in the process. The results also suggest that not only is there a relationship between ‘creative’ industries and local diversity but that more than one kind of diversity is significant. Not only is specific ‘economic’ knowledge relevant but the confluence of cultures also appears to provide advantage to such economic activities.

4.5 Discussion and Conclusions

This paper seeks to further develop our understanding of the connections between local diversity and human creativity and in doing so attempts have been made to provide more specific conceptions of both diversity and creativity. With the former the key development presented here is a widening of the notion of what constitutes local diversity. Typically local diversity has been conceived in terms of economic sectors. This approach fails to capture effectively the presence of multiple forms of knowledge which can be instrumental in stimulating the creative process. From an empirical perspective this
means expanding the ways in which local diversity is measured beyond economic sectors and including other methods of categorizing people that reflect some common knowledge-based criteria. The theoretical connection to creativity is that more the local presence of differentiated knowledge provides more opportunity for local economic actors to make novel combinations. This leads to the need for a more specific definition of what constitutes ‘creativity’ and, in particular, what constitutes ‘creative’ economic activity. The argument made here is that creativity should not be used as a general term that encompasses all knowledge production but rather is a particular form of knowledge production. The important distinction made is the difference between scientific knowledge of the material world (physics, chemistry, etc.) and knowledge that relates to human experience (arts, humanities, etc.). In academic settings we are comfortable with discussing differences in how knowledge is produced in relation to differences in subject matter, yet these notions are rarely applied to knowledge produced in the course of economic activity. Further discussion of this notion seems a logical way forward if we are to better understand why knowledge production and in particular creative activity thrives in certain contexts and wilts in others. Subsequently, there needs to be a more precise comprehension of how creativity impacts local economic competitiveness.

While the debate between the relative merits of local diversity versus specialization has received a significant amount of attention in the past, there tends to be a lack of theoretical and empirical detail of the specific processes involved. Investigating such details requires more than the regional science approaches typically used to address questions of local diversity versus specialization. The data presented in this paper suggest that local diversity provides favourable conditions for highly creative economic activities.
The nature of the analysis does not however provide any insights into the underlying mechanisms involved. In order to investigate these further we need to be innovative with our research approach and methods. One area that shows promise is connecting geographic location with social network analysis. If we can better understand the connections between how peoples’ local environment affects their access to a variety of other people, we can begin to get at questions of how location affects learning and subsequent creative activity. Another emerging tool is agent-based modeling. This involves constructing simulations of human activity that can include social interaction, learning, and creativity that are carried out across space and time. These models show promise in illuminating how individual choices co-evolve with aggregate structures and can provide valuable insights into how the creative process may play out in ‘real’ situations.

Finally, a potential practical lesson to draw from this analysis is to question the appropriateness of ‘one-size-fits-all’ creative city economic development policies. As the analysis suggests, creative economic activity seems to thrive in highly diverse places. In particular, both economic diversity and cultural diversity were found to be positively correlated with the geographic concentration of ‘creative’ economic activity, while in contrast, science-based ‘discovery’ industries were positively correlated with economic diversity but negatively correlated with cultural diversity. The key point is that different local environments seem to be conducive to certain kinds of knowledge production. From a policy perspective this offers a potential revision of previous notions of picking ‘winning industries’ on which to focus government support, to picking ‘winning combinations’ of industry and location. Of course this also begs a question of a political
nature of whether it is desirable to encourage the increasing geographical concentration of industries, which may be good for the industries themselves in terms of competitiveness, or if it is more desirable to encourage the spatial spread of industries, which may be less beneficial to the industries themselves but better for regions that lack certain advantages. While this paper has focused predominantly on the impact of diversity in the location of creative industries there are certainly other factors at work for not only creative industries but other types of economic activity as well. With this in mind it is important to conduct further research on these factors and also keep in mind that there is not a ‘one-size-fits-all’ local economic development strategy. In this respect ‘creative city’ policies must be tailored to fit the local environment. It must also be recognized that creativity is not the only source of local economic competitiveness.
Chapter 5
THE SOCIAL NETWORK CHARACTERISTICS OF CREATIVE WORKERS

5.1 Introduction

The ability to generate new ideas and knowledge is widely viewed as a key source of economic vitality. This notion is of particular interest to geographers who study regional economic inequalities and generally agree that collective innovative capabilities are increasingly important to local economic well-being. One of the many strands of this work concerns the relationship between the amount of local economic variety and a region’s innovative capacity and ultimately its economic performance. One view is that specialization facilitates more learning as communication is significantly more efficient between those with congruent knowledge-sets. The basic counterargument is that diversity stimulates more innovation as novelty is derived from the recombination of previously unrelated knowledge. These competing arguments have become commonly expressed as the Marshall-Arrow-Romer (MAR) and Jacobs hypotheses and despite their long-standing position in the literature the debate remains largely unresolved as Glaeser (2003) states, “different time periods and different samples give different results which suggest that there is no universal truth on this topic”. He continues by suggesting that perhaps the traditional research approach is insufficient and that alternative methods may be necessary in order to make progress on the subject. Further to this point the typical approach to this research question involves quantitative methods in the regional science tradition. While the limitations of such an approach have been widely discussed in the literature, a specific recent critique advocates a shift from a regional science perspective to a more relational approach (Bathelt and Gluckler 2003). This paper proposes that such a shift is particularly appropriate for research on the MAR-Jacobs as the underlying
theories are based on the notion that local structures influence specific relationships while
the traditional methods tend to directly measure the structure but only assume the
relationships. In general, there has been a movement towards qualitative methods and
case-studies in particular while ‘doing relational geography’ (Boggs and Rantisi 2003)
but it is difficult to produce generalizable findings at the regional level that address the
question discussed here. One of the key aims of this paper is to demonstrate that can in
some cases be done at a higher level of aggregation and that certain generalizations can
be proposed. In order to do this literature from network analysis and the social
psychology of creativity are used to set up a theoretical framework for the analysis of the
social network characteristics of people in the Canadian labour force. Data from the
General Social Survey (2003) is used to identify two apparent patterns. One is that there
are significant differences in the social network characteristics of workers in relation to
the type of work that people are engaged in (based on occupational and industrial
classifications). In particular, the data shows that people employed in highly creative
industries and occupations tend to have larger, more dynamic, and more diverse sets of
social relations. Secondly, there is a strong correlation between the extent of peoples’
social networks and their levels of income when controlling for many additional factors.
The paper concludes by discussing these findings in the context of how local
characteristics may affect social network characteristics which in turn may affect the
spatial patterns of certain types of work.

5.2 Theories of Diversity and Creativity

The theoretical framework of this paper attempts to connect three sets of literature:
the economic geography literature on local diversity versus specialization; the sociology
literature on strong versus weak ties, and; the social psychology literature on the effects of diversity in the performance of small groups. Each of these literatures is in some way relates to the theme of the socio-economic impact of diversity, though they differ in terms of scale and focus. The goal of this section is to try and find parallels in these literatures that can be combined to provide a basis for the subsequent empirical analysis.

5.2.1 Local Diversity versus Specialization

The effectiveness of local diversity versus local specialization in fostering higher levels of innovation has been debated in the economic geography and related literature for decades. Glaeser et al (1992) summarize the two positions in relation to key contributions by Marshall (1890), Arrow (1962), and Romer (1986) who present arguments for the benefits of local specialization and Jacobs (1969) who expresses the advantages of diverse local environments. Both positions rely on two key assumptions, the first is that learning and innovation are fundamentally social activities that require frequent interaction (Foray and Lundvall 1996), and the second is that physical proximity greatly facilitates interaction and the transmission of tacit knowledge (Storper and Venables 2004). The common notion is that the local environment matters with respect to the amount of immediate potential learning opportunities (Maskell and Malmberg 1999). The contention is whether innovation is more likely to occur as a result of interaction between those with highly related or more dissimilar knowledge sets, and then ultimately how this is affected by local economic structure. Despite intriguing recent work on this question (For examples see: Feldmand and Audretsch 1999; Desrochers 2001; Frenken, Van Oort and Verberg 2007; Desrochers and Sautet 2008) it remains largely unresolved. This stalemate is perhaps due to a general lack of methodological innovation as Glaeser
(2003: 92) suggests that, “investigating the actual hard evidence on innovations, we will be able to assess the relative importance of idea combinations and the role of diversity and concentration”. This implies a shift to more detailed work on innovation from more structural work in the regional science tradition. This however highlights the basic dilemma facing researchers who address the question of local diversity versus specialization, in that on one hand it is difficult to make direct linkages to local structure from detailed case studies, and on the other it is equally difficult to make any direct claims about relational micro-processes from structural analysis. The next section of this paper seeks to begin to address this dilemma by exploring theory that may offer ideas as to how research can be done at high levels of aggregation while also directly looking at relational processes.

5.2.2 Strong Ties versus Weak Ties

The role of networks in the innovation process has received increasing attention in recent years and more specifically social network analysis has become a more commonly applied research approach. A central concept of this approach is that ‘who you know’ largely determines ‘what you know’ and so by analysing sets of relationships researchers can better understand how knowledge is produced and transferred. A debate within the social network analysis literature that has many parallels with the local specialization versus diversity debate relates to the relative merits of ‘strong’ versus ‘weak’ ties. A touchstone for this debate was Granovetter’s (1973) ‘strength of weak ties’ hypothesis that more distant social contacts (weak ties) are more effective sources of information than closer contacts (strong ties). The logic supporting this argument is that as people interact more frequently with one another their individual knowledge-bases become
increasingly similar and that ‘weak ties’ are potentially more valuable sources of information as more distant contacts are more likely to know *different* things. This idea has spurred a significant amount of further work on the merits of strong versus weak ties. Burt (1992) claims that it is not so much the frequency of contact between individuals that matter, but rather the amount of cognitive distance between them. He argues that people who bridge ‘structural holes’ between cognitively different groups are in a potentially advantageous position. Others meanwhile, make claims that strong ties also provide certain advantages. For example, Nelson (1989) finds that strong ties in organizations reduce the amount of conflict. Carpenter et al. (2003) show that strong ties are more effective for the dissemination of information within organizations. Others demonstrate (Lin et al. 1981) that while weak ties may be more effective for searching, strong ties are more effective for career advancement as experience increases. Granovetter (1983) acknowledges many of these claims in a review of his own work and the various studies that followed.

There are commonalities between the discussion of weak ties and strong ties and the debate between regional diversity and specialization. The general theoretical link is the notion of the various benefits between difference and similarity. It is recognized that weak ties, like diversity, are typically better for novelty. Conversely, strong ties and specialization are more efficient for communication and for fostering cooperation and trust. There is perhaps a subtle yet important difference in the approach to the two discussions. In the weak ties and strong ties discussion there is less of an overarching question as to which is ‘better’ in an overall sense as there is at times in the diversity versus specialization debate. Instead the focus is on what functions they serve. The
questions are perhaps more nuanced in that they ask ‘good for what’ rather than just ‘better or worse’. The recognition that both strong and weak ties each offer opportunities and constraints means that making choices between them depends very much on the problem at hand and the context in which it exists. These similarities are reinforced by a subset of the social psychology of creativity literature that deals specifically with the dynamics of homogeneous and heterogeneous groups. This literature provides somewhat of a bridge between the regional perspective of the diversity versus specialization debate and the more individual perspective of the strong versus weak ties literature.

5.2.3 Homogeneity and Heterogeneity in Small Group Contexts

The literature on creativity in small group contexts provides an intermediate conceptual ground between the regional level discussion of local diversity versus specialization and the agent level discussion of string versus weak ties in that it more clearly connects the characteristics of the whole (group) to the actions of individuals and subsequent outcomes. This literature can be categorized into two broad categories. One is grounded in management and deals mainly with organization and work-team diversity, while the other is based in social psychology and examines behaviour in controlled small-group settings. The purpose of this section is to ask whether any insights from these micro-level studies can be applied to the regional-level.

In both the management and social psychology literatures on creativity there is momentum in the view that creativity is not so much about individual talent as it is a social phenomenon that is fostered by certain contexts. From this perspective the management literature tends to be motivated by normative aims of generating more creative outcomes through organizational structure and policies while the social
psychology literature tends to focus on process. A recurring theme in both literatures is the general advantage of building diverse yet cohesive work teams. For example

Woodman et al. (1993) state that group creativity is, “influenced by group composition (e.g. diversity), group characteristics (e.g. cohesiveness, group size), and group processes (e.g. problem solving strategies), and contextual influences stemming from the organization”. There are three common reasons in the literature as to why diversity often has a positive impact on creativity. One is that the presence of cognitive diversity typically means that there are more varied perspectives which can be combined in novel ways (Scheider and Northcraft 1999). The second is that dissent is more common in diverse groups, meaning that status quo outcomes are less likely (De Dreu and West 2001; Nemeth and Nemeth-Brown 2003). The third is that internal diversity increases the group’s ability to project novelty as well as draw in new knowledge through more varied external networks (Perry-Smith and Shalley 2003). These findings are generally congruent with concepts more familiar to economic geographers, including recombinant growth (Weitzman 1998), lock-in (Arthur 1989; Maskell and Malmberg 1999), and absorptive capacity (Cohen and Levinthal 1990). While not just confirming these concepts this literature provides perhaps a more detailed and nuanced picture of how diversity may influence micro-level activity. For example, Milliken et al. (2003) find that while the presence of cognitive diversity can eventually lead to more creative outcomes, there is an initial unease amongst group members as they take time to build trust and understanding. Additionally, Uzzi and Spiro (2005) find that successful creative outcomes can reinforce collaborative work teams in the arts, which reduces group creativity over the longer term.
In combination, these three sets of literature tend to support the common notion that difference offers greater opportunities for generating novelty, whether it is in a structural sense at the regional level, a relational sense between sets of actors, or on a group level. There is generally however, a lack of integration of these literatures as they also tend to focus on distinct sets of questions and related methods. Regional level questions of diversity and specialization are often highly structural and assume certain micro-level processes, while conversely those using the network analysis approach make direct observations of micro-level processes but tend to stop short of extrapolating to larger scales. The empirical section of this paper attempts to bridge this divide by analysing a large scale data set (the Canadian General Social Survey) that includes the social network characteristics of individuals as well as employment and income variables. This analysis demonstrates relationships between the dynamism and diversity of individuals’ social networks and levels of income and creativity.

5.3 Data and Measurement

In this section data from the Canadian General Social Survey are analysed in two ways. The first is a regression model that demonstrates a correlation between the scope of individuals’ social networks and higher income. This general finding is congruent with existing literature that has demonstrated similar patterns. As causality is difficult to firmly establish in such analysis the explanation for such correlations is necessarily somewhat speculative. As discussed previously in this paper explanations of the relationship between larger number of social connections (weak ties in particular) and economic benefits tends to relate to increased knowledge of opportunities and information in general. The second set of analysis in this section examines an additional
possible advantage in that individuals with more extensive social networks may have
greater creative potential. In order to test this idea the size, dynamism, and diversity of
individuals’ social networks are compared between categories of industry of employment
as well as occupation with a focus on those employed in highly ‘creative’ forms of work.

5.4 Social Networks and Income Levels

The first set of data analysis is a multiple regression model (Please see Table 5.1) of
various factors that explain annual income levels of employed individuals between the
ages of 25 and 64 (inclusive). The basic independent variables include such factors as age,
education, hours/weeks worked and so on. In addition, three variables are included that
aim to capture the size and scope of the social networks of individuals. These variables
indicate how many ties individuals have across three levels of tie strength: family
members, close friends, and ‘other’ friends. It is assumed that family members represent
the strongest ties while ‘other’ friends represent the weakest ties. The model
demonstrates that there is no correlation between the number of family ties and income
levels while the number of friends does have a significant and positive relationship with
higher levels of income. And specifically, the number of weaker ties has a larger impact
on the model than the number of moderate ties.

These results are generally congruent with previous research that demonstrates an
economic benefit to wider social networks. Due to the nature of this type of analysis,
claims of specific causality can only be speculated on but other more detailed work has
shown that wider social networks provide access to more differentiated information
which can be leveraged for economic gain. Granovetter’s (1973) ‘strength of weak ties’
hypothesis was derived from research on individuals’ awareness of job opportunities.
Subsequent research has tended to apply social network analysis in the same vein whereby the advantages of more ties and better network position provides some sort of heightened awareness of opportunities. There have not been many attempts to interpret such findings from a creativity perspective. A prospective rationale in this sense is that if novelty is derived from the recombination of existing knowledge, then those with access to a greater amount of differentiated knowledge should enjoy a ‘creative advantage’. The next set of analyses examines the potential of this line of reasoning by examining the differences in the social network characteristics of individuals in different types of employment with an emphasis on highly ‘creative’ work.
Table 5.1 – Multiple Regression Model of Social Ties and Income Levels

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Adjusted r-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>.381***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.156***</td>
</tr>
<tr>
<td>Sex</td>
<td>.215***</td>
</tr>
<tr>
<td>Education</td>
<td>.257***</td>
</tr>
<tr>
<td>Weeks Worked</td>
<td>.274***</td>
</tr>
<tr>
<td>Hours per Week</td>
<td>.301***</td>
</tr>
<tr>
<td>Country of Birth</td>
<td>.076***</td>
</tr>
<tr>
<td>Urban/Rural</td>
<td>.059***</td>
</tr>
<tr>
<td>Close Relatives</td>
<td>-.004</td>
</tr>
<tr>
<td>Close Friends</td>
<td>.019**</td>
</tr>
<tr>
<td>Other Friends (not close)</td>
<td>.057***</td>
</tr>
</tbody>
</table>
5.5 The Social Network Characteristics of ‘Creative’ Workers

This section provides a descriptive analysis on the differences in the social network characteristics of individuals according to their occupational classification and industry of employment. The characteristics examined go beyond the numbers of various types of ties and include variables that relate to frequency of contact, propensity to make new ties, and the cultural diversity of existing ties. Those working in ‘creative and cultural’ occupations and industries are the focus of the analysis as they are often identified as being distinct (For example see: Florida 2002). It is important to clarify that ‘creativity’ is meant to be understood as a specific form of knowledge production, different from scientific discovery or technological innovation, with the key feature being the social dimension of the subject matter itself. In other words, ‘creativity’ represents the production of knowledge that is concerned with human experiences and values and its value is judged in a highly subjective manner contingent on the preferences of the audience. To Amabile (1996) for knowledge production to be considered ‘creativity’ it must be ‘heuristic’ rather than ‘algorithmic’ in nature. Sternberg and Lubart (1996) identify a similar difference between novelties that are generated in response to ‘open’ (to interpretation) versus ‘closed’ problems. Santagata (2004) makes a distinction between ‘creativity’ and ‘innovation’ by proposing that creativity is ‘non-utilitarian’ and ‘non-cumulative’ and innovation is ‘utilitarian’ and ‘cumulative’. A possible implication of such distinctions relates to the notion that learning is a social process, and so by extension different types of learning may involve somewhat different social dynamics.

5.5.1 Numbers of Ties
On the first set of indicators that outline the numbers of ties according to three levels of strength (family, close friends, other friends), those working in creative and cultural occupations and industries have the largest numbers of friends on average but are closer to the median when it comes to connections to family members (please see Table 5.2). This pattern generally supports the notion that those in creative and cultural work tend to have wider access to information via their social networks than those in other fields. Due to the nature of the data no specific causal connection can be drawn, but it opens up potential lines of thought such as: creative work demands larger networks, the nature of creative work is inherently more social, or those with larger social networks are drawn to creative work. Interestingly, those in manufacturing work, which is often associated with higher levels of alienation, tend to have the least extensive social networks.
Table 5.2 – Social Network Characteristics Rankings by Occupation and Industry

<table>
<thead>
<tr>
<th>Occupation classification</th>
<th>How many relatives do you have who you feel close to</th>
<th>How many close friends do you have</th>
<th>How many other friends (neither relatives or close friends)</th>
<th>Past month: how often did you see your friends</th>
<th>Past month: frequency communicate with friends by phone</th>
<th>Past month: frequency communicate with friends e-mail or Internet</th>
<th>Past month: how often socialize with people you work with</th>
<th>Past month: new people met (not work/school)</th>
<th>Past month: new people met on Internet</th>
<th>Past month: how many friends contacted past month: same mother tongue</th>
<th>Past month: how many friends contacted past month: same ethnic group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management occupations</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Business, finance and admin. occupations</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Natural and applied sciences</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>7</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>1</td>
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<tr>
<td>Health occupations</td>
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<td>5</td>
<td>5</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Occupations in social science, education</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Artistic/culture/recreation/sport</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
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<td>Sales and services occupations</td>
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<td>7</td>
<td>6</td>
<td>1</td>
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<td>4</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Trades, transport and equipment</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>9</td>
<td>10</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>9</td>
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<tr>
<td>Occupations unique to primary industry</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Occupations unique to processing and mfg.</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>5</td>
<td>10</td>
<td>9</td>
<td>8</td>
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<td></td>
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<tr>
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<td>3</td>
<td>13</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Forestry, fishing, mining, oil and gas</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>13</td>
<td>12</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>16</td>
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<tr>
<td>Utilities</td>
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<td>16</td>
<td>4</td>
<td>9</td>
<td>16</td>
<td>11</td>
<td>16</td>
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<td>4</td>
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<td>Manufacturing</td>
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<td>Transportation and warehousing</td>
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<td>Professional, scientific and tech. services</td>
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<td>15</td>
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<td>12</td>
<td>5</td>
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<td>2</td>
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<tr>
<td>Management, admin. and other support</td>
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<td>12</td>
<td>16</td>
<td>8</td>
<td>5</td>
<td>9</td>
<td>14</td>
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<td>15</td>
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<tr>
<td>Information, culture and recreation</td>
<td>5</td>
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<td>1</td>
<td>2</td>
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<td>1</td>
<td>5</td>
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<tr>
<td>Accomodation and food services</td>
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<td>7</td>
<td>7</td>
<td>1</td>
<td>1</td>
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<td>3</td>
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<tr>
<td>Other services</td>
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<td>6</td>
<td>8</td>
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<td>6</td>
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<td>Public administration</td>
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<td>8</td>
<td>12</td>
<td>2</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Canadian General Social Survey 2003

9 For detailed data please see Appendix B
5.5.2 Frequency of Social Interaction

In terms of frequency of face-to-face contact with friends, those in creative and cultural occupations and industries are near the top. This group has the most frequent levels of non-face-to-face contact in terms of interaction via the telephone and internet. The latter point raises the question of whether creative and cultural workers are more likely to have more geographically disparate acquaintances. Unfortunately, the data is limited in its geographical content, but this is certainly a potential line of further enquiry. The final indicator in this group shows that those in creative and cultural occupations and industries are much more likely to socialize with work colleagues than average. This provides more evidence of a direct connection between the social characteristics and economic activity of creative work.

5.5.3 Network Dynamism

This data indicates the propensity of individuals to make new acquaintances. It shows that those in creative and cultural occupations make new connections more often than any other category of worker (this trend is less pronounced with the industrial classifications). Specifically, this group is most likely to make new acquaintances outside of work which suggests a greater diversity of attachments. Additionally, creative and cultural workers are more likely to make new acquaintances on the internet than the average worker which may point to a more geographically dispersed social network.

5.5.4 Cultural Diversity of Ties

The final set of indicators provides information on the cultural diversity of individuals’ social networks. As with the previous indicators those in creative and
cultural occupations tend to have the highest number of acquaintances from ethnic groups other than their own (or fewest from their own) and ranked second highest for acquaintances from other linguistic groups. Once again this trend was less pronounced with the industrial classification data. These indicators point to a wider variety of cultural connections and presumably a wider range of cultural knowledge. It would seem that a diversity of cultural knowledge is important to those whose primary economic activity is producing cultural goods and services and so such relationships likely bring both a social and economic benefits.

5.5.5 Summary

Across the entire range of data there is a very strong pattern that shows individuals working in creative and cultural fields tend to have larger, more dynamic, and more diverse social networks. The trend is particularly acute when the data is segmented by occupation (as opposed to industry of employment). While this general correlation cannot by itself lead to specific claims of causality it certainly provides a strong basis for further lines of enquiry. These potential avenues of investigation are expanded upon in the final section of this paper.

5.6 Discussion

The analysis presented in this paper attempts to establish a link between the social network characteristics of individuals and creativity. There is some evidence in the literature on economic geography that suggests higher levels of local diversity augment local creativity. One of the main problems of this literature however, is that it assumes micro-processes that essentially involve the intermingling of diverse actors while not making direct observations of them. There is also evidence in the social network analysis
literature that shows that people with larger and more diverse social connections tend to enjoy economic advantages. However, this literature does not tend to credit heightened creative ability as a potential mechanism of this advantage. The data in this paper demonstrates a correlation between network diversity and creative economic activity by using occupational and industrial classifications as a proxy for creativity itself. This highlights a potential reason why such data is not typically used in creativity-related research in that finding a sensible dependent variable that measures creativity is notoriously difficult. The pattern is however quite apparent and lends credence to the notion that a greater variety of social connections facilitates creative activity. This in turn gives support to the notion that diverse places provide a local ‘creative advantage’ by specifying and making explicit the micro-processes that potentially convert the raw material of geographically concentrated cognitive diversity into novel ideas. There is also evidence in the literature that demonstrates a correlation between the local concentration of creative economic activities and local levels of diversity (Florida 2002). However, while there is evidence of a relationship between social network diversity and creative activity, as well as local diversity and creative activity, there is a general lack of evidence that suggests a connection between local diversity and social network diversity. This missing piece highlights perhaps the most significant gap in the literature. It is more common to find geographically oriented research on the concept of homophily (For example see McPherson et al. 2001), or in other words why similar people tend to interact with one another, than it is to find research on the circumstances and situations in which people seek out those that are different from themselves. A notable exception is the work of Fischer (1982) although this research demonstrates the differences between large
and small places rather than more or less diverse places. A necessary step in remedying this gap in the literature is a greater sensitivity to geography in data collection and coding. The US General Social Survey is better in this respect than its Canadian counterpart, in which there are only basic provincial and urban/rural geographic variables. An increased range of territorial classifications based on specific research question would undoubtedly expand the possible avenues of exploration with regard to the impact of the local environment on the social dynamics of individuals.
Chapter 6
A MODEL OF DIVERSITY, CREATIVITY, AND AGGLOMERATION

The centres of creativity – Athens in its heyday; the Arab cities of the tenth century; Florence in the Renaissance; Venice in the fifteenth century; Paris, London, and Vienna in the nineteenth; New York in the twentieth – were affluent and cosmopolitan. They tended to be at the crossroads of cultures, where information from different traditions was exchanged and synthesized. They were also loci of social change, often riven by conflicts between ethnic, economic or social groups. (Csikszentmihalyi 1996: 139-140)

6.1 Introduction

The United Nations recently estimated that for the first time in history a majority of the world’s population is living in cities (United Nations 2008). When this fact is considered in conjunction with the quotation above the prospect exists for an unprecedented era of global creativity. This is by no means inevitable, however, as the conditions in which creative activity flourishes extend beyond simple urbanism to more complex relational processes. If the world’s cities are going to become bastions of creativity there needs to be a better understanding of how creativity, diversity, and cities co-evolve.

This final chapter draws together the theory and results of the empirical analysis into a model that captures the various dynamic relationships between creativity, diversity, and agglomeration. The model also includes the potential role of public policy in building environments that are conducive to creative activity. These insights are discussed following a review of each of the six general processes identified in the model.

6.2 A Model of Relational Processes

There is ample evidence in the literature as well as in this dissertation that identifies a set of correlations between the geographies of diversity, agglomeration, and creativity.
Yet the understanding of the specific underlying processes is still somewhat vague. The model presented in this section (Please see Figure 6.1) is meant to provide generalizations about the nature of these relationships while also outlining avenues of future research.
Figure 6.1: A Model of Diversity, Agglomeration, and Creativity
6.2.1 Diversity → Creativity

Ways in which diversity may contribute to the generation of creative activity is probably the most thoroughly explored component of the model. The common notion is that the presence of diversity increases the range of possible combinations of difference (Jacobs 1969). These combinations are essentially novelties that have the potential to produce some form of social change. One of the particular contributions that this dissertation seeks to make concerns the relational aspects of the micro-processes involved in connecting difference. Of central importance is the role of context in affecting the actions of individuals with respect to choices of interaction with others who are relatively more similar or different to them. In general, the findings from chapter 3 suggest that difference begets more difference. This seems to be in line with theory which suggests that diverse places prevent groupthink (Nemeth and Nemeth-Brown 2003), thereby reducing risks associated with new experiences and dissent. Subsequently, more novelty is generated and further difference is produced. The findings from chapter 5 suggest that people engaged in highly creative economic activities tend to have the largest, most diverse, and most dynamic social networks relative to those in other activities. Furthermore, these activities are found in higher concentration in diverse city-regions as elaborated upon in chapter 4.

Many researchers have attempted to demonstrate a clear link between local diversity and increased levels of creativity, but the fact that the question is still debated indicates that this is a topic that remains unresolved (Glaeser 2003). For this line of work to move forward it would seem that a stronger understanding of the micro-processes involved is needed. The underlying argument suggests that local context has an impact on
individuals’ patterns of interactions in that people in more diverse places will necessarily have more diverse sets of relationships. This link however is most often assumed and rarely directly established in the literature. There may be case-study and anecdotal evidence that diversity ‘matters’ to creativity, but without true comprehensive comparative data it is difficult to gauge whether relative levels of diversity do in fact matter to the social dimensions of the creative process. With this in mind datasets such as the General Social Survey that contain information on social relationships and social engagement need to pay more heed to geographical variables so that place factors can be incorporated more directly into research on social dynamics. This would enable an extension of the analysis presented in Chapter 5 by making a direct link between the social characteristics of a place and the social network characteristics of individuals. Ultimately, this would help to illuminate how the social characteristics of a place affect knowledge flows within and between regions.

6.2.2 Creativity → Agglomeration

The link between creativity and agglomeration is based on the notion that novelty produces growth. This argument tends to be economic in nature as it suggests that the generation of novelty is an essential element of local economic sustainability (Jacobs 1969). Places must evolve both economically and socially if they are to survive and prosper over time. Creativity therefore is a crucial component of long-term viability. In this respect, it is rational for workers and firms to move in order to be physically proximate to knowledge production and the opportunities that this entails (Florida 2002). The agent model presented in chapter 3 simulates how places with more creative activity tend also to be characterized by higher rates of growth. More tellingly, however, is the
fate of less dynamic locations. The model shows that locations with a negative balance of knowledge flows also have a negative balance of migration. Population stagnates or declines as influence wanes.

While there has been a fair amount of speculation about the ‘pull’ factors of highly creative places to people and firms there is still a dearth of specific evidence to suggest that local creativity has a significant impact on patterns of mobility. To this end more work needs to be done on the specific rationales that people and firms have for relocating. It has also been suggested that ‘creative’ people are more likely to move to places with certain characteristics, but it is also necessary to better understand how the presence of such individuals impacts the overall levels of growth of city-regions.

6.2.3 Agglomeration → Diversity

The notion that diversity is fuelled by in-migration is fairly well understood. This is particularly true of culturally-based knowledge that is produced elsewhere and transferred with the arrival of migrants. Less frequently acknowledged however, is the role of scale in maintaining diversity. Larger places can act as a buffer against assimilation as internal communities grow in size. When people have the choice of interacting with people with whom they share many similarities this allows them to form distinct groups, which in turn enables them to build and maintain their shared identities (Fischer 1982). Conversely, there tends to be much more redundancy of social ties in smaller places which in turn leads to the development of a more singular community identity. The model presented in chapter 3 demonstrates how larger places can maintain multiple internal communities while smaller places tend to remain relatively homogeneous. Evidence from Canadian
city-regions discussed in chapter 4 seems to support this by demonstrating a significant correlation between city size and levels of diversity.

There seems to be a growing recognition in the literature that size is a vital element of local economic performance. Evidence suggests that large places are getting larger still while smaller centres often seem to struggle to compete in the modern economy. Size itself however, cannot be credited with directly producing growth, but instead must in some way have an impact on the decisions, or perhaps the range of decisions, that people make. It is these linkages that will require additional attention in future research.

6.2.4 Creativity → Diversity

Local diversity is not only generated by migration, but is also produced through increasing specialization on an individual level. As Jacobs (1969) notes that as new forms of work are generated the skill sets of workers tend to become more highly specialized. In this sense, creativity has a recursive relationship with diversity. The creation of novel products can lead to entirely new industries. New cultural communities can also be established, often from internal schisms within existing groups. For example, a new denomination of a religion is born from a dissenting sub-group within an established religion. In both the economic and cultural sense new cognitive communities begin from creative activity. This process is one of the foundations of the agent-model in chapter 3. The model begins with a basic set of ‘knowledge’ categories which form the basis of agent interaction and group identity. As creativity occurs in the model, new combinations are made and new types of knowledge are established, thereby adding complexity to the identities of agents, communities, and locations.
The processes of increasing complexity described here suggest that there is a certain momentum to the creative process. If creativity and diversity tend to be highly localised then this has serious implications for increasing geographic inequality. Research on inequality in a knowledge-based economic context is still relatively nascent. Further work in this direction will be not only important academically, but will likely have important policy implications as well.

6.2.5 Diversity → Agglomeration

Diversity is often indirectly linked to urban growth via its role in the creative process, but a more direct link can also be considered. It is somewhat simplistic to think of urban growth as being monolithic in character. Cities do not tend to grow as a single unit with growth evenly distributed across its constituent communities. Different groups have different rates of growth. They can grow internally, or often, they grow by attracting non-local members. ‘Global pipelines’ (Bathelt et al. 2004) of information between like-groups can also ease the movement of people and firms, as existing non-local relationships raise awareness of a place and reduce impediments to migration. In this sense agglomeration occurs through ‘relational growth’ rather than just singular local attributes. This behaviour can be observed in the agent-model in chapter 3 as early movers provide a beachhead for subsequent migration of ‘like-minded’ agents. The data presented in chapter 4 demonstrated a significant (yet somewhat weak) correlation between local diversity and employment growth.

Urban growth is often discussed in economic terms, yet there is also a distinct social component. People are more likely to move to places where they already know someone than to places where they do not. It is logical then to assume that more diverse places
have more pools of potential newcomers on which to draw. For example, in Canada immigration is the main source of population growth and the three largest and most diverse cities attract a disproportionate number of immigrants. An interesting point however, is that these three cities also have net domestic out-migration. These patterns are complex and in some ways seem contradictory and they are certainly in need of additional study.

6.2.6 Agglomeration → Creativity

The concept of homophily suggests that like tends to attract like. People are more likely to interact with others who are similar to them as there is a greater sense of mutual trust and tacit understanding. The connection of difference therefore, is an atypical phenomenon as cognitive distance lowers the level of trust and understanding, and ultimately acts as a constraint on interaction. The importance of face-to-face contact suggests that physical distance is a further constraint (Storper and Venables 2004). Yet, the connection of difference is a vital element of the creative process. Thus, the spatial concentration of diversity facilitates the creative process by removing one of the two key constraints to connecting difference. Larger places offer a greater scale of possibilities. When considered in terms of potential new combinations, greater amounts of difference offer exponential returns. This is perhaps the key finding of chapter 3 in that larger locations offer ‘creative economies of scale’. The analysis presented in chapter 4 also finds a positive a correlation between region size and creative economic activity. This does not mean that smaller places are completely devoid of creative activity. In fact, there are examples such as Prince Edward County in Ontario that are managing to develop and attract creative economic activity. Such places often have creative advantages other than
diversity such as natural beauty or rich cultural histories. They can also succeed through such policy measures as generating a strong local brand or hosting cultural festivals. That being said, the data clearly shows that not only is creative economic activity highly concentrated in large and diverse urban areas, but it is becoming increasingly so.

The amount of difference contained in large and diverse cities in Canada is truly something to marvel at. The notion that so many different perspectives can not only coexist but also come together and thrive is a credit to the strength of the social and political institutions at all levels of government. The role of civic governance in fostering local creativity is beginning to receive more attention in the literature. A particular area of research that would benefit the related themes of this dissertation is how local institutions manage to bring together and facilitate discourse between disparate groups.

6.3 Policy Messages

Prior to discussing more specific policy messages it must be acknowledged that for creativity to truly flourish, a number of basic institutional foundations need to be in place. If creativity is essentially about the process of social change, then open societies are better geared to fostering creative activity. In this respect, political and economic systems that evolve through consensus building rather than centralized decision making generally are more favourable conditions for creativity. Furthermore, if a place desires to be highly creative in the sense that it generates novelties that have a non-local transformative effect, then it must have a world-class education system. If mastery is a first step in the creative process, there has to be a system in place that helps citizens obtain these essential foundations.
As there is certainly a degree of serendipity involved in the creative process it may seem at first inspection that a laissez-faire approach to public policy may be in order. This is not the case however. While the creative process itself may benefit from a decidedly hands-off attitude, the underlying conditions that allow creativity to flourish require a significant amount of public intervention. Thick, not thin, institutions are required for building and maintaining creative environments. The model outlined in the previous section includes policy inputs specific to the twin contextual foundations of the creative process: diversity and agglomeration. This is not to say that policymakers should only be concerned with these two arenas, for example education policy is an additional realm that clearly matters to a region’s creative potential, but that they are aligned with the main findings of this research.

6.3.1 Diversity Policy

While there is an increasing amount of attention given to diversity and cosmopolitan policies in general, there is also certainly room for specific discussion of how diversity can be guided in ways that help foster creative activity. In a broad and initial sense policies and institutions need to support the presence of diversity. This means encouraging tolerance of difference and enabling new populations to arrive as well as new sub-groups to form locally. If diversity is going to foster greater creativity however, it must be connected and mixed. This is perhaps the area in which policies and institutions can make the greatest impact. As discussed earlier in sections of this dissertation, it is normal for people to interact with others who are similar to themselves. If creativity occurs when difference intersects then perhaps a degree of assistance is required in order to connect people who would not likely interact otherwise. The intent
here is to not make any specific prescriptions but rather to highlight the key issues that need to be considered with regard to the treatment of diversity issues on a city-region level.

6.3.2 Agglomeration Policy

One of the foundations of the economic geography literature is the idea that the spatial proximity of actors is a significant factor in economic performance. The typical reasoning is that as economic activity is a social process that involves interaction, and as physical distance is a constraint on interaction, the agglomeration of activities is an economically rational choice. There is a downside to this however, as such behaviour tends to lead to an uneven spatial distribution of economic activity and thereby often disadvantages those not living in central places. There is then an inherent political question between whether it is desirable to encourage large agglomerations to occur which may benefit overall levels of creativity and economic activity, or to attempt to purposefully prevent such patterns from occurring and thereby risk lower levels of economic activity while reducing geographic inequalities. As the literature has recognized the increasing importance of knowledge and learning to economic performance, there seems to be somewhat of a lag in the interpretation of this work in terms of spatial inequalities. One of the inherent difficulties with ‘knowledge’ being the primary asset is that while it can be distributed via education policies it cannot be redistributed in the sense that it is transferred away from haves to have-nots. It is also largely embodied and thus difficult to manage as it is often the case that the highest skilled migrate to advantaged places in search of greater opportunities (Florida 2008). The possibility also exists that even within highly successful regions there may be
growing levels of inequality that are geographically manifested at the neighbourhood level. While these underlying political questions cannot be answered here, it will be important to continue research on these processes so that informed choices can be made as it would seem that in the longer-run issues of inequality may prove more vexing than issues of how to facilitate more creative economic activity.
References


## Appendix A: Economic and Cultural Diversity of Canadian City-Regions

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Source: Canadian General Social Survey 2003
Appendix B: (continued)

| Industrial classification                  | Ordinal (1-5) | | Ordinal (1-5) | |
|-------------------------------------------|---------------|---------------|---------------|
| Source: Canadian General Social Survey 2003 |                |               |               |

Past month: how often did you see your friends
Past month: frequency communicate with friends by phone
Past month: frequency communicate with friends e-mail or Internet
Past month: how often socialize with people you work with
Friends contacted past month: same mother tongue
Friends contacted past month: same ethnic group

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| Source: Canadian General Social Survey 2003 |                |               |               |

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Source: Canadian General Social Survey 2003