

Great Minds Do Not Think Alike: Contrasting Creative and Cultural Occupations with Science and Technology Occupations

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ABSTRACT

It is becoming increasingly recognized in various literatures that not all knowledge is produced in the same manner and that distinguishing between types of knowledge production processes has significant implications for economic geography and local development policies. Empirical findings from the Canadian General Social Survey show that creative and cultural workers are much more likely to be self-employed, hold multiple jobs, and work irregular schedules, than their counterparts. This is matched by creative and cultural professionals maintaining significantly larger and more dynamic social networks, primarily accounted for by greater numbers of local weak-tie relationships. Additionally, this group is most likely to live and work in the same neighborhood, which plays a role in blurring the boundaries between social and economic spaces. The results are discussed in light of the literatures on the knowledge-based economy and precarious labor.

Keywords: Creativity, Innovation, Cognitive cultural economy, Knowledge-bases, Social networks, Precarious labor

1. INTRODUCTION

The terms 'creativity' and 'innovation' are often used in conjunction with one another in a manner that suggests synonymy. They are most often combined within reference to the broader conception of the 'knowledge economy' which, within an economic development framework, contends that local prosperity is achieved by being able to produce high-value added goods and services that are continually being reinvented. This paper contends however, that creativity and innovation should be understood as distinct processes within a knowledge-based economy framework. The implications are more than semantic. 'Creativity' is most commonly linked to the production of cultural products while 'innovation' tends to be associated with the production of science and technology. At the core of the argument for clearly demarcating these terms is that the social dynamics of producing culturally-based knowledge are significantly different from the social dynamics of producing science and technology-based knowledge. Moreover, this involves both how new knowledge is produced and how it is consumed and valued. In short, there are basic epistemological dissimilarities that manifest in varying systems of production and work practices. As these dynamics are embedded in spatially specific social processes they also exhibit contrasting geographies across multiple scales from individuals to firms to neighborhoods to city-regions. A number of studies explore these differences in a systematic manner. The psychology literature on creativity provides thorough discussions on the very definition of 'creativity' (innovation is a less common term in this field). While quite expansive, there is general agreement that creativity involves the production of novel ideas that are in some way valuable or useful. It is also increasingly acknowledged that creativity is a social process rather than something that takes place in the minds of 'lone geniuses'. This is evident in both the novelty and value compo-

nents of what constitutes creativity as it involves a great deal of learning in the first instance and significant testing of value in the second. Both of these are seen to be fundamentally social in nature. The specific social and learning dynamics involved in each represent a large part of how 'artistic creativity' and 'scientific creativity' are differentiated in the psychology literature with the former characterised by 'open' problem solving using heuristic knowledge and the latter by 'closed' problem solving using algorithmic knowledge. Similar ideas are reflected in a more applied manner in the economic geography literature on industrial knowledge-bases. This body of work classifies economic activities into three broad categories of symbolic (culture), synthetic (technology), and analytic (science) (Asheim & Gertler, 2005; Asheim, Coenen, & Vang, 2007; Martin & Moodysson, 2011). Allen Scott's work on the 'cognitive cultural economy' highlights the distinct characteristics of cultural products and the industries that produce them (Scott, 2008). This framework recognizes that creative and culture work is often organized around short-term projects undertaken by constantly evolving teams which are linked to a reliance on social networks but also potentially precarious conditions. A key contribution of this literature is that the direct role that the city, and even particular types of neighborhoods, play in the social dynamics of the creative process.

This paper adds to these ideas by contrasting the work arrangements and social network characteristics of professionals engaged in producing culture with professionals who produce science and technology. These differences are analyzed within a geographic framework which highlights how the social processes of 'creativity' and 'innovation' have distinct spatial systems. It is suggested that from a policy perspective, understanding these distinctions is vitally important for generating effective local environments and institutions that help foster each knowledge pro-

duction process. This paper uses the Canadian General Social Survey to identify the key differences between individuals in arts and culture occupations and those in science and technology occupations. These two groups are compared according to work arrangements (i.e. paid employees/self-employed; work schedules; work location) and by the characteristics of their social networks (i.e. how many strong ties/weak-ties; how many local ties/non-local ties). Ultimately, the data shows that those working in 'creative' occupations tend to have far less structured work arrangements (i.e. more self-employment; highly irregular work schedules) as well as have much larger social networks than those working in science and technology occupations. Furthermore, the difference in size of social networks is almost entirely explained by cultural workers having significantly more local weak-ties. The main implication of these tendencies is that the wider urban-social context matters more to the creative process and those engaged in it than those working in science and technology who tend to work in more firm-based and structured systems.

2. THE PSYCHOLOGY OF CREATIVITY

While creativity has received a great deal of attention in the economic geography literature over the past decade, the research into the creative process has a much longer history in the field of psychology. A central component of this literature goes to the very heart of how creativity itself is defined. While there are many disagreements and certainly many subtleties, there is general agreement that creativity involves the production of new/novel ideas that are also in some way useful/valuable (Csikszentmihalyi, 1996; Gardner, 1993; Sternberg & Lubart, 1999). The shift from an individualistic view of this process to a more social understanding hinges on the notion that on one hand the production of novel ideas first requires learning and recombining existing knowl-

edge and on the other depends on convincing others that a new idea is valuable involves a great deal of social interaction (Nemeth & Nemeth-Brown 2003, pp. 63-84; Paulus & Nijstad 2003, pp. 3-14). Instead of being conceived as the moment when a new idea crystallizes in the mind of an individual, creativity is increasingly seen as a non-linear process that takes place over a period of time (sometimes even decades long) within particular social and cultural contexts (Simonton, 2000). The word 'innovation' also appears in the psychology literature (often in conjunction with creativity) but 'creativity' is the more common term. Attempts to distinguish these concepts are often framed as 'artistic creativity' versus 'scientific creativity'. If creativity is understood as a response to a particular 'problem', then the specific nature of the problem is a key aspect of how artistic endeavours are distinct from scientific ones. For example, Sternberg and Lubart (1996) make a distinction between 'open' and 'closed' problem solving in which 'closed' problems have specific solutions while 'open' ones do not. Open problems relate to the creative process which involves the cultural norms and values of both the creator and the 'audience' while closed problems relate to technological and scientific endeavours. Amabile (1996) makes a distinction between heuristic knowledge production and algorithmic knowledge production, whereby the former can only be truly considered 'creativity'. This is similar to Santagata's (2004) framework which describes creativity as "non-utilitarian" as opposed to innovation which is driven by the logic of specific and measurable improvement. While no problem or process can be thought of as purely open/heuristic/non-utilitarian or closed/algorithmic/utilitarian, discrete instances of knowledge production can be imagined as being located somewhere along a spectrum. In practice, particularly within an economic/industrial context there are likely pieces of knowledge from multiple points of the spectrum being combined and turned into products.

3. KNOWLEDGE-BASES

A recent addition to the economic geography literature provides a framework for differentiating and locating economic activities according to the 'knowledge-base' of industries (and perhaps regions). The underling concept is that various knowledge-intensive industries function on different types of knowledge and thus different processes. This is largely a response to the understanding that there is no universal model for either industrial clusters or regional innovation systems. Thus, making qualitative distinctions in a systematic manner is an important theoretical contribution. The knowledge-base literature began with two types before adding a third. Synthetic knowledge and analytic knowledge were proposed within the innovation systems literature (Asheim & Gertler, 2005) and symbolic knowledge was included in order to recognize the unique aspects of the creative and cultural industries (Asheim, Coenen, & Vang 2007; Martin & Moodysson, 2011). Symbolic knowledge is associated with artistic endeavours, analytical knowledge encapsulates natural sciences and mathematics, while synthetic knowledge relates to applied science and engineering. Originally conceived as discrete categories, the framework has evolved into a continuum akin to the descriptions of artistic and scientific creativity in the previous section.

A key aspect of the knowledge-base framework is the degree to which tacit knowledge is involved. This is important as it relates to the importance of face-to-face interaction (Storper & Venables, 2004) and thus to the degree to which knowledge is mobile or culturally (and locally) embedded (Gertler, 1995; Gertler, 2003). Asheim et al. (2007) propose that analytic knowledge is the least tacit/most codified whereby both the subject and process are highly rational and can be communicated in a universal and often mathematical language. Furthermore, synthetic knowledge in-

volves more tacit knowledge as it involves know-how and craft-based skills that rely on learning by doing. Finally, symbolic knowledge is the most tacit as both the subject matter (cultural products) and the means of production (learning by doing and observing) rely heavily on tacit knowledge. A key implication is that industries that rely on symbolic knowledge also rely more heavily on 'local buzz' (Bathelt, Malmberg, & Maskell, 2004) and are thus possibly more interconnected with the local social environment. This is reinforced by the temporary project-based nature of work within symbolic industries that necessitate continual realignment of teams and skills (Grabher, 2002). Large urban centres are generally where the largest concentrations of symbolic industries are located. The common hypothesis given for this fact is that cities provide the greatest critical mass of networking opportunities that are vital sources of information for know-who knowledge as well as providing vast amounts of cultural signals to those engaging in the creative process.

4. THE COGNITIVE CULTURAL ECONOMY

Probably the fullest and most detailed accounting of how cities play a role in the creative process is provided by Scott's (2008) comprehensive concept of the 'cognitive cultural economy'. There is perhaps no concise definition of the cognitive cultural economy as it attempts to capture a broad array of the main driving forces of the contemporary capitalist system. It encapsulates the knowledge-intensive industries and occupations that are the main sources of growth as well as their particular characteristics that set them apart from other segments of the economy but also in a temporal sense whereby work practises and arrangements have shifted qualitatively and quantitatively from previous eras. Primary amongst these characteristics is the non-routine nature of work and the organization around relatively short-lived projects and teams. These work arrangements have increased the reliance on

social networks as sources of knowledge of opportunities and reputations. Such arrangements create a greater deal of insecurity and precariousness as contract and temporary employment situations are common if not the outright norm (Gill & Pratt, 2008). Coping and surviving in such a system requires workers to be 'always on' and constantly monitoring for opportunities but also for trends and developments within their area of expertise. An outcome of such a system is that work schedules are bound to be highly irregular and deviate from the traditional 9-to-5 Monday-to-Friday setup. These work arrangements and subsequent reliance on social networks also manifest in the spatial patterns of these industries and occupations. In particular, large cities are the dominant location for these activities as they provide a greater range of resources and critical mass for networks and the subsequent forming of novel combinations of knowledge that define the creative process.

One of the most compelling contributions of Scott's work is how he has not only made a connection between urban areas and the cognitive cultural economy but clearly implicated the city as a direct actor in the creative process itself (Scott, 2010). Similar to the instincts of Jacobs (1969), Scott (2010, p.121) cogently argues that urban environments are themselves actors in the creative process:

The creative field of the city can be seen, in short, as a system of cues and resources providing materials for imaginative appropriation by individuals and groups as they pursue the business of work and life in urban space. But it is also a sort of canvas on which creative and innovative acts are variously inscribed. Within this field, individuals are continually if intermittently entangled in transactional exchanges with one another, and in this manner they receive and emit signals that are variously charged with information.

The notion that the city provides tangible spaces for the creative collisions of people and ideas is certainly not new (Wirth, 1938; Hall, 2000), but Scott's conception ties the role of urban environments directly to the specific inter-firm networking and labor market practices of contemporary capitalist activities that rely heavily on the creative process. The short-term project-based nature of creative and cultural work increases its reliance on inter-firm relations as well as work arrangements that tend to be insecure and irregular while requiring an almost constant need to be monitoring for ideas and opportunities. In short, this segment of contemporary capitalism is marked by a great deal of social intensity. This is where the city enters the process as it provides not only the space for these interactions but the critical mass of people and their knowledge which intersects in highly fluid and serendipitous ways. While the largest cities tend to be the focal points of creative and cultural economic activities, evidence also suggests that it is very specific and particular districts and neighborhoods within these urban areas that act as focal points (Currid & Williams, 2010). Altogether, the cognitive cultural economy is the interrelationship of particular work arrangements, social networking patterns, and spatial systems that characterize economic activities that are highly dependent on the creative process. These elements are explored empirically in the remainder of the paper.

5. DATA AND METHODS

The data presented in this paper originates from a single source that allows for a multi-dimensional comparison of those working in culturally-based occupations with those engaged in science and technology-based occupations. Specifically, the Canadian General Social Survey (2008) on Social Engagement allows for a systematic appraisal of how these two types of work differ in terms of: (1) work arrangements (i.e. hours/days; employment status; employment location); (2) the size, com-

position, and dynamism of social networks; and (3) the geography of work and social networks. The main advantage of this approach is that it uses a single large dataset that contains a wide range of variables that allows for both depth and breadth of analysis. This is in contrast with many studies that tend to rely on case-study and qualitative approaches which are limited in their ability to compare directly between industrial and/or occupational categories while being able to make direct generalizations about the differences between them.

The General Social Survey (GSS) is an annual survey conducted by Statistics Canada that has a target of 25,000 respondents which are representative of the population and geography of the country. In addition to tracking basic social trends on a year-to-year basis, the GSS includes a special topic for each iteration that typically repeats every five years. The special topic for the 2008 GSS was social engagement which assessed how various ways in which individuals interact with one another. One of the key elements of the 2008 GSS is that it includes a set of questions pertaining to the number and strength of social ties that each respondent maintains. Furthermore, the 2008 edition was the first to include a geographic qualifier to these questions by asking how many of these ties resided within the same region as the respondent. These variables are capable of providing important new insights especially when presented in conjunction with more standard economic variables such as occupations and other characteristics of employment.

As the main hypothesis of this paper is that creativity and creative work are significantly different from innovation and work in science and technology professions, the general analytical approach is the presentation of a series of cross-tabulations between occupational categories and descriptive variables. The GSS uses one-digit National Occupational Classification (NOC)

system in order to categorize economically active individuals according to the type of work that they do. The two occupational categories highlighted in this paper are: 'C - Natural and applied sciences and related occupations' and 'G - Occupations in art, culture, recreation and sport'. The descriptive variables provide insights into the work arrangements and social network characteristics, as well as the geographies of each. While the overall survey sample size is approximately 25,000 this number is reduced by nearly half when eliminating all individuals not active in the labor force. When the occupational categories are applied the sample for cultural workers is generally around 500 while the N for science and technology is typically just under 900. The sample sizes vary by variable as the response rates and classifiable results differ by individual question in the survey. The standard errors are included for all of the data.

While much of the empirical research pertaining to knowledge-bases takes an industrial approach, the data presented in this paper uses an occupational lens. Its unit of analysis is individuals rather than firms. Conceptually, an occupational approach considers the functions of individuals while an industrial approach is based on the core competencies of firms. As the central hypothesis of this paper concerns knowledge production practices, it is more appropriate to focus on the people who are directly engaged in these processes: professionals with specific abilities and roles. If an industrial approach were to be taken individuals working within specific sectors without a direct responsibility for creativity or innovation would be included (e.g. an accountant working within a film production company) and would skew the results away from the main hypothesis. Taking an occupational approach should not be read as a critique or rejection of an industry approach but rather one that better fits with both the specific theoretical aims and particular dataset presented.

6. FINDINGS

The data presented in this section are organized around three interconnected themes. The first compares the work arrangements of professionals working in arts and culture against those working in science and technology fields. Specifically, it contrasts employment status (e.g. employed/self-employed; permanent/contract) and work schedules (e.g. regular/irregular shift; day/night). The main finding from this data is that the work arrangements of creative and cultural workers are far less structured than those working in science and technology occupations. The second theme examines the social network characteristics of the two groups. In particular, the size of individuals' social networks (i.e. average number of relationships) and the general strength of ties (e.g. close family; close friends; other friends) are measured for each occupational category. The key insight from this set of variables is that creative and cultural professionals have much larger social networks than science and technology professionals and that this difference is wholly due to the former maintaining more weak tie connections with 'other friends'. The third theme relates to the spatial characteristics of individuals' work and relationships and thus is directly embedded within the first two themes. With the former the physical relationship between work and home is measured (e.g. average distance from home to work; propensity to work at home) and with the latter the location of relationships is incorporated into

the analysis (e.g. number of ties in same region/different region). The data show that the majority of creative and cultural professionals work in the same neighborhood in which they live (within 2km). They also show that the greater number of weak ties typically maintained by creative and cultural workers is almost exclusively local. The overarching set of implications are that creative and cultural professionals have much more fluid and irregular working arrangements outside of traditional firm boundaries and that these arrangements are supplemented by larger social networks that are spatially bounded within the same region and even the same neighborhood. In contrast, science and technology professionals typically work within firms with highly structured work arrangements while generally maintaining smaller social networks and not living in the same neighborhood context in which they work. Each of these points are expanded upon in turn with the aim of making connections that suggest that the socio-spatial dynamics of creativity and innovation exhibit distinct characteristics.

6.1 Work Arrangements

The higher propensity of creative and cultural professionals to be self-employed, working irregular hours and/or on contract, and hold multiple jobs is well documented in the literature. The nature of these work arrangements however are most often framed within the notion of 'precarious' labor practices that are in many ways problematic (Gill & Pratt, 2008; McDowell

Table 1. Self-employment rates by occupation

Respondent is...	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
1: ...a paid worker?	88.0	1.09	61.6	2.17	83.7	0.33
2: ...self-employed?	11.8	1.08	37.8	2.16	16.1	0.33
TOTAL	99.8		99.4		99.8	
N =	894		503		12,677	

Source: Statistics Canada, General Social Survey, 2008

& Christopherson, 2009). Furthermore, these practices are typically presented as something that is either new or increasing in quantity or severity. People working in the 'creative industries' seem to receive a larger amount of attention in this regard than many other segments of the labor force, particularly science and technology industries. An important question then becomes 'do work practices vary so significantly between creative and cultural workers and science and technology workers'? The following data outlines these differences in more detail to better address this question.

The practice of self-employment is often seen as an undesirable last resort when more stable jobs within organizations are unattainable. For some, these perceptions have shifted somewhat as the practice has grown and the concept of 'entrepreneurship' has been prompted by many governments as a key mechanism of economic growth and vitality. The countervailing criticism is that the self-employed are more vulnerable due to their lack of benefits and security. The latter narrative has commonly been linked to creative and cultural workers. Table 1 shows that this is not without reason as those working in cultural occupations are roughly three times more likely to be self-employed (37.8%) than the overall working population (16.1%). Conversely, science and technology professionals are less likely than average to be self-employed (11.8%).

Beyond the dichotomy between paid employees and the self-employed there are additional structural differences of labor practices that exist within paid employment. Chief among them is the use of contract employment as opposed to indefinite employment arrangements. The former presents a similar debate to self-employment versus paid employee arrangements, but in this case the issues are between the potential advantages of 'flexibility' against the possible disadvantages of 'insecurity'. Table 2 highlights the significant differences between creative and cultural paid employees and science and technology paid employees whereby the former are far less likely than the latter to have 'regular' employment. Specifically, nearly 40% of paid employees working in cultural occupations do not have 'regular' employment but rather work on a contract, seasonal, or casual basis. This figure contrasts with a rate of just over 10% for science and technology professionals and roughly 16% for all paid workers.

An additional element of work arrangements that is often linked to those working in creative and cultural occupations is the necessity of holding multiple jobs. In many cases work is temporary, seasonal, or otherwise unpredictable which necessitates obtaining additional employment opportunities. The data do indeed support this notion as Table 3 shows that those working in creative and cultural occupations (16.1%) are

Table 2. Type of employment by occupation

Respondent is...	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
1: ...regular employee	89.4	1.10	61.6	2.84	84.2	0.36
2: ...seasonal employee	3.1	0.62	16.8	2.18	5.5	0.22
3: ...term employee	6.1	0.85	13.6	2.00	4.8	0.21
4: ...casual or on-call employee?	1.4	0.42	7.9	1.58	5.6	0.22
TOTAL	100.0		100.0		100.0	
N =	784		295		10,535	

Source: Statistics Canada, General Social Survey, 2008

Table 3. Multiple jobs holders by occupation

Respondent is...	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
1: Yes	4.1	0.68	16.1	1.76	8.1	0.25
2: No	95.9	0.68	83.9	1.76	91.9	0.25
TOTAL	100.0		100.0		100.0	
N =	847		438		11,704	

Source: Statistics Canada, General Social Survey, 2008

twice as likely as the overall working population (8.1%) to hold multiple jobs and four times as likely as those working in science and technology occupations (4.1%).

Schedules are a further aspect of work arrangements that are structured in significantly different ways between occupations. Traditionally, the 9 to 5 workday and the Monday to Friday work week are held as the ideal arrangement. Not only does this schedule provide a highly structured work arrangement but it tends to allow for similarly structured non-work/living arrangements to be more easily maintained. This is especially true within family units whereby partners need to coordinate with one another as well as with children who are in school. Overall, the 9 to 5, five days-a-week schedule offers a clearer set of live-work boundaries that are stable and predictable. Conversely, arrangements that do not conform to this schedule can be presented as less desirable and are linked to the precarious labor discourse around short-term contract work and employment in multiple jobs. Creative and cultural professionals are often linked to the latter and the data from the Canadian General Social Survey largely support this view. Table 4 outlines the typical work schedules of individuals working creative and cultural occupations and science and technology occupations. It shows that only half (50.4%) of creative and cultural professionals typically work a 'regular daytime schedule or shift' while a large majority (85.1%) of science and technology professionals do have such an arrangement. At the opposite end of the spectrum

nearly a quarter (23.4%) of creative and cultural professionals report working an 'irregular schedule' while only 6.2% of science and technology professionals report the same.

In terms of overall work arrangements there are very clear distinctions between the tendencies of creative and cultural professionals and those working in science and technology. The former are far more likely to be self-employed, work on contract or on a seasonal basis, while also often working irregular schedules that do not conform to the 9 to 5, Monday to Friday model of employment. By contrast, a larger majority of science and technology professionals tend to be paid full-time employees of firms who work regular daytime hours five days a week. While it is common in the literature to frame the typical work arrangements of creative and cultural professionals as precarious and an undesirable outcome of challenging structural and institutional environments, it is also possible however to interpret these findings as a direct outcome of how the social dynamics of the creative process best functions. The creative process as it pertains to the production of culturally-based knowledge is itself highly fluid and unpredictable. The problem solving nature of creativity involves a great deal of unknowns and open-ended questions. Product life-cycles tend to be quite short and organized around projects (Grabher, 2002) which require the continual reformulating of teams (Uzzi & Spiro, 2005). Conversely, science and technology problems tend to be more clearly defined with specific goals and means to measure

Table 4. Usual work schedule by occupation

Respondent is...	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
1: ...a regular daytime schedule or shift?	85.1	1.19	50.4	2.24	67.8	0.42
2: ...a regular evening shift?	1.4	0.40	6.9	1.14	5.9	0.21
3: ...a regular night shift?	0.5	0.24	0.7	0.37	2.5	0.14
4: ...a rotating shift?	4.3	0.68	10.4	1.37	9.8	0.26
5: ...a split shift?	0.1	0.11	4.1	0.89	1.0	0.09
6: ...a compressed work week?	0.2	0.16	0.2	0.22	0.5	0.06
7: ...on call or casual?	1.9	0.46	2.7	0.73	2.2	0.13
8: ...an irregular schedule?	6.2	0.81	23.4	1.90	10.0	0.27
9: ...other?	0.2	0.16	1.2	0.48	0.4	0.06
TOTAL	100.0		100.0		100.0	
N =	893		499		12,661	

Source: Statistics Canada, General Social Survey, 2008

and assess potential solutions. There is often a greater degree of structure and predictability and thus a greater potential to formally organize teams in stable long-term arrangements within firms.

6.2 Social Networks

Social network analysis has become an increasingly common research tool within the economic geography literature on creativity and innovation as it offers a framework for examining how knowledge circulates and how people learn from social interaction. This is very much connected to the 'relational turn' (Boggs and Rantisi 2003) in economic geography whereby the nature of linkages between actors is the focus of inquiry. The basic premise of social network analysis within economic geography is that who-you-know influences what-you-know and where-you-are affects who-you-know. The key implication is that location and knowledge are linked via patterns of social interaction which are strongly influenced by physical proximity (Boschma 2005). Key concepts borrowed from the social network analysis literature include Granovetter's (1973) 'strength of weak ties' and Burt's (1992) 'structural holes' hypotheses (and the vast amount of subsequent research) which postulate that people or groups

with whom interaction is less frequent or less intimate provide greater learning opportunities as they are more likely to possess 'different' knowledge and experiences. This connects back to the notion of 'cognitive distance' while setting it in an embodied context. In other words, if certain knowledge is more beneficial to the creative and innovative processes, then certain relationships are also more beneficial. Therefore, understanding the patterns of relationships and where people fit within social networks can be useful for understanding relative capacities for creativity and innovation. From an empirical perspective in the economic geography literature social network analysis has been commonly used in case studies or patent-based research. While both approaches have provided many excellent insights, neither is able to provide for systematic economy-wide comparative analysis.

A key component of the 2008 Canadian General Social Survey is the inclusion of questions pertaining to the extent and patterns of individuals' social networks. One of the important benefits of this is that it enables direct comparisons of the social network characteristics of various subsets of the entire population. Specifically, the average number of social ties per individual can be

Table 5. Size, composition and geography of social networks by occupation

Average number of ties of respondents	Natural and applied sciences and related occupations			Occupations in art, culture, recreation and sport			All occupations		
	Local	Non-local	Total	Local	Non-local	Total	Local	Non-local	Total
Close Family	3	4	7	4	4	7	4	4	8
Close Friends	4	2	6	5	1	6	5	2	6
Acquaintances	20	13	34	31	14	46	24	12	36
TOTAL	28	18	46	40	19	59	33	17	50

Source: Statistics Canada, General Social Survey, 2008

segmented by their relative strength and general location for different occupational categories (Table 5). Perhaps the most striking finding of the data presented in this paper is that those working in creative and cultural occupations have on average far larger social networks than those working in science and technology occupations. Those in creative and cultural professions report having an average of 59 people who they consider to be close family, close friends, or acquaintances. This compares to a figure of 46 for science and technology professionals and 50 for the overall population. These figures represent the highest and lowest numbers of social connections of all discrete occupational categories, or in other words, creative and cultural professionals tend to have the largest social networks while the networks of science and technology professionals are much smaller.

A second important finding is that the difference in the relative sizes of social networks between creative and cultural and science and technology professionals is almost entirely due to the number of reported acquaintances (weak ties) between the two groups. Both groups report having an average of 13 close family and friends (strong ties), while those working in creative and cultural occupations have 46 acquaintances as opposed to 34 for science and technology professionals. This suggests that creative and cultural workers have a wider access to differentiated knowledge on account of their larger weak-ties networks.

A third key finding is that creative and cultural professionals have more dynamic social networks

than those working in science and technology occupations. The former group report a higher rate of making new connections within the past month than the former (Table 6). Though the data provided by the General Social Survey is ordinal and therefore averages cannot be computed, slightly less than half (48.3%) of creative and cultural workers reported making at least one connection over the past month while the figure for science and technology professionals is 37%. Furthermore, creative and cultural professionals recorded higher rates in each of the subsequent responses.

While it cannot be definitively determined from this data as to why these differences exist, there are a few explanations that are not mutually exclusive. One is that in more fluid work arrangements, a larger and more dynamic weak-tie network provides vital information on opportunities for work. This is congruent with Granovetter's (1973) original hypothesis and dependent variable as well as Scott's (1999) more specific findings on creative workers. A second possibility is that the creative process is better served by being situated within a wider variety of knowledge and experience. If creativity depends on making and evaluating novel combinations of existing knowledge, then it would follow that having access to a wider variety of existing knowledge would provide more possibilities for this to happen (Jacobs, 1969; Weitzman, 1998; Spencer, 2012).

6.3 Spatial Systems

To this point the data presented in this paper shows that there are clear differences between the work arrangements and social networks of

Table 6. Dynamism of social networks by occupation

New ties made in past month (not through work or school)	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
None	63.0	1.62	51.7	2.23	59.7	0.44
1 or 2	20.5	1.35	22.3	1.86	19.9	0.36
3 to 5	9.5	0.98	13.0	1.50	12.3	0.29
6 to 10	5.3	0.75	6.3	1.08	5.0	0.19
11 to 20	1.0	0.33	5.0	0.98	2.2	0.13
More than 20	0.7	0.27	1.8	0.59	1.0	0.09
TOTAL	100.0		100.0		100.0	
N =	891		503		12,588	

Source: Statistics Canada, General Social Survey, 2008

creative and cultural professionals and those in science and technology occupations. A third and related dimension to these differences involves divergent spatial systems which are reflected within the geographies of work and social interaction. With advances in information and communications technologies (ICT) predictions suggest that physical proximity between work and home and between interpersonal relationships would become less relevant (Cairncross, 1997). These predictions have largely been shown to be incorrect, especially within a knowledge-based economic geography framework (Morgan, 2004) that stresses the continued importance of tacit knowledge and the importance of 'being there' (Gertler, 1995; Gertler, 2003). In terms of physical proximity, face-to-face interaction is considered to be a vital aspect of the transmission of tacit knowledge (Storper & Venables, 2004) and thus reinforces the economic logic of agglomeration. Undoubtedly new ICTs are changing the ways in which people interact with one another, but it remains an open question as to precisely how this is occurring as technologies continue to rapidly evolve.

While the General Social Survey is not intended for extensive geographical analysis it includes a number of variables that provide some important insights into the spatial systems of work arrangements and social networks. Beginning with the latter, not only is the difference in the size of so-

cial networks between creative and cultural and science and technology professionals characterized by a greater number of weak ties but these additional weak ties are almost entirely local (Table 7). The GSS asks respondents how many of their social ties 'live within the same local region' as they do. While this is not clearly defined, it can potentially provide key insights into the geography of social networks. The main implication of this finding is that if wider weak-tie social networks are more important to creative and cultural professionals and that the majority of these ties are local, then local environments that improve the ability of people to form such networks offer a potential advantage. In particular, large and diverse regions which tend to have higher proportions of creative and cultural workers may do so due to the increased possibilities that they provide for making novel and valuable combinations of knowledge.

The second key finding pertaining to geography is captured by the physical proximity between home and work locations. Once again there are very stark differences between creative and cultural and science and technology professionals with the former group tending to live much closer to work than the latter (Table 7). More than two out of every five (41.4%) creative and cultural professionals live within 2km of their primary work locations and 69.6% live within 10km while the corresponding figures for science

Table 7. Commuting distances by occupation

How many kilometres is/was respondent's place of work from residence	Natural and applied sciences and related occupations		Occupations in art, culture, recreation and sport		All occupations	
	% of respondents	Standard Error	% of respondents	Standard Error	% of respondents	Standard Error
0-2 km (including working from home)	13.7	1.18	41.4	2.31	24.6	0.40
2-10 km	30.6	1.59	28.2	2.11	32.1	0.43
10-20 km	23.1	1.45	15.7	1.71	20.2	0.37
20-50 km	25.2	1.49	11.8	1.51	17.6	0.35
Over 50 km	7.2	0.89	2.9	0.78	5.5	0.21
TOTAL	100.0		100.0		100.0	
N =	846		455		11,602	

Source: Statistics Canada, General Social Survey, 2008

and technology workers are 13.7% (within 2 km) and 44.3% (within 10 km). While the geographic component of the social network variable is imprecise, some inferences can be drawn from the commuting distance variables. As people tend to spend most of their time at home, at work, and travelling between the two, it is reasonable to suppose that most face-to-face social interaction occurs somewhere within or between these realms. The fact that a substantial majority of creative and cultural professionals live within 10km of their work and that their work arrangements tend to be very fluid and flexible suggests that the relatively small areas that they inhabit are locations that provide a great deal of opportunity for social interaction. In a broad sense, Scott (2008) has identified large urban regions as foci for the cognitive cultural economy. Furthermore, certain districts within these cities possess a special combination of cultural amenities, built-form, and sites of consumption which set the scene for the social interactions that drive such economic activities (Currid & Williams, 2010; Scott, 2010). For those in creative and cultural professions it seems that a live-work dichotomy does not readily apply and that this overlap is reinforced by the spatial overlap between home and workplace. This clearly differs from the experiences of most science and technology professions who live and work in separate districts with the city and have more structured work arrangements. These differences can on the surface be ascribed

to distinct labor market practises but underneath these practises lie differing social dynamics of knowledge production.

6.4 Summary of Findings

In their totality the findings show that the work arrangements, social networks, and spatial systems vary significantly between creative and cultural and science and technology professionals (Table 8). Creative and cultural professionals tend to have much more fluid work arrangements characterized by higher rates of self-employment, casual or contract work, with highly irregular schedules. This is matched by much larger social networks involving greater numbers of weak-ties as well as a higher propensity to make new connections. The majority of social relationships are maintained within the same locality and likely the same neighborhood as creative and cultural workers tend to live and work within close proximity. Science and technology professionals display almost entirely opposite patterns with very regular work arrangements defined by full-time, regular employment on a 9-to-5 Monday-to-Friday schedule. They also tend to have significantly smaller social networks which are specifically accounted for by the possession of fewer weak-ties. While their social networks are similarly local in nature they display a clear spatial pattern of separation between home and work. The findings for the former support many of Scott's theories about the cognitive cultural economy.

Table 8. Summary of differences by occupation

	Creative and Cultural Occupations	Science and Technology Occupations
Work Arrangements	<ul style="list-style-type: none"> • High levels of self-employment • High levels of contract, temporary, casual, and seasonal employment • High levels of multiple job holding • High levels of part-time employment • Highly irregular work schedules 	<ul style="list-style-type: none"> • Low levels of self-employment • High levels of regular, permanent employment • Low levels of multiple job holding • High levels of full-time employment • Highly regular 9-5 Monday-Friday work schedules
Social Networks	<ul style="list-style-type: none"> • Larger • More weak-ties • Highly dynamic 	<ul style="list-style-type: none"> • Smaller • Fewer weak-ties • Less dynamic
Spatial Systems	<ul style="list-style-type: none"> • More local weak-tie relationships • Live and work in same neighborhood 	<ul style="list-style-type: none"> • Smaller • Fewer weak-ties • Less dynamic

7. DISCUSSION

The findings from the Canadian General Social Survey strongly support the notion that creative and cultural work differs significantly from that of science and technology. Labor markets and work arrangements are more fluid and irregular in the creative and cultural professions which rely more heavily on larger weak-tie social networks that are predominantly local in nature. While these differences can be quantified with the data from the CGSS, the underlying explanations as to the causes of these differences can only be suggested. That being said it is important to present such a discussion in order to contextualize the findings, propose connections to policy making, and provide possible directions for future research.

Theory from the psychology literature on creativity proposes that 'artistic' or 'cultural' endeavours are characterized by 'open' problems that are primarily addressed with heuristics. This is in contrast to problems of a 'scientific' nature that require more algorithmic solutions. While in practice it is likely that no problem is purely one or the other, there are certainly differences when conceived in a framework of a range of economic activities. Perhaps a clearer common example of these differences is found in the way

in which subjects are segmented in educational institutions. In this context it is understood that there are general pedagogical differences between arts and humanities classes and those in mathematics and natural sciences. With the former experiential learning is contextualized by factors of individual identity and positionality, while with the latter there is a much greater degree of universality. Although both certainly involve tacit knowledge best learned from direct face-to-face interaction, it can be argued that this method of learning is more important to creative and cultural undertakings than it is to science and technological ones.

An additional element of these differences is the pace at which culture evolves relative to that of scientific knowledge and technology. When one considers that 'culture' in its totality involves virtually every decision made by every person, the degree of complexity is impossible to fully comprehend. Each time someone decides what to wear, what to eat, what music to listen to, they are contributing in some way to the evolution of culture. Thus, the subject of culture itself is inherently a moving target. This is in contrast to basic 'scientific' topics such as the composition of a hydrogen atom, the boiling point of water, or how gravity works in that while our knowledge and understanding of these phenomena evolve

and change, sometimes even in radical ways, the subjects themselves for the most part remain constant. These differences have major implications for how we learn, particularly in terms of social dynamics. Our understanding of culture comes from our interaction and immersion in other peoples' experiences. This can be direct face-to-face contact, the observation of strangers somewhere in the public realm, or through the consumption of various media. This involves constant and continual monitoring of other peoples' choices and behaviours, often in an unconscious manner. An essential element of this is being in a position, both socially and geographically, to maximize these learning opportunities. At the extreme other end of the spectrum, where basic scientific frontiers are being expanded, the social dynamics are narrower. While anyone can (and does) contribute to the evolution of culture, only a limited few can have the same direct impact on the latest scientific discoveries. Thus, the social dynamics of scientific learning are more tightly bounded around communities of practise. These differences are mirrored in the framework of 'open' versus 'closed' problems in the psychology literature on creativity. Initially intended to explain the nature of the problem they can also be analogous to the social dynamics involved in each process.

These distinctions are an important basis for offering possible explanations for the contrasting work arrangements, social network characteristics, and geographies between creative and cultural professionals and those working in science and technology fields. The fast pace of cultural evolution is likewise characterised by more than a degree of chaos and unpredictability. In order to harness this force in order to derive economic value work is often organized around temporary projects and teams. Avoiding excessive lock-in and groupthink (Nemeth & Nemeth-Brown, 2003) is crucial to maintaining a competitive edge. These work arrangements are buffeted by

larger weak-tie networks that provide greater awareness of both opportunities for employment as well as monitoring the latest cultural trends. A spatial implication of these practises is that it is paramount to be locally embedded within environments which provide maximum exposure to the latest trends, styles, and fashions as well as the people producing them. Large urban areas house a disproportionate amount of creative and cultural economic activities, and as the evidence in this paper and others suggests, these activities are even more tightly bound in specific neighborhoods and districts where the live-work boundaries of creative and cultural professionals are extremely blurry.

8. POLICY IMPLICATIONS

The stark differences highlighted in his paper between creative and cultural professionals and those in science and technology fields belies the notion of a homogenous 'creative class' or conception of 'knowledge workers'. One implication of this is that there also cannot be a single regional economic development model of 'creativity and innovation'. The 'regional innovation system' approach is an economic development concept that has gained a significant amount of traction in both policy making and academic circles (Asheim & Isaksen, 2002; Cooke, 2001). This approach involves coordination between firms, workers, public institutions, higher education, and other actors such as trade associations and labor unions working together to innovate with the goal of sustaining the local economy in the face of global competition. It is generally applied to industries with more of a science and technology focus which also tend to demonstrate markedly higher wages. While this model may be effective for such economic activities it may very well be a mistake to assume that the creative and cultural industries share similar dynamics. That is not to say that aligning various actors and institutions is not desirable but that the 'systems' approach

may be overly prescriptive. Regional innovations systems tend to be organized around specific sets of technologies and expertise. Once again, the type of problem solving can be considered more towards the 'closed' end of the spectrum. It is likely that more 'systematized' solutions are more suited to such problems. Creative and cultural endeavours are however, more open and chaotic and so a systems approach might not be apt. Amabile's (1996) work on creativity within firms and organizations may provide some insights into a possible alternative. This research suggests that the best way to foster creativity is to provide optimal supportive contexts while avoiding too many top-down directives and structures. This can involve such things as ensuring that there are diverse work teams and allowing people the freedom to pursue their own creative instincts. Such thinking could be applied to the regional level whereby cities themselves are seen as providing maximum opportunities for creative activities to flourish. This could mean anything from good urban design of public spaces to subsidized artist studios to policies that increase and enhance cultural diversity. Whatever the specific details are the main point is that distinct policies are needed for 'creative contexts' and 'innovation systems'.

A second major policy implication relates to the notion of precarious labor practises, particularly in the creative and cultural professions. While this is not primarily a paper with a focus on political economy, the data clearly provide some potentially valuable insights in this regard. In particular, there is some debate as to whether creative and cultural professions differ greatly from other subcomponents of the 'creative class' such as IT professionals. The data presented in this paper leave little doubt, that at least within the Canadian context, there are very stark differences in labor market practises between these various groups. The short-term contract, temporary, and irregular aspects of creative and cultural work are generally deemed to be 'bad' as

they are a source of insecurity, lower wages, and stress. The lack of formal institutions provided by larger organizations and labor regulations is often seen as the major culprit. Additional data from the CGSS supports the notions that creative and cultural professionals do indeed tend to have lower wages and less job security, but that this does not translate into feelings of unhappiness or sense of less mastery or control over their lives. Why apparently higher levels of economic precariousness do not lead to higher levels of dissatisfaction is unclear but a possible explanation lies with the propensity of creative and cultural professionals to have larger social networks. The networked nature of this type of work is often seen as the fallout from the lack of more formal structures and organizations and thus a way of coping with economic insecurity. Furthermore, such a free-agent environment is viewed as hyper-competitive and cutthroat. A possible rebuttal to this view is that these social networks are as much communal and cooperative as they are competitive. There is a great deal of evidence to support the notion that social networks provide robust support and help to mitigate problems of insecurity and precariousness (Bain & McLean, 2013). This should not at all be interpreted as a belief that social networks are a cure-all solution and that a laissez-faire approach should be taken. Instead, there needs to be a balance between providing formal policies that support creative and cultural workers (such as subsidized spaces and labor regulations) while avoiding any top-down structures that impede the social dynamics of the creative process itself. With regards to the latter, Amabile (1998, p. 77) argues that, "creativity is undermined unintentionally every day in work environments that were established for entirely good reasons to maximize business imperatives such as coordination, productivity, and control". While this is only a cursory take on the precarious nature of creative and cultural work, the creativity and innovation literature or the precarious labor literature should not be dismissive

of one another. A closer look at the social psychological dynamics of the creative process there is likely to yield a great deal of common ground.

9. FUTURE DIRECTIONS

With any research that analyzes a large secondary dataset there are likely going to be as many new questions as there are findings. While there is value in being able to quantify systemic differences between creative and cultural professional and their science and technology peers, many of the underlying reasons for these variations cannot be wholly explained with this data. Though many qualitative studies help further our understanding of creativity and innovation processes, it is important that more be done in a comparative manner in order to better understand the differences between types of knowledge and the social dynamics that generate them. Quantitative datasets can also be improved as there are a number of gaps and shortcomings in tools such as the CGSS. Since the CGSS is not primarily intended as a mechanism for studying economic activity it could be improved in this regard. Specifically, it could be improved in order to enable direct connections to be made between social networks and work networks and to what degree the two overlap. The overall goal would be to gain greater insight into how people learn from one another and how this differs between various groups. The CGSS is likewise not meant for detailed geographic analysis and could similarly be improved in this area. More information about where social interactions take place and details about the nature of these interactions could shed more light on how local environments influence these exchanges and ultimately affect learning opportunities. Finally, the results in this paper are derived from a national survey and therefore the degree to which the findings are generalizable to other contexts is questionable. To this end it would be fruitful if similar data were available in other contexts in order to assess the relative importance of various

institutional and cultural factors on the different work arrangements, social networks, and geography of creative and cultural and science and technology professionals.

ACKNOWLEDGMENTS

The author would like to thank his colleagues at the University of Toronto for their ongoing support. In particular, he would like to thank the cities team at the Martin Prosperity Institute, with a special mention to Richard Florida and Vass Bednar for their collaboration and contributions. The author would also like to acknowledge the contributions of the Local IDEAs team at the Munk School of Global Affairs.

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