ENTREPRENEURSHIP, INNOVATION AND INDUSTRIAL DEVELOPMENT: GEOGRAPHY AND THE CREATIVE FIELD REVISITED[1]

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Abstract

Creative destruction is a central element of the competitive dynamic of capitalism. At the same time, this phenomenon assumes concrete form in relation to specific geographical and historical conditions. One such set of conditions is investigated here under the rubric of the creative field, i.e. the locationally-differentiated web of production activities and associated social relationships that shapes geographic patterns of entrepreneurship and innovation in the new economy. The creative field operates at many different levels of scale, but I argue that the urban and regional scale is of special interest and significance. Accordingly, I go on to describe how the creative field functions as a site of (a) entrepreneurial behavior and new firm formation, (b) technical and organizational change, and (c) the symbolic elaboration and re-elaboration of cultural products. All of these activities are deeply structured by relations of spatial-cum-organizational proximity and separation in the system of production. The creative field, however, is far from being a fully self-organizing entity, and it is susceptible to various kinds of breakdowns and distortions. Several policy issues raised by these problems are examined. The paper ends by addressing the question as to whether industrial agglomeration is an effect of producers' search for creative synergies, or whether such synergies are themselves simply a contingent outcome of agglomeration.

The Object of Inquiry

1. Throughout his voluminous writings, Marx insisted on the notion of capitalism as a turbulent scene of production and exchange, gripped by the forces of competition in an endless process of self-transformation. In these circumstances, every firm faces a stark choice between the continual need to upgrade its process and product configurations or eventually going out of business. The result is what Schumpeter (1942), in an explicit invocation of Marx, called "creative destruction," i.e. the periodic abandonment of old equipment, production methods, and product designs in favor of newer and more economically performative assets. At the same time, as both Marx and Schumpeter recognized, creative destruction is inscribed within an ever-expanding sphere of economic activity due to the growth of existing firms, the extension of entrepreneurship, and the appearance of new products on final markets. Capitalism, in brief, is a complex field of forces spurring constant qualitative and quantitative readjustments across all its multiple dimensions of operation (see also Baumol 2002). Sometimes these readjustments are of cataclysmic proportions, as when steam replaced water-power in the nineteenth century; more often than not, as Rosenberg (1982) points out, they take the form of small, incremental steps, many of which may be miniscule, but which overall produce the incessant turbulence descried by Marx.

2. Of late years, there has been a considerable outpouring of literature devoted to these matters, much of it partaking of institutionalist and evolutionary economic theory (e.g. Archibugi et al. 1999; Arthur 1990; David 1985; Edquist 1997; Foray and Lundvall 1996; Freeman 1995; Lundvall and Johnson 1994; Nelson 1993; Von Hippel 1988). An important aspect of this literature is the emphasis that much of it assigns to geography – and above all to the region -- as an active force in molding industrial performance qua new firm formation, learning, invention, and economic development (cf. Acs et al. 2002; Antonelli 2003; Audretsch and Feldman 1996; Cooke and Morgan 1998; Feldman 1994; Howells 1999; Maskell and Malmberg 1999; Oinas and Malecki 1999; Simmie 2003; Storper 1995). This growth of interest in the geographic foundations of industrial performance can in large degree be ascribed to the emergence of a dominant post-fordist (or more simply "new") economy since the late 1970s and early 1980s, and to the concomitant transformations, often quite radical, of the industrial landscape that have ensued.

3. Throughout the greater part of the twentieth century, the leading edges of economic expansion in the advanced capitalist societies were constituted mainly by fordist mass-production sectors (steel, cars, petroleum products, food processing, and so on). Schumpeter himself, i.e. the "later" Schumpeter, identified sectors like these, with their substantial research budgets and central R&D laboratories, as the principal foci of applied innovative activity and technical change in the capitalism of that period. Observers of technological change in the immediate post-War decades, such as Mansfield (1968), made much of the

distinction between basic and applied research, with the latter being in important ways pulled along by the former as engineers and other technical workers translated theoretical ideas into practical blueprints for industrial application.

4. A complementary view of processes of innovation and change in this period of economic history is encapsulated in the so-called product-cycle model (Vernon 1966). Here, the analysis turns on the notion that sectors of production and/or systems of applied technology go through a predictable series of evolutionary changes from their moment of inception to their final expression in the form of mature mass production. The model recognizes three main stages of development in any sector, i.e. (a) a period of infancy and experimentation as new technologies and products make their appearance and as small entrepreneurial firms spring into existence in order to exploit them; (b) a period of growth, based on research-intensive process and product development, accompanied by the shakeout of underperforming assets; (c) a period of maturity or oligopoly in which just a few very large firms making standardized products dominate the entire sector, and in which technological change has radically slowed down. Several attempts were made to incorporate a theory of industrial location into the product cycle model, as expressed in a composite story to the effect that new industries originate in agglomerated "incubators" and then steadily disperse outward as they develop, until in the final stages of maturity, virtually all production is decentralized to cheap-labor locations (Norton and Rees 1979; Struyk and James 1975).

5. In spite of its many over-simplifications and oversights, this vision of technological change and entrepreneurship can be taken as an approximate description as to how at least some mass-production sectors evolved in the post-War decades. Even in the context of fordist mass-production, however, the product-cycle model fails to provide a really adequate account of technological trajectories and the evolution of the firm (Storper 1985). As the new leading edges of capitalist development today -- such as high-technology manufacturing, neo-artisanal industry, business and financial services, the media, and so on -- have come to the fore, the deficiencies of the theory have grown yet more apparent, above all in view of the circumstance that one of the defining features of the new economy is its persistent postponement of anything like the stage of maturity. New-economy sectors are endemically given to continuous learning and hyper-innovation in all phases of their growth, not only in so far as tangible technologies are concerned but intangible capital of all kinds as well (Amable et al. 1997; David and Foray 2002).

6. Thanks to the great surge of published research on these matters in recent years, a very much more elaborate and forthright theory of the spatial foundations of creative activity in contemporary capitalism can now be articulated. I have already attempted a preliminary synthesis in this direction with my exploration of the notion of the creative field as a critical underpinning of the modern cultural economy (Scott 1999a). The present essay is an attempt to broaden the terms of reference of this earlier work, and to encompass the new economy as a whole,

from technology-intensive manufacturing on the one hand to producers of purely symbolic outputs on the other.

The Concept of the Creative Field

7. The notion of a field of creative forces can be used to describe any system of social relationships that shapes or influences human ingenuity and inventiveness and that is the site of concomitant innovations. An adjunct idea is that this field will rarely be frozen in time and space, but that the very innovations it triggers will also act back upon it, thereby causing changes in its organization and operational logic. In the sphere of the economy, such a field might correspond with any number of different relational arrangements. It might be represented by a system of labor-management relations, a particular type of corporate structure, a certain group of sectors (such as high-technology industry), or as Leydesdorff and Etzkowitz (1997) have suggested, a "triple helix" of academic, business, and governmental interests. Freeman (1987) and Nelson (1993) have identified the national economy and its institutional foundations (or the national innovation system) as yet another kind of creative field.

8. A more specific identification of the creative field pertinent to the present investigation is that it comprises all those instances of economic effort and organization whose spatial and locational attributes, at whatever scale they may occur, promote development- and growth-inducing change. To narrow the focus yet more, the creative field in this discussion is represented by sets of industrial activities and related social phenomena forming geographically-differentiated webs of relationships giving rise to specific entrepreneurial and innovative outcomes. An intrinsic element of this definition is that both the field on the one side and its effects on entrepreneurship and innovation on the other are reflexively intertwined with one another.

9. This broad idea is in fact far from new, and aspects of it can be found in different formulations in the literature on such topics as the innovative milieu (Aydalot 1986; Camagni 1995; Maillat and Vasserot 1986), the learning region (Florida 1995; Morgan 1997; Storper 1996), regional innovation systems (Cooke and Morgan 1994; Oinas and Malecki 2002), and the like.[2] My present objective is to resynthesize this literature in a way that tries to broaden its theoretical bases and that carries some of its hitherto unexamined implications forward onto new terrain. In practice, the overwhelming – though not exclusive -- emphasis of the following discussion is on agglomerated economic structures such as industrial districts, regional productive complexes, and urban economic systems. Phenomena like these are almost always characterized by dense networks of firms and multifaceted local labor markets, and as a wealth of published research has shown, these are the settings within which entrepreneurial and innovative energies flourish par excellence in the new economy (Acs 2002; de la Mothe and Paquet 1998; Domanski 2001; Fischer et al. 2001; Hall 1998; OhUllacháin 1999).

[2] See Moulaert and Sekia (2003) for a useful review of these ideas and their interrelations.

Notwithstanding this emphasis on agglomeration, more than passing attention is also paid to much wider spatial frameworks of industrial activity and their implications for entrepreneurship and innovation, including, in the limit, the global.

10. At the same time, the idea of the creative field goes far beyond specific applications in the domain of the economy. The sphere of culture, too, has been much illuminated by arguments that are essentially variations of the notion of the creative field. The social conditions of creativity in art and science, for example, have been examined by commentators such as Becker (1982), Crane (1992), Hennion (1981), Livingstone (1995), and White and White (1965), among many others. Authors like these argue that aesthetic and epistemic communities, and the forms of inspiration and inventiveness that they display, all bear mediated relationships to wider social forces and the specific forms of expression that they foster. This is the message of social epistemology more generally (Barnes et al. 1996; Latour and Woolgar 1979; Mulkay 1972).

11. In these senses, then, the broad concept of the creative field has affinities with the theory of practice as articulated by Bourdieu (1972) and the structure-agency theory of Giddens (1984). For both of these analysts, human societies consist of a reflexive duality whose basic features entail (a) sets of existing social relations that channel the expectations and behavior of individual agents in various ways, while (b) individual expectations and behavior in turn actualize and reproduce social relations. Neither the relations nor the connections that run reflexively between them and individual agents are hard-wired, as it were, but are negotiated out in exceedingly complex processes of human choice and social change. This is not the place to indulge in extended commentary on these theoretical problems. For present purposes, it suffices to observe that in a world that operates in these ways, human practices (e.g. entrepreneurship or innovation) will in certain respects be explicable in terms of social relations, and vice versa, in recursive relationship over time.[3] As a corollary, we can also say that social and economic change in this world will often be wayward but rarely purely adventitious in relation to previous states of order; that is, it will tend to be path-dependent, an issue to which we shall return later.

The Entrepreneur in Spatial Context

[3] The preceding commentary admittedly runs counter to the emphasis accorded in much current theory to pure unmediated agency and the social autonomy of the subject. Under the guise of the "cultural turn" this point of emphasis has recently made great strides in a number of social sciences, most notably for our purposes in economic geography. However, an intellectually-vigorous economic geography, it seems to me, needs to ward off this kind of sentimental humanism (while simultaneously offering due acknowledgment of the significant role of culture in the eventuation of social outcomes), not only on the basis of the theoretical ideas developed by Bourdieu and Giddens, but also on the ad hominem grounds that if transformations of existing socio-spatial relations by means of free-floating acts of volition were on the cards then we would presumably already be within sight of utopia. As it is, these relations ramify with remarkably stubborn persistence on the landscape at every scale of geographical resolution.

12. A fairly common view of the entrepreneur turns on the notion of the risk-taking individual, imbued with animal spirits, in pursuit of self-realization, independence, and prosperity.[4] An allied proposition is that the entrepreneur must also display remarkable skills and cognitive capacity, especially in the early stages of firm formation when the probability of failure is invariably high (Casson 1982). These notions are often deployed in behavioral investigations of the individual's decision to become an entrepreneur. A common finding is that this decision is triggered by some unforeseen contingency, such as the loss of a job due to lay-off or plant closure (Nijkamp 2003).

13. Another, and not incompatible view of entrepreneurship is found in the product-cycle and incubator concepts mentioned earlier. Thus, when a new industrial sector emerges (the stage of infancy in product-cycle terms), the pioneering entrepreneurs within the sector are said to depend vitally on certain critical incubation processes. This is a time when the first firms to make their historical appearance normally face highly unstable conditions in regard to technologies, product designs, management practices, and so on. An "incubator," so the theory goes, would help these firms to survive at a critical stage in their development, and ideal incubators consist of environments offering many different positive externalities (Struyk and James 1975). These types of environment are most often found in the core areas of large urban regions with their dense infrastructures, their abundant supplies of rental premises for commercial use, and their diverse services. According to these concepts, it is in these core areas above all that new entrepreneurial ventures will be most likely to flourish.

14. Neither of these perspectives on the entrepreneur can be said to be plainly wrong, though each leaves much to be desired in terms of analytical penetration and closure, on the one side because it largely evacuates the central issues of social context, and on the other because a rather misleading biological metaphor stands in the way of a more resolute grasp of the social forces at work. More recent research has greatly improved upon both perspectives by taking cognizance of the importance of social embeddedness and by more ruthlessly pursuing the details of economic logic. The central hypotheses at work in this new research revolve around the twin notions of networks and social capital (Cooke 2002; Elfring and Hulsink 2003; Noteboom 1999; Westlund and Bolton 2003). Thus, the entrepreneur is not just a lonely individual pursuing a personal vision, but also a social agent situated within a wider system of production that can be represented as a grid of interactions and opportunities in organizational and geographical space. The grid is composed of more or less densely developed backward, forward, and lateral commercial linkages together with social relationships through which critical information flows continually about business contacts, resource availability, labor market conditions, and so on. As such, the grid as a

[4] Schumpeter (1934 p. 93) refers to the motives of the entrepreneur in terms of "the dream and the will to found a private kingdom … the will to conquer … the joy of creativity."

whole is also a unit of social capital, i.e. a source of benefits to all entrepreneurs or would-be entrepreneurs collectively.

15. In some accounts, these ideas are further qualified by appeal to the concept of weak and strong ties formulated by Granovetter (1973). An entrepreneur caught up in a network of strong ties is likely to enjoy high levels of supportive interaction with other individuals belonging to the same network. However, the content of the interaction will be apt to cover only a relatively narrow range of information, because strong ties between the individuals of a group lead to constant mutual reinforcement of ideas. An entrepreneur with weak ties will receive fainter and less consistent signals, but these will tend to cover a much wider array of novel information. The ideal network environment for the entrepreneur, as Elfring and Hulsink (2003) point out, is one that involves some balanced mix of strong and weak ties.

16. So far so good. The network idea clarifies the task of conceptualizing entrepreneurial effort as a socially- and spatially-embedded phenomenon, but also raises new substantive questions. What is it in particular that defines the order and character of any given network? And how do networks of entrepreneurs evolve over time? These questions lead immediately to some basic issues of industrial organization.

17. Consider Figure 1 which is meant to represent the evolution of a network of inter-firm transactions or linkages and corresponding information flows. I should stress that the figure itself is entirely hypothetical and schematic. It should be viewed only as a simplified abstraction, one possible developmental path out of a very large family of alternative paths. The initiating event of the evolutionary sequence shown in Figure 1 is the establishment of a new entrepreneurial venture. If demand for the products of this venture is stagnant or limited, it remains an isolated event. If demand is growing rapidly, however, a series of derivative entrepreneurial ventures may be set in motion. One possible consequence of growing demand, of course, is that the original firm will simply expand in size to keep up with consumption. A second possibility (given limited internal economies of scale) is that other entrepreneurial ventures will be founded to take advantage of widening horizontal production opportunities. A third possibility (given limited internal economies of scope) is that yet other ventures will spring forth by vertical disintegration as economies in the social division of labor expand. As demand continues to grow, further and further expansion in the horizontal and vertical dimensions will tend to occur (see Scott 1983). Again we will assume for the sake of argument that as this happens all ventures remain directly and indirectly linked together within a single network. Accordingly, as shown in Figure 1, the network will evolve through a series of stylized stages in which each generation is marked by (a) an expansion in the number of establishments in pre-existing sectors, and (b) the formation of a new vertically-disintegrated sector or subsector. This evolving network, moreover, will tend to be a locus of expanding external economies of scale and scope, together with pecuniary externalities à la Krugman

(1991) and Scitovsky (1954), giving rise to system-wide competitive advantages. It also constitutes a structure or field of entrepreneurial possibilities, meaning that its changing internal order provides a sort of template onto which actual patterns of new firm formation can be (approximately) mapped, providing that there is no deficit of individual entrepreneurial effort. This mapping is expressed in the form of both churning (the refilling of old organizational positions as failed firms are replaced) and developmental change (quantitative and qualitative of the network). In this formulation, entrepreneurship begets entrepreneurship via the latent structure of evolving industrial systems.

18. As things now stand, Figure 1 represents a purely organizational entity lacking locational coordinates. The firms within the network, whatever its stage of development, may be widely dispersed, strongly clustered, or some combination of the two. The case of clustered development, however, is of special interest and significance, because so many different sectors in the new economy are prone to spatial expression in this manner due to the agglomeration economies that they create. In more specific terms, the actual and latent external economies of scale and scope engendered by the network are transformed into agglomeration economies by the locational (clustering) strategies of producers. The consequence will be that the locational choice of the first entrepreneur, even if it is perfectly random, is liable to turn into a self-fulfilling prophecy by reason of the developmental dynamic that is now set in motion (Krugman (1991)). By this I mean that the initial seed that is planted sets off a train of subsequent events in which an organized production network comes gradually into being and is increasingly locked into the initial location by its own expanding stock of agglomeration economies. Moreover, as agglomeration intensifies, individuals already working in establishments within the network are especially well positioned to observe emerging entrepreneurial opportunities as and when they loom onto the horizon, thus pushing development yet further ahead. If this argument is correct, we can expect a high proportion of new entrepreneurs in the agglomeration to be established residents of the local area (Romanelli and Schoonhaven 2001).

19. In line with these remarks, it might be contended that William Shockley's decision to set up his Shockley Semiconductor factory in 1955 in the then backwater of Santa Clara County was random in the sense suggested.[5] But once Silicon Valley starts to develop as an agglomeration of innovative semiconductor producers, success for any subsequent entrepreneur in the same field becomes increasingly and systematically keyed in to that location. This broad analysis, moreover, is consistent with (which is not the same thing as being proven by) two recurrent sets of observations about entrepreneurial activity in regional contexts. First, firm spin-offs in both the horizontal and vertical dimensions are a

[5] Contrary to most accounts of the origins of Silicon Valley, there was nothing truly decisive about the existence of Stanford University at nearby Palo Alto to Shockley's decision (Scott and Angel 1987). It might be argued that if Shockley had studied location theory (even as it then was) his first choice would more likely have been Southern California with its burgeoning defense industry.

commonly observed phenomenon in expanding regional economic systems, as illustrated by the generational trees of firms that have been traced out for the semiconductor industry in Silicon Valley (Assimakopoulos et al. 2003) or the medical device industry in Orange County (de Vet and Scott 1992). Second, the empirical evidence suggests that entrepreneurs do indeed have a distinct propensity to establish firms in regions where they already live, and that the rate of start-up tends to be especially high in dense functional agglomerations (Almeida and Kogut 1997; Cooper and Folta 2000; Sorenson and Audia 2000).

20. Consolidation of any given industrial agglomeration is reinforced by the formation of what Florida and Kenney (1988) refer to as social structures of innovation, i.e. specialized service suppliers (such as venture capitalists, investment bankers, law firms, management and technology consultants, and so on) that help to maintain high local levels of entrepreneurial effort (see also Malecki 1991). Local educational and training facilities, too, are increasingly caught up in local developmental processes, and often play a major role in supporting new firms. Thus, Zucker et al. (1998a) have shown, for the case of the Californian biotechnology industry, that entrepreneurs and leading researchers in nearby university laboratories often join forces in order to establish knowledge-intensive start-ups. A further advantage of agglomeration, according to Cooper (2000), is that it facilitates the formation of well-matched founding teams of entrepreneurs; and Fornahl (2003) has pointed out that agglomeration enhances each entrepreneur's ability to observe, assess, and learn from the successes and failures of others.

21. The argument thus far brings us in some respects full circle back to the notion of the incubator. However, this largely metaphorical idea can now be much improved upon by a more explicit account of the endogenous structure of production networks and the ways in which they help to channel entrepreneurship. These networks have been closely identified here with regional complexes of economic activity, but to repeat, there are many – and probably growing numbers of -- empirical cases of production networks that extend over vastly wider geographical ranges, including the national, continental and global scales, and in which entrepreneurial activities are accordingly equally dispersed.

Space-Time Dynamics of Innovation I: Knowledge, Learning and Technical Change

Frameworks of Practical Knowledge

22. Practical knowledge is a critical underpinning of all innovative activity. Practical knowledge in turn is structured by its intrinsic relationship to basic science (biology, chemistry, physics, and so on), though the relationship is never one to one because cost, demand, competition, and other variables play important roles in how specific pieces of information are actually deployed in the search for new and improved processes and products. Dosi (1982) has proposed that we use the

term technological paradigm to describe any coherent combination of know-how, practical applications, and theoretical science. He has suggested that paradigms follow evolutionary trajectories such that they unfold according to an internal logic of development, though the process is almost always fitful and incomplete. The evolution of any given paradigm is also a social process to which many different parties contribute by piecemeal accretion of particular fragments of knowledge (Perez 1983). Concomitantly, the innovative potential of any industrial system will be heightened where many of these fragments are sufficiently different from one another, yet intra-paradigmatically related, so that their combination yields new insights (Antonelli 2003). This is a slightly different way of expressing the idea that a balanced mix of weak and strong links is likely to be more synergistic than a set of purely strong or purely weak links. Noteboom (1999) has made essentially the same point in his account of the impact of cognitive distance (further refined in terms of novelty and communicability) on learning. Too little novelty or communicability is unhelpful, and so is too much; intermediate doses of both are calculated to push learning forward most rapidly.

23. Technological paradigms, then, evolve over time by means of internal incremental changes generated by different participants in the knowledge-production process. Occasionally a paradigm will become exhausted and will cease to yield much in the way of new insights and competitive advantages. On other occasions a paradigm shift may occur as a superior new paradigm emerges, sometimes resulting in a brusque rupture in prevailing patterns of industrial development. The same rupture will sometimes be accompanied by radical readjustments in the locational structure of production, with corresponding changes in the geography of entrepreneurship and innovation. The point is dramatically exemplified by the crisis of the Manufacturing Belt and the growth of the Sunbelt after the early 1970s as post-fordist industrialism started its spectacular ascent (Storper and Walker 1989). Steed (1971) has documented a more sharply-focussed case of technological-locational rupture in his study of the demise of traditional linen manufacturing in Ulster after the Second World War in the face of competition from the international synthetic fiber industry.

24. The ideational core of any paradigm is invariably composed of what can be identified in the terms proposed by Polanyi (1966) as both tacit and explicit knowledge (Foray and Steinmuller 2003; Gertler 2003; Lissoni 2001; Pinch et al. 2003). Tacit knowledge is describable as a kind of inarticulate sense of how things work which is embodied in particular individuals in particular organizational settings. Tacit knowledge is difficult to transmit to others and can often only be transferred by means of personal encounters and practical demonstrations. By contrast, explicit knowledge is codified or codifiable in ways that make inter-personal communication relatively easy. Polanyi himself illustrates the difference between the tacit and the explicit by reference on one side to the know-how involved in being able to drive, and on the other to the systematic theory of the motorcar. This illustration underline's Polanyi's contention that our total personal stock of knowledge is almost always more

extensive than our ability to inscribe it all in formal texts. Since tacit knowledge is specific to given individuals, and may also be culturally encoded, it is especially difficult to transmit over long distances, whereas explicit knowledge can be more directly and cheaply transferred by means of formal inscription (Antonelli and Calderini 1999; Gertler 2003), though Foray and Steinmuller (2003) argue that new ways of recording tacit knowledge (with the aid of digital technologies) are likely to enhance its transferability to wider circles of recipients. In practice, the distinction between the tacit and the explicit is rarely cut and dried, and most forms of knowledge are a complex amalgam of the two.

Stocks and Flows of Knowledge in the Creative Field

25. Whatever its paradigmatic features, or its tacit/explicit dimensions, economically useful knowledge is always unevenly spread out over many different sites at many different geographic scales from the local to the global (Archibugi et al. 1999; Bunnell and Coe 2001). Typical active sites of knowledge-accumulation in the creative field are the individual worker, the firm, or the sector; other sites are represented by specialized institutions such as schools and universities, research laboratories, labor unions, or trade associations. Such sites constitute the neurons of the creative field, so to speak, but their power to generate new knowledge is magnified many times over when they come into definite interrelationship with one another. A central question at this stage is what kinds of knowledge accumulate at different sites, how are the bits and pieces interconnected, and how do the concomitant flows and interchanges promote spatially-determinate forms of process and product innovation?

26. The pressures of competition in capitalism make it imperative for firms continually to revitalize their core competencies in the search for production and marketing advantages. The knowledge that enables them to do so comes from two main sources. First, firms acquire knowledge by dint of learning based purely on their own internal resources. Learning-by-doing is no doubt the most pervasive means by which they do so, above all in the case of small firms, which usually do not have the wherewithal to engage in formal research (Antonelli and Calderini 1999). Large firms, by contrast, are frequently capable of carrying out in-house R&D, and the results of this activity often play an important role in identifying breakthrough innovations. Second, firms also learn by appropriating knowledge produced by external sources, such as other firms or institutions like universities or government laboratories. The pathways by which knowledge spills over in this way are many and various; they include written texts, informal conversations, inter-firm mobility of workers, strategic alliances, and so on. In these ways, knowledge produced at one site is acquired, often gratis, at other sites (Anselin et al. 1997; Audretsch 2002; Feller 2002; Grossetti 1995; Maskell and Törnquist 2003; Rodríguez-Pose and Refolo 2003; Varga 2000; Zucker et al. 1998b).

27. A particularly important form of knowledge generation and exchange occurs when firms engage in complex business transactions with one another, especially

where these entail a good deal of preliminary discussion and mutual assessment. For example, Russo (1985) shows how small-scale, informal, but cumulatively significant innovation occurs in the tile-manufacturing district of Sassuolo in the Third Italy, as manufacturers and their suppliers of machinery negotiate with one another about the specifications of new equipment orders. In a similar vein, Von Hippel (1988) has pointed to the important role of information feedback from users to manufacturers of surgical instruments. Manufacturers typically rely on such feedback as a major source of ideas for product improvement and innovation (see also Lundvall 1988; Lundvall and Johnson 1994). In some instances, groups of firms build managerial mechanisms such as joint ventures or R&D alliances in order to enhance the intra-group flow of knowledge, with the biotechnology industry being an outstanding example of this tendency (Powell et al. 1996).

28. By all accounts, inter-firm flows of knowledge are a pervasive phenomenon in the world of contemporary industry, and are critical stimuli of innovation. For a sample of relevant studies on this matter see Cumbers et al. (2003), Edquist (1997), Gertler (1995), Powell et (1996), Rallet and Torre (1999), Uzzi and Lancaster (2003). Most of these studies put a heavy, but by no means exclusive, emphasis on the importance of locational proximity as a prime requisite for the successful transmission of knowledge between different parties. In cases where face-to-face intermediation of tacit knowledge is at stake, the role of proximity is especially critical. A basic point that now needs to be pressed home is that this spatial condition reaffirms the major role of industrial agglomeration in the articulation of the creative field, above all in the case of new-economy sectors with their transactions-intensive linkage structures (Audretsch 2002; Morgan 2004; Scott 2000; Simmie 2003).

29. Empirical confirmation of the powers of spatial agglomeration in regard to knowledge-generation can be found in the empirical work of Acs et al. (2002), Jaffe et al. (1993), OhUllacháin (1999) and others on the geography of patenting. This work suggests that patenting activity is typically concentrated in agglomerated centers of production. A parallel line of research based on innovation data compiled by the US Small Business Administration underscores these results by consistently pointing to the spatial concentration of innovative events (Acs 2002; Audretsch and Feldman 1996; Feldman and Audretsch 1999; Feldman and Florida 1994). The innovative activities of small firms are especially susceptible to the positive stimulus that comes from agglomeration (Almeida and Kogut 1997). The work of Jaffe et al. (1993) is exceptionally significant as a confirmation of the positive impacts of proximity and agglomeration in the creative field because it actually traces out lines of influence from one patent to another as revealed by the citations to prior patents that accompany any application for patent protection to the US Patent and Trademark Office. On the basis of a large body of data collected in this way, Jaffe et al. show that cited patents originate with a high degree of statistical likelihood from the same geographic locality (state and metropolitan area) as citing patents.

30. The ambiguities of patent data as a measure of innovation have often been pointed out (see, in particular, Griliches 1990). Patents are notably troublesome as a measure of innovation, because not all innovations are patented, and not all patents are equally innovative or rewarding. For this reason, the empirical work cited in the previous paragraph is far from conclusive, even if it tends to point in one dominant direction. A particular problem with much of this work is that it proceeds largely on the basis of aggregated measures of patenting activity or innovation, in which data for many different sectors are pooled together. A high proportion of published studies based on aggregate data display a statistically significant and positive relation between patenting/innovation and the clustering of firms, but rarely the increasing returns to cluster size that we would expect on theoretical grounds. More disaggregated analysis would presumably show great variety from sector to sector in regard to rates of innovation as a function of locational clustering, with some sectors displaying strong reactions while others remain inert. Beaudry and Breschi (2003), Breschi (1999), and Lamoreaux and Sokoloff (2000) show that numerous cases exist of industrial clusters that fail to demonstrate any proclivity whatever to innovation. Clearly, more refined analyses are required to push our understanding forward here. Further commentary on these matters (together with a small statistical experiment) is provided in the Appendix to this paper.

31. One stream of research does in fact attempt a somewhat more refined approach to the problem of innovation in industrial agglomerations, though the insights provided are on the whole rather slim. I am referring here to those efforts that distinguish between so-called Marshall-Arrow-Romer externalities and Jacobs externalities as sources of innovative effects and productivity increases (Baptista and Swann 1998; Capello 2002; Feldman and Audretsch 1999; Glaeser et al. 1992). The former are defined as externalities that are produced and consumed only in a given sector; the latter are defined as externalities that flow between firms in all sectors. Some analysts, like Baptista and Swan (1998), have found Marshall-Arrow-Romer externalities to be dominant; others, like Feldman and Audretsch (1999) find that Jacobs externalities are more prevalent; in yet other cases, e.g. Capello (2002), both types appear simultaneously to be at work. On due reflection, this ambiguity is not surprising. The simple reason is that both measures are inadequate substitutes for other more directly relevant variables, for from what has gone before, we may infer that the critical issues are less the sectoral origins of externalities, than their roots in transactional networks, local labor market structures, infrastructural artifacts, and so on. When economists claim to find evidence for Marshall-Arrow-Romer externalities or Jacobs externalities, they are not uncovering fundamental dimensions of innovation, but only distorting mirrors through which more basic processes are reflected.

32. Despite the emphasis on agglomeration in this account, it bears repeating that the geography of industrial innovation also needs to be set within a far wider frame of reference. As we have seen, the nation is a critical nexus of social forces constituting a distinctive innovation system. Increasingly, too, much innovation

today emanates from relationships that are nothing less than global in extent (Amin and Cohendet 2004). Multinational corporations are a major factor here. Whereas R&D activities were once thought to be endemically tied to domestic locations (see, for example, Pavitt and Patel 1991), the evidence now indicates that multinationals are increasingly prone to spread their research and scanning activities across multiple international sites (Cantwell and Janne 1999; Dunning 1993). A noteworthy detail here is that the foreign R&D laboratories of multinationals have a special affinity for locations in specialized agglomerations where they can tap into and appropriate local expertise and then re-diffuse it through their intra-corporate networks (Cantwell and Iamarino 2002; Chacar and Lieberman 2003; Cohendet et al. 1999; Ernst and Kim 2002). This re-diffusion is accomplished by long-distance transmission of information complemented by occasional face-to-face meetings of key personnel. Indeed, it is common practice in both the corporate and non-corporate worlds to enrich the flow of information between individuals normally located far from one another, by means of temporary gatherings (quasi-agglomerations) such as conferences, seminars, workshops, and so on. These gatherings present an opportunity for brief but intensive inter-communication in highly personalized situations, after which the participants disband back to their scattered work sites.

33. New information and communication technologies are now bringing about major shifts in knowledge-flow processes. Not only is it becoming possible to transmit ever larger quantities of explicit knowledge over greater distances at decreasing cost, but much tacit knowledge as well. Some analysts, such as Kaufmann (2003) and Leamer and Storper (2001), have claimed that the capacities of the Internet are limited in this respect because it does not easily lend itself to ostensive interactions. However, if the speculations of Cohendet et al. (1999) and Foray and Steinmuller (2003) turn out to be on track, we can expect considerable relaxation of this limitation to occur in the future, as the Internet, in combination with embedded work stations, becomes increasingly capable of handling information transfers of enormous complexity and subtlety.

Cultural Differentiation of the Creative Field

34. Spatial relations of proximity and separation exert profound effects on the functioning of the creative field, but cultural variations between different social groups and different places also modify these effects in very tangible ways. A shared culture is often a significant asset in promoting knowledge exchange and innovative effort, just as cultural differences can result in costly misunderstandings, particularly if tacit knowledge is also involved. Gertler (1995) has documented a number of disruptive misunderstandings between Canadian users of advanced process machinery and German producers due to culturally distorted flows of information and contrasting codes of reference. In a complementary vein, Nonaka (1994) has emphasized that common patterns of socialization promote more effective communication of tacit knowledge. In circumstances where bonds of trust can be established, communication is likely to

be even further enhanced (Cooke 2002; Cooke and Morgan 1998; Uzzi and Lancaster 2003). A vivid illustration of the play of cultural factors in processes of communication and innovation can be found in the now classic work of Saxenian (1994). This work traces out contrasts in the changing fortunes of high-technology firms in Silicon Valley and Route 128 over the 1970s and 1980s, with the former group of firms being relatively open to external influences and interchange, whereas the latter were significantly insulated from inflows of new ideas. As a result, according to Saxenian, firms in Silicon Valley displayed a distinctively greater propensity for adaptation, survival, and innovation than those located along Route 128.

35. Once again, the important role of agglomeration as a nexus of performative intensity is underlined in these remarks. Localized clusters of firms and workers are sites of intense and recurrent daily interaction, and they are, by the same token, scenes of at least some forms of common socialization and cultural development. Local residents often develop shared understandings and codes that ease inter-personal communication and that facilitate the formation of fresh insights as they come together in the workplace (Breschi and Malerba 2001; Brown and Duguid 2000a). Certain tightly-wrought sub-groups of residents and workers may acquire certain of the attributes of technical and epistemic communities, or what Wenger (1998) calls communities of practice. Still, and despite the apparently uplifting case of Silicon Valley (Brown and Duguid 2000a; Saxenian 1994), we should not exaggerate the tendency for intra-community cultural norms to converge to a state where positive synergies with the local economic order are always engendered. Examples of less positive outcomes abound in reality, not to mention the cases of traditional cultures that are in various ways at odds with the functional essentials of capitalistic development.

Space-Time Dynamics of Innovation II: Culture, Sensibility and Symbolic Products

36. One of the striking features of the types of knowledge, learning, and innovation that we have considered thus far is that they tend to be cumulative: one discovery leads potentially on to another in round after round of evolutionary progress. By contrast, there are important facets of the modern economy that are given chronically to the search for novelty, but that do not display much cumulative development in the guise of better and more efficient ways of doing things. The outputs of fashion industries, such as clothing or jewelry, are obviously strongly subject to this syndrome. More generally, cultural-products sectors as a whole, as represented by motion pictures, music, electronic games, architecture, or tourism, as well as the fashion industries in the narrow sense, are all engaged much of the time in the pursuit of novel but essentially non-incremental output variations. These cultural-products sectors represent a major and rapidly growing share of employment and output in the new economy (Power 2002; Pratt 1997; Scott 2000), and they are the core elements of a rapidly widening system of design-intensive production in contemporary capitalism. To be sure, individual industries

in the cultural economy are also susceptible to radical technological change (Schweizer 2003), but the main emphasis in the present discussion will be on shifts in their symbolic content and stylistic appearance.

37. Just as conventional manufacturing industries fall under the sway of technological paradigms and trajectories, so cultural-products industries are subject to the play of design archetypes, i.e. basic frameworks of reference within which certain elements of substantive content and style can be endlessly combined. Any given archetype may correspond with a particular firm, region, sector, or nation. Like technological paradigms, design archetypes are subject to radical structural shifts, sometimes because of changes in final market demand, sometimes because of technological or organizational change in underlying production processes. The history of Hollywood over the last century provides a number of dramatic illustrations of the latter type of change, most notably the aesthetic shifts that occurred as the classical studio system gave way to the so-called New Hollywood in the 1940s and 1950s (cf. Bordwell et al. 1985).

38. Cultural-products industries are in general exposed to high levels of uncertainty and risk due to the fickleness of consumer tastes, even where this does not entail basic changes in design paradigm. In some sectors (such as music) the instabilities of this situation are compounded by the circumstance that they are subject to what Peterson and Berger (1975) have called "cycles of symbol production" in which large firms (or majors) and small independent producers vie with one another in rotating sequence for market share[6] (see also Hirsch 1972). Because of this volatility, cultural-products industries are especially given to vertical and horizontal disintegration (Caves 2000; Scott 2002b; Storper and Christopherson 1987) such that production is spread out over networks of many different firms. In addition, numerous sectors in the cultural economy exhibit strong signs of industrial dualism as represented by dominating groups of majors complemented by masses of smaller independents. The dense interlinkages that run vertically and horizontally throughout these sectors, combined with the massive aggregate labor demands that they generate, encourage the firms that make them up to converge together much of the time in dense spatial agglomerations. Such agglomerations are especially, but not invariably, found in large metropolitan areas like New York, Los Angeles, Paris, London, or Tokyo, where they form distinctive industrial quarters or districts.

39. The transactions-intensive structure of the cultural economy is realized at two main levels: one inter-firm, the other intra-firm. First, firms in sectors like motion pictures or music recording coalesce functionally together around particular projects (often financed and organized by majors), only to fall apart again when any project is completed and then re-coalesce in new combinations as further projects come along. Such interaction, as we know from the previous discussion,

[6] The independents pioneer new styles that first attract audiences in marginal market niches. As some of these styles become popular, the majors then bring them aggressively into the mainstream. The scene is now set for new styles to appear on the fringes of the market. And so on.

promotes the circulation of ideas and is a stimulus to innovation. Second, many firms, especially those that put a premium on imaginative product designs, organize their workers in temporary project-oriented teams in which regular employees, part-time staff, and freelance specialists combine together to pool their expertise and talent (Bielby and Bielby 1999; Blair et al. 2001; Grabher 2002; Sydow and Staber 2002). Shifting, open-ended teams of this sort are often capable of multiplying the creative powers of their individual members many times over (Nonaka 1994). Arresting examples of this phenomenon are offered by Hennion (1981) and Kealy (1979) in their accounts of how popular music recording sessions proceed through sequential adjustment as different participants, from the performers to the recording engineers, respond to one another's suggested improvements. Grabher (2001) has described the organization of work in the advertising industry in analogous terms.

40. This multiple and constantly shifting transactional structure in cultural-products industries means that workers become enmeshed in complementary and socially coordinated career paths (Montgomery and Robinson 1993). If anything, this condition is even more pronounced in the cultural economy than it is in other new-economy sectors, and it is a powerful mechanism of general socialization and habituation. Equally, it reinforces the effects of other mechanisms tending to engender distinctive cultural communities in particular places. Workers in these communities thus not only develop complementary technical skills, but also come to share sensibilities and mental attitudes that help to boost their joint creative capacities to yet higher levels. A work force molded in these ways is an exceptionally valuable asset in production systems where transfers of tacit knowledge are a key element of the labor process; and it is of particular moment in the cultural economy where competitive performance derives above all from the distinctive aesthetic and semiotic properties of final products. In addition, densely developed industrial agglomerations are almost always endowed with formal and informal workers' associations that bring workers into even closer mutual interaction. Cultural-products agglomerations are rife with such associations, which are an important means of reducing the abnormally high-levels of uncertainty and risk to which creative workers are typically exposed (Benner 2003). Workers participate in these associations not only to facilitate the acquisition of labor market information, but also to keep abreast of new developments in their specialized fields of activity (Scott 1998).

41. Communities of cultural-products workers and their associated production systems are the loci classici of what Florida (2002) has called the "creative class," though Florida's definition of this social category ranges far beyond workers in cultural-products industries as such. Ambitious and talented individuals in search of professional and personal fulfillment find these communities irresistible, and they accordingly flock in from every distant corner in a process that Menger (1993) has referred to as "artistic gravitation." As a consequence, the labor pools of dynamic cultural-products agglomerations are continually subject to

replenishment by selective in-migration of workers who are already predisposed to high levels of job performance even in advance of their arrival.

42. An additional ingredient in this rich creative mix of production networks and local labor markets is place itself, not only as a collection of industrial capabilities and skills, but also as a stockpile of traditions, memories, and images that function as sources of inspiration for designers and craftsworkers, and that help to stamp final products with a unique aura (Drake 2003). Thus, Parisian fashions, London theater, Nashville music, or Scotch whiskey, are not just generic fashions, theater, music, or whiskey but authentic expressions of an accumulation of past accomplishments, and they accordingly acquire reputations that may be imitated but can never be fully replicated elsewhere (Molotch 1996). This association between place and product, moreover, is self-reinforcing because the two sides of the coin are joined together through their interdependent reputations built upon the reprocessing of old images and the continual addition of new ones to the local repertoire of symbologies.

43. The unique capabilities and reputations of the individual firms that make cultural products and the places where they are located commonly imbue final outputs with unique competitive advantages on consumer markets. In the terms proposed by Chamberlin (1933), these products are subject to monopolistic competition. Chamberlinian competition is widespread throughout the new economy, but it is doubtless most intensely developed in the cultural economy. One symptom of this condition is the addiction of cultural-products industries to the quest for novel product configurations. But so, too, is the occasional case where a firm's outputs resist notable change over long periods of time because of their unique status on consumer markets. Thus, once a firm has established a brand with a durable reputation for quality (such Louis Vuitton handbags, or Wedgwood pottery, or Rolls-Royce cars) it has a strong incentive to maintain the basic shape and form of its products. Even in these cases, periodic fine-tuning of final designs is prevalent.

44. The rapid rise of cultural-products agglomerations in almost all of the high-income economies in recent years goes hand in hand with cognate transformations in the wider urban environments in which they are ensconced. Cities where a high proportion of the labor force works in cultural-products sectors are themselves subject to major transformations of their physical and social fabric in sympathy with local patterns of economic development. Landry (2000) has alluded to this phenomenon in terms of the encompassing notion of the creative city. Some of the most advanced expressions of this propensity can be observed in great city-regions of the modern world. Certain areas in these cities display a more or less organic continuity between the local physical environment (as expressed in streetscapes and architecture), associated social and cultural infrastructures (museums, art galleries, theaters, shopping and entertainment facilities, and so on), and the production activities that cluster in adjacent industrial districts (advertising, graphic design, audiovisual services, publishing, or fashion clothing, to mention only a few). Numerous cities have sought to promote this continuity

by consciously re-organizing critical sections of their internal spaces like theme parks and movie sets, as exemplified by Times Square in New York, The Grove in Los Angeles, or the Potsdamer Platz in Berlin (Roost 1998; Zukin 1991; Zukin 1995). In these cities, work, leisure, and social life increasingly ramify with one another in synergistic interrelationship. The music scenes of Los Angeles and New York dramatically exemplify this trend, with their vibrant mix of live music venues, bars, restaurants, boutiques, and so on, and their associated recording industries. The success of these two complexes of specialized urban life can be judged in part by the fact that they consistently turn out streams of hit records in numbers that disproportionately and significantly exceed even those that we might expect from their great size (Scott 1999b).

45. Of course, the cultural economy, along with new-economy sectors at large, is also caught up in insistent processes of globalization, in the double sense that cultural products flow with relative ease through international markets, and that producers are increasingly drawn to move relatively standardized work tasks to cheap labor locations in other countries (Scott 2002a, 2002b). Like other dynamic sectors of modern capitalism, cultural-products industries are dominated by very large multinational conglomerates, most of which are involved in all phases of production, from content origination, through distribution, to final sales. The majors embedded in these conglomerates typically command significant economies of scale and scope, hence allowing them to concentrate their creative energies on the production of ambitious blockbuster outputs for global markets (Scott 2002b). At the same time, and nowhere more than in media sectors, such as film and television, the majors are engaged in building global networks of creative partnerships such as international joint ventures, strategic alliances, co-productions, and so on. One of the benefits of these arrangements is that they allow producers to scour the world for talent, skills, and ideas. The Hollywood majors are the driving force behind this trend as they push ever forward in the race to produce successful global blockbuster films.

46. International markets for cultural products may currently be dominated by the outputs of majors located in a small number of global city-regions, but they are increasingly subject to contestation by producers in other places. A number of secondary cultural-products agglomerations around the world, even in peripheral countries, are currently seeking to upgrade their creative capacities and to expand their presence on export markets. Bollywood cinema is a notable case in point (Pathania-Jain 2001). Many of these agglomerations have useful local assets in terms of distinctive traditions, styles, and world-views, but producers often remain unable to tap into wider markets because of the cryptic cultural codes in which their outputs are enveloped. This state of affairs presents enormous creative challenges to producers and workers in these agglomerations as they seek to maintain significant levels of product differentiation (monopolistic competition again), and yet to cultivate more syncretic sensibilities so that their outputs are able to command a share of global markets.

Collective Order of the Creative Field

47. The creative field that undergirds the new economy is constituted as a constellation of workers, firms, institutions, infrastructures, communication channels, and other active ingredients stretched out at varying densities across geographic space. This web of forces is replete with synergistic interactions variously expressed as increasing returns effects, externalities, spillovers, socialization processes, evolving traditions, and so on, and it is above all a locus of extraordinarily complex learning processes and knowledge accumulation. These properties of the creative field mean that it functions as a sort of commons, especially as so many of its constituent elements and processes are free-floating, as it were. As such, they are the private property of none and the collective property of all, though by the same token, they often exhibit signs of severe over- or under-production and misallocation. Places where these maladjustments occur are therefore potentially liable to underperform in economic terms relative to their theoretical optimum (Lawson 1999; Niosi and Bas 2001; Oinas and Malecki 2002). In principle, then, there are real gains to be made where systems of public oversight of the creative field can be brought to bear on these problems, though once this statement has been made, it must immediately be qualified by the observation that our current capabilities in terms of relevant policy-making and planning still remain far from equal to the task (Storper and Scott 1995).

48. In the period extending roughly from the 1920s to the 1970s, the perceived functional failures of industrial innovation systems (and the suggested policies directed to their rectification) were formulated in quite different terms from those that dominate the present discussion. This was the period when fordist mass production was running its course, and when formal technological research was seen as being the critical source of increases in productivity. As economists of the period pointed out, this kind of research was (and is) subject to severe market failure (Arrow 1962). Private firms have difficulty in exerting ownership rights over any new knowledge that they may produce, with the consequence that they tend to underinvest in research relative to expected social return. Arrow's point, correctly, is that this state of affairs explains and justifies pervasive governmental programs in support of basic research.

49. To be sure, this problem has by no means disappeared, and government remains to this day a major source of research funding. However, as the new economy has gathered momentum, numerous shifts in the nature of public support for innovative activity have occurred, with civil associations, foundations, and private-public partnerships acting more and more to complement direct governmental subsidies. Much public support now also comes from bottom-up sources, and since the 1970s and 1980s, purely local initiatives such as innovation or design centers – often funded by municipal authorities -- have played an important part in bolstering agglomeration-specific forms of innovation (Bianchi 1992; Castells and Hall 1994). At the same time, the strengthened intellectual property rights regime in the United States since the passage of the Bayh-Dole

Act of 1980 allows for a great extension of patenting power across different products and institutional arrangements (Orsi and Coriat 2003), and this has encouraged a massive surge in new patent applications over the last decade or so (Antonelli 2003; David and Foray 2002). For cultural-products industries, intensified legislative attack on the problem of product piracy will help to bring further protection. Moreover, the tacit nature and cultural specificity of much of the knowledge base of new-economy sectors provides some shelter to firms from critical information leakages to third parties.

50. Just as market failures are common in the domain of research and development, so they also pervade education and training. Hence public support is again called for to maintain a dynamic and innovative economic order at both the local and national levels. There is always great pressure on municipal authorities to ensure that useful skills are constantly in supply, and specialized education and training activities subsidized by local governments are invariably to be found in and around dense industrial agglomerations. Public and quasi-public agencies also frequently contribute to the formation of local social capital by promoting trade fairs, exhibitions, festivals, cultural preservation measures, and so on, all of which have considerable direct and indirect impacts on entrepreneurship and innovation. In much the same way, there has been a notable expansion of late in the formation of representative bodies acting as the guardians of regional trademarks and warranties, certificates of geographic origin, and so on, all of which are important devices for protecting community intellectual property. In the new economy, even local authorities have become part and parcel of the entrepreneurial and innovative powers of the creative field (cf. Harvey 1989).

51. Urban planning is another of the instruments deployed by many municipalities today in their quest to enhance the collective order of the creative field. Urban planners have always been concerned with issues of infrastructure and land use, but today their activities are focused more directly than they ever were in the past on local business development and the promotion of innovative industries. A dramatic example of this shift in urban planning priorities is offered by the grandiose Multimedia Corridor Project in Malaysia (Bunnell 2002). Other examples are represented by the efforts of municipalities all over the world to develop science and technology parks in order to promote local economic development and growth. Some of these efforts – such as Stanford Science Park, Research Triangle Park, or Sophia Antipolis – have been spectacularly successful, but many others have failed to live up to their expectations (Luger and Goldstein 1991).

52. A further example of an urban planning initiative focused on the encouragement of industrial creativity and innovation can be found in recent transformations of the central garment-manufacturing area of Los Angeles. In an effort to upgrade both the local environment and the clothing industry much of this area was turned into a specially-zoned enclave in the mid-1990s, officially designated the Fashion District. This enclave now exudes a carnivalesque atmosphere deriving from the

local assemblage of renovated buildings, colorful street scenes, and up-scale shopping facilities that have sprung into existence. Although sweatshop factories still abound in the area, it has increasingly become a center of innovative fashion design and a unique tourist attraction (Scott 2002a). Parallel developments are observable in the planned cultural quarters that can now be found in a number of old European manufacturing cities (Brown et al. 2000; Jeffcut and Pratt 2002).

53. Institution-building to manage the plethora of information flows (and derivative learning effects) in spatial and functional clusters of producers offers yet another important set of possibilities for collective action in the creative field. We have already noted that these flows frequently evade social control because they so often take the form of involuntary and unreliable overspill effects. Institutional arrangements that are capable of at least partially internalizing and managing these flows are therefore highly desirable elements of the creative field (see, e.g. Audretsch 2003; Lissoni 2001; Walcott 2002). Experiments in building such arrangements have been notably characteristic of high-technology industrial agglomerations over the last couple of decades. One outstandingly successful instance is the CONNECT program in the San Diego area, which seeks to promote the local biotechnology industry by linking private entrepreneurs with science and business programs at the nearby University of California at San Diego (see Scott 1993). A real, but elusive basis for recalibrating information flows and stimulating innovation is trust. In the absence of trust -- or perhaps better yet a calculated sense of mutual codependence -- the long-term collaborative interaction that is essential for evenhanded exchanges of sensitive information between private firms can rarely be established. “Calculated” is the operative word here, for an excess of naïve trust only opens producers up to predatory business practices.

54. Lastly, the creative field as a whole is subject to path-dependent evolution, and for this reason, as well, informed policy intervention can often boost economic performance (Boschma and Lambooy 1999; Nelson and Winter 1982). Path dependency is notably characteristic of agglomerated production systems where tightly interlocking transactional interdependencies and local labor market structures open up certain options for further development while foreclosing others (recall Figure 1). The opportunities and threats presented by this situation mean that there is a positive role for certain kinds of system-steering activities over time. Two hypothetical cases may be invoked to illustrate the point. First, an agglomeration that develops as the center of gravity of a new industry often acquires first-mover advantages based on incipient agglomeration economies that then push it forward as a dynamic hub of specialized entrepreneurship and innovation (cf. David 1985). Given the right conjuncture of circumstances, policy makers can occasionally exploit first-mover advantages to push their region ahead in the race to develop. Second, as any regional economy continues to grow it may start to lock into increasingly dysfunctional configurations, as in the case of the firms located along Route 128. Lock in of this sort has many possible sources, but the induration of social and cultural conventions that may once have been

beneficial, but then become shackles on further innovative advances, appears to be one of the more common of them. Constant vigilance and mutual cross-checking are therefore required by all stakeholders in order to head off looming problems in this regard.

A Final Word

55. In this paper I have tried to sketch out a geographic theory of the creative field and the ways in which it shapes the functions of entrepreneurship and innovation in the new economy. In writing the paper, I have drawn heavily on the primary research of many other scholars while at the same time seeking to synthesize this work within a wider theoretical framework.

56. The creative field as identified here is representable as a web of locationally-differentiated, multiscalar interdependencies between production, work, and territory. I have argued at length that this tense force-field of interdependencies can help us understand a number of critical dimensions of entrepreneurship and innovation. In particular, I have suggested passim that there are very basic variations in these activities from place to place as a function of underlying spatial and locational processes. Geography, in other words, is not simply a passive frame of reference, but an active ingredient in the performance of important segments of the economy. In my portrayal of entrepreneurship and innovation as socially- and spatially-embedded processes, there is no attempt on my part to depreciate the role of individual intelligence and imagination in securing economic growth and in pushing new product development forward. Rather, I have argued that human action is always an expression of the integrity of each individual's power to choose and to challenge, even as it is simultaneously and organically situated within real social structures.

57. As the difficult issues addressed by this analysis have come into view, I have hinted at a further question that can now briefly be made explicit. Why, in short, do certain places at certain times develop as foci of remarkable creativity in the form of exuberant entrepreneurship and innovation? Why did Lancashire become such a prominent center of the cotton textile industry in the nineteenth century and a vortex of related inventive genius? Why and how did Hollywood emerge as a world center of film production some time after 1915? Why did Silicon Valley evolve into a hotbed of high-technology entrepreneurial effort and innovation over the 1960s and 1970s?

58. The analytic deconstruction of the creative field as set forth above does not provide any ultimate answers to these questions, but it does point out some fruitful avenues of further investigation. Four brief points now need to be made by way of clarification. First, the precise geographic location where the seed that initiates regional growth comes to rest is often quite arbitrary. Second, there may be many pathways of subsequent regional development, but all of them are marked by hysteresis. Third, regional competitive advantage is secured by an

endogenous dynamic of intensifying agglomeration economies in combination with the growth of external markets. Fourth, entrepreneurship and innovation are the active mechanisms (i.e. the principal expressions human agency) in this developmental process. More generally, the answers to the questions posed above need to be formulated in terms of a dynamic of cumulative causation whose end point is definable not terms of some primum mobile or first cause, but in terms of its own historical momentum. This remark leads at once to an ontology of regional growth and development that is sensitive to notions of economic evolution and their connections to the ideas of Marx and Schumpeter, Bourdieu and Giddens, as conjured up at the beginning of this paper.

59. One final puzzling question remains. The essence of this question has already been partially articulated above, but I shall re-frame it (provisionally) in terms that bring it more plainly into view, namely: Is it the search for knowledge and innovative energy that induces firms to agglomerate together in geographic space; or is it the prior convergence of firms around their own center of gravity that gives rise to the high levels of knowledge creation and innovation so often observed in dense agglomerations? We can point to specific analytical claims in the literature that veer to the one side or the other of this question -- particularly perhaps to the former (e.g. Brown and Duguid 2000b; Malmberg and Maskell 2002; Pinch and Henry 1999; Storper 1995) -- but not to any decisive general resolution, partly because the question itself is in fact not properly posed. In reality, processes of agglomeration are very much more multidimensional than the question allows. Thus, there are plenty of industrial agglomerations that are active and growing even though their creative capacities appear to be quite limited;[7] conversely, we can point to many agglomerations where the main engine of growth is rather clearly their insistent creative vigor. Nor should we forget the (increasing?) number of instances of highly innovative industrial systems that show no proclivity to agglomeration whatsoever. Actually, the driving forces underlying most cases of industrial agglomeration today are in all likelihood rooted in a combination of factors, as suggested in the classical Marshallian approach to the problem. In more specific terms, as I have argued consistently above, there can be few, if any, truly "independent variables" at work in the creative field, but only structures of direct and indirect interdependence that play out in many different ways in different geographical and historical circumstances.

[7] The garment industries of numerous large cities in both low- and high-income countries illustrate this point well.

Appendix

In this Appendix, I describe a brief and admittedly far from definitive statistical experiment by way of illustrating how the propensity to patent as a function of geography can vary by sector. The experiment is based on patenting information for two sectors -- jewelry and printed circuit boards – chosen for their contrasting technological bases and the sharpness of their identifications in the North American Industrial Classification System (NAICS).

For each of the two sectors, the number of patents taken out from 1992 to 2002 was calculated from the searchable database published on the Internet by the US Patent and Trademark Office. Only patents issued to residents of the United States were considered. Patents were identified on the basis of the occurrence in their titles of the keywords "jewelry" or "printed circuit boards." A scrutiny of individual patent descriptions suggests that these keywords are remarkably effective in selecting relevant data. All patents were coded by state. In all, 716 patents were extracted for jewelry, and 1,041 for printed circuit boards.

Various data items (again coded by state) were also taken from the 1997 US Economic Census for NAICS 33991 (Jewelry and Silverware Manufacturing) and NAICS 334412 (Bare Printed Circuit Board Manufacturing). Note that silverware manufacturing represents only an extremely small element of NAICS 33991. The data culled in this way refer to the usual range of census variables (employment, number of establishments, value added, and so on). These data, supplemented by total population counts, were then deployed as independent variables (in the form of natural numbers, ratios, and logarithms).

Numerous regressions of patenting activity in the two sectors were run in the search for statistically significant relationships. Almost all of the independent variables used in the analysis turned out to be insignificant. Only three independent variables proved to be consistently and robustly significant, namely, employment, number of establishments, and total population, each of which can be roughly interpreted as an index of agglomeration. Employment and number of establishments, however, are very closely correlated with one another. Since employment is a somewhat less satisfactory measure of agglomeration than number of establishments, it was eliminated from the analysis. Rather surprisingly, average establishment size was persistently insignificant in all model runs.

The final regressions selected for presentation here are:

(1) $PAT_{jk} = 0.0026\ EST_{jk}^{\ 0.5981}\ POP_k^{\ 0.4012}$ $(R^2 = 0.84;\ \underline{N} = 41)$;

(2) $PAT_{pk} = 1.2150\ EST_{pk}^{\ 1.2161}\ POP_k^{\ -0.1054}$ $(R^2 = 0.89;\ \underline{N} = 39)$.

Where PAT_{jk} and PAT_{pk} are, respectively, the total number of patents in jewelry and printed circuit boards taken out between 1992 and 2002 in the $\underline{k}^{th}$ state, EST_{jk} and EST_{pk} are, respectively, the number of establishments in the jewelry and printed circuit boards sectors in 1997 in the $\underline{k}^{th}$ state, and POP_k is population of the $\underline{k}^{th}$ state in the same year. States with no patenting activity in the relevant sector were eliminated from consideration.

All computed regression coefficients are significant at the 0.01 level except for the coefficient attached to POP_k in equation 2, which is not significant.

The important point about this exercise is that patents for jewelry exhibit positive but diminishing returns with respect to number of establishments, whereas patents for printed circuit boards exhibit strongly increasing returns. Possibly, this contrast is related to differences in the technological foundations of the two sectors. The effects of population are positive and significant in the case of jewelry patents, and negative but insignificant in the case of printed circuits. This result may be a reflection of a situation where some degree of jewelry patenting is carried out by individuals not

directly associated with the jewelry industry, but where patenting in printed circuit boards is almost wholly confined to industry specialists.

As limited an exercise as this may be, it does underline the major point that any attempt to pool patents or innovation data for many different sectors is likely to be fraught with statistical problems. In particular, it suggests that we are likely to find that important differences exist from sector to sector in regard to the effects of agglomeration on learning and innovation. There are probably numerous industries in which patenting activity is in fact not particularly sensitive to agglomeration processes, and hence it is scarcely surprising that increasing returns to scale are so rarely observed in aggregate models.

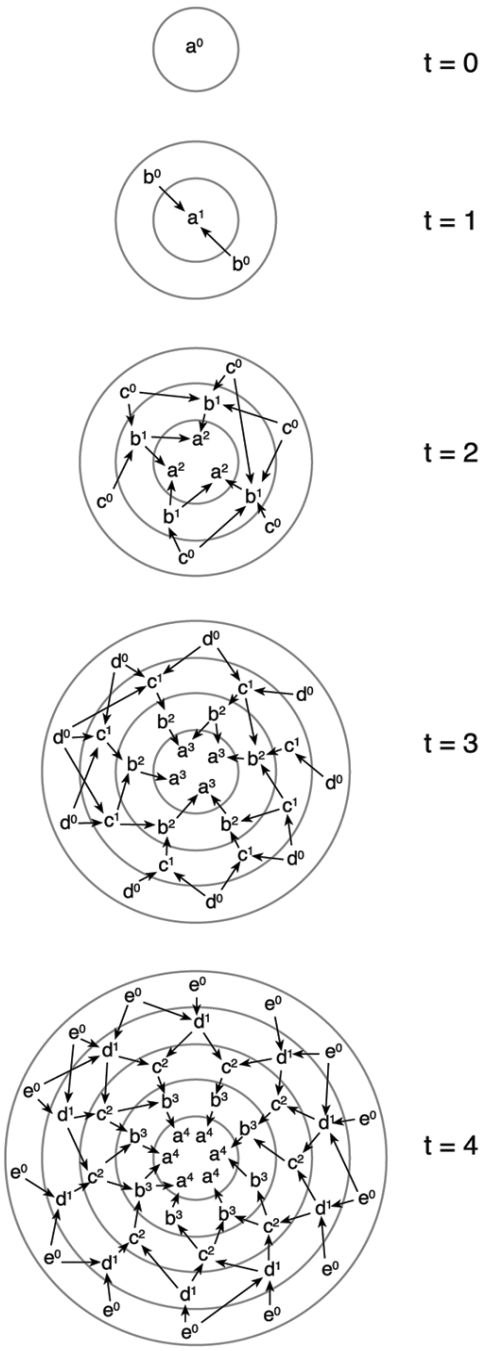

Figure 1. Schematic representation of the vertical and horizontal development of a network of inter-establishment transactions. The symbols $\underline{a}^{\tau}$, $\underline{b}^{\tau}$, $\underline{c}^{\tau}$, $\underline{d}^{\tau}$, and $\underline{e}^{\tau}$ represent establishments differentiated by sector and evolutionary generation, τ, where τ for any given sector is equated to zero at the time of the first appearance of a new establishment in that sector. The symbol $\underline{t}$ refers to time in general. It is understood that the changing structure of production from $\underline{t}$ to $\underline{t}+1$ is associated with qualitative internal changes in establishments as they evolve from the corresponding generation τ to generation $\tau+1$. The arrows represent procurement linkages, but these should also be understood as sites of information exchange. Linkages will usually be highly variable over space and time.

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