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The Art of Systems: The Cognitive-Aesthetic Culture of Portal Cities and the Development of Advanced Knowledge Economies

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INTRODUCTION

There are two ideas of culture. One is romantic (Murphy & Roberts, 2004). Culture in the romantic sense is a function of nations. Nations are defined by territory, language, and social norms. Nations possess incommensurable characteristics—different ways of doing things and creating things, and different mind sets, that provide advantages in global economic and social competition. In particular the “genius” of a nation produces innovation. A second, and older, idea of culture equates culture with the civilization of cities. This idea precedes the modern romantic idea of nationhood. Culture as a function of the civilization of cities is less the expression of incommensurable qualities and habits and is more the consequence of the universals of shape, pattern and form.

These are universals in the sense of their reach. They can be understood irrespective of nationality and, acquired and stored as knowledge, they can be widely imitated and are applicable in many domains. A little like nations, however, this kind of pattern knowledge does not emerge just anywhere. Nor is it most potently applied just anywhere. Its natural ecology is the city, especially as we shall see shortly, the porous environment of great portal cities. The emergence of pattern knowledge is closely associated with the aesthetics of these littoral cities and the high-quality design cultures that such cities invariably produce. In the second model of culture, then, it is the art, design power and beauty of cities that produces innovation.

Japan exemplifies the two meanings of culture. It has a strong, easy-to-recognize set of national characteristics. The Japanese way of doing things is often used to explain the wealth of Japan's economy. But, long before Europe, archipelagic Japan was a highly urbanized society which had a refined aesthetic culture and which relied on the intensive importation of knowledge even when, from a national perspective, Japan was "closed" to the world. Today the 41 universities of Kyoto, and its huge industrial research park infrastructure, owe considerably more to the urban culture of art and knowledge than they do to the national "difference" of Japan. This is especially so at the socio-cultural level of fundamental far-reaching innovation. National culture has a significant role in the identity formation of linguistic or territorial groups. Yet, as an innovation driver—a shaper of technological, economic and social forms with a high propensity for export—national difference is much less significant. The largest part of human innovation has for the longest time been tied to the culture of cities.

THE ART OF SYSTEMS

The particular significance of all of this is that, while the human species has always on some level innovated, in the last two hundred years innovation has become a core economic and social force. What we have come more recently to call the knowledge economy is simply a reflex of this. Knowledge, it needs to be emphasised, is not per se innovative. Mostly knowledge is something that is second hand. It passes from one person to another. Yet, sometimes, the act of knowledge produces something new—something unheard or something unprecedented. Newness is not such an important quality in itself. Where it is important is where knowledge that is new produces something that gives shape to the world. This kind of knowledge patterns what we make and how we manage, what we say and how we feel, what we do and how we behave in the world. Let us call this formative knowledge or pattern knowledge. The amount and the influence of this kind of knowledge have grown sharply in the last two hundred years. Usually it begins obscurely enough and normally in some domain of art or science. What is impressive is how quickly pattern knowledge now moves from the quieter corridors of the arts and science into bustling thoroughfares of wider society.

One of the reasons for this is that a large number of modern institutions—ranging from corporations to governments—routinely absorb and apply, utilise and spread, promote and develop new knowledge (Heller, 1985). Another reason is the growth of self-organizing systems in the modern world. Observing and mimicking patterns is a human trait. The mimetic power of social systems and information systems in the modern world has expanded significantly. Since the Industrial Revolution, economy activity based on applied science and applied art has grown at an enormous rate. Governance based on the social sciences and cultural industries based on the humanities have expanded in tandem. Modern institutions—ranging from manufacturing corporations to government departments to film studios—have become adept at modelling and restructuring using pattern knowledge. Despite this, our "knowledge of knowledge" remains elusive. It is a far trickier question to explain how pattern knowledge emerges than to describe its impact on economic behaviour and social organization.

The classic philosopher's paradox—that knowledge is ignorance—indicates just how difficult it can be to precisely answer the question "what is knowledge?" One of the oldest confusions is to equate knowledge with opinion. We still do this, and we do it alongside all of the newer idols of knowledge we have invented, not least the idea that the accumulation of information is the same as knowing things. The fallacy of equating knowledge and information is illustrated by a very simple example. Stock investors who ignore the financial news and who pay attention solely to profit and loss results make better investment decisions (Surowiecki, 252-254). The opinions of pundits and the 24/7 flow of information gets in the way of making good financial judgments. So often, in the case of knowledge, less is more. Knowledge is always economical. There is a good reason why this is so. Knowledge as opposed to opinion, expression, or information fixes on the form or shape of things. Knowledge is a function of system or architectonic arrangement. Knowledge is intimately connected to the art of systems, the art of how things are systematically arranged so as to be most pleasing, useful, efficient, economical, just, inspiring or moving. Knowledge is the comprehension of form. Information, opinion and expression are often superfluous to the essentials of form. They just get in the way.

Considered as a unified field, then, knowledge is “aesthetic”. Knowledge, in the strong sense, is the aesthetic or art of systems. Self-reflexive accounts of high-level knowledge creation tend to conclude on a very repetitive note: knowledge begins with an image. It starts with the intuition of an image, a shape—a sketch of something in the mind. The aesthetic quality or art of systems cuts across economy and emotions, work and entertainment, politics and imagination. It is common across all of the compartments and spheres of human action and cognition. Thus, to know something is also to know how to arrange something or how something is arranged. Aesthetic qualities, we must always remember, are not simply social phenomena. The art of systems plays its role in the formation of societies and economies. But systemic aesthetic qualities are also pervasive in the physical and biological domain as well. Characteristics like symmetry are built into the fabric of the universe (Greene, 238-243). It is unsurprising then that knowledge economies are functions of both the arts and the sciences. Beauty is to be found in self, society, and nature. Knowledge, in the sense of the art of systems, is knowledge of the commons. It is, at its root, the mind’s grasp of the common forms or common morphologies of self, society and nature.

The aesthetic or art of systems may be explicit or tacit. We can explain “what” we know, but more often we rely on inarticulate assumptions of knowing “how” to do something. Knowledge breakthroughs usually make what is inexplicit, explicit. We give an account of what we know. But most knowledge remains implicit in the structures or systems we build or that we discover around us. In the most advanced economies and societies, we are surrounded by ever-deepening layers of knowledge embedded in complex systems. Yet we don't very often read a manual to make sense of a software system, any more than we read a travel guide to make sense of a city. We buy these code books for reassurance, but in practice our deepest knowledge comes through reconnaissance and navigation of these systems as we identify their aesthetic or systemic properties, and match them with our intuitions of the same.

Knowledge in the sense of the aesthetic ordering or art of systems is not, and has never been, equally distributed across the face of the earth. Knowledge clusters: there are knowledge-rich societies and knowledge-poor societies. Some economies interpolate high levels of systems knowledge; others exist literally hand-to-mouth. The explanation of why this is so is, at least partially, a function of place. In certain definable places, knowledge concentrates, which also means that in these places high-level "aesthetic" regimes emerge. The chief nodal points in which knowledge concentrates are portal cities and sea regions. The powerhouse examples of portal societies or portal regions in history are to be found around the Mediterranean (ancient Greece, Renaissance Florence and Venice), the North Sea (the Low Countries, Southern England since the Renaissance, and the Scottish Lowlands in the eighteenth and nineteenth centuries), the Seaboards and Great Lakes of North America since the sixteenth century, and the China Seas in the nineteenth and twentieth centuries. Adding to these maritime regions the "inland peninsulas" of Europe—especially the Île-de-France and the triangular regions bounded by the Elbe and Salle Rivers, the Maas and Rhine Rivers, and the Rhine and Danube Rivers—we find that these societies, in their golden epochs, are responsible for most of the human species' towering artistic, literary, political, economic, scientific, and technological inventiveness.[1] Unsurprisingly, then, portal regions have also emerged as the principal incubators of modern kinds of intellectual capital (Murphy, 2005a). Advanced economies across the last 150 years have put great effort into transforming tacit knowledge into explicit knowledge and turning explicit knowledge into forms of intellectual property especially patents and copyrights (Howkins). Intellectual property, like generic knowledge, clusters in littoral, insular, peninsula, and riverine zones, regions, and states.

This recent history echoes deeper patterns in the distribution of knowledge. Scattered step-like across the last two and a half thousand years of human history, there have appeared a series of geographical regions distinguished by exceptionally high levels of intellectual innovation and the ability to use this groundbreaking capacity to generate economic wealth, social prosperity, and geo-political influence. Each of these regions has been characterized by two or more "world cities" that mirror each other, a maritime or riverine geography, and a precocious ability to trade, communicate and project themselves over long distances. Each region has developed a portal character. That is to say, each is an intensive importer and exporter of one or more of the following: goods, money, people, or information. A condition of this is that each develops porous systems that complement more conventional social systems based on rules and hierarchies.

PORTAL SOCIETIES

Porous systems, especially those with "global" reach, emerge where a society is good at encouraging designing intelligence. Portal societies are characterized by powerful cultures of design that are proficient in deploying the morphological resources of the commons. "Beautiful, elegant, fair, efficient, and economic" structures and processes are created by acts of design. Design represents a distinctive mode of economic and social production, distribution and interaction. Designing intelligence finds its epitome in high-level arts and sciences. The pursuit of aesthetic beauty and mathematical elegance mirrors the pursuit of lucid laws and social fairness.

A recurring characteristic of portal city regions is the creation of order by design. Order by design, a key part of the art of systems, facilitates the long distance, cross-cultural reach of portals. To do this, it reduces the grip of rules and hierarchies in social organization in favor of aesthetic self-organization. The latter is crucial. For aesthetic self-organization stimulates tacit and explicit innovation. Beauty and its many synonyms (e.g. mathematical elegance, social symmetry) are key drivers of social reform, systems development, product creation, machine efficiency, and so on.[2] The same thing that animates social and economic creativity propels great art and science, and creates great urban centers. Here we see the underlying symmetry between designing intelligence, the historic concentration of world-class arts and sciences in portal regions, and the economic wealth and aesthetic order of their cities. Common to all is the power of beauty.

Portal zones include historic cases like the fifth-century BCE Aegean and Black Seas (Athens), the Renaissance Mediterranean (Venice), and the seventeenth- and eighteenth-century North Sea (London, Amsterdam, Edinburgh). The modern age saw the development of powerful maritime city-regions in the New World notably the pseudo-sea regions (the East Coast, Great Lakes-Hudson region, the California coast) and littoral cities (Boston, Chicago, Detroit, Toronto, New York, San Francisco) of North America, the urban coastal cities and "beach civilization" of Australia, and the islands of New Zealand.[3] The nineteenth and twentieth centuries saw the rise of the China Seas region, and the emergence there of a series of insular and peninsula societies—Japan and more recently Singapore, South Korea, and Taiwan—that have accumulated high levels of intellectual capital and have developed impressive technocratic cities.

Like all other species of society and economy, portal regions include interesting cases of failure, and also of triumph over failure, such as

a. the dashing of Thomas Jefferson's hopes that the Mississippi-Gulf of Mexico-New Orleans region would become an economic powerhouse in the nineteenth century.

b. the faltering attempts to re-energize the Mediterranean in the same century as the territorial power of the Russians and Ottomans broke the tissue of connection between the Mediterranean and Black Seas, and oceanic power finished off the Mediterranean city-states.

c. the swallowing of the riverine city-states and principalities of Europe by French and German territorial power in the nineteenth century, and the splitting of Baltic and maritime East Asian economies by Soviet and Chinese Communist territorial power in the twentieth century.

d. the re-emergence of older portal regions—the Mediterranean (Northern Italy and Israel) after 1945; the renaissance of Black Sea and Caspian Sea zones and the reunification of the Baltic after the end of the Soviet Union, re-orientating historic intellectual capital rich coastal societies (e.g. Lithuanian, Estonia) to their littoral near-neighbors (e.g. Finland); and the re-emergence of the South Coast of China as a powerhouse with complex relations to its insular twin, Taiwan, following the partial retreat of state socialism in China.

e. the latter-day resurrection of the Gulf of Mexico as a major portal region structured around the Houston-Miami littoral arc, its oil-sea industries and high-tech space industries.

The ups and downs of these long-term, large-scale processes are well-illustrated by the case of the rise and fall of the large mainland-dominated Communist states in the Soviet Union and China. The resulting capitalist-communist geo-political bi-polarity disrupted historical patterns of sea ecumenes in the Black Sea, the Mediterranean, the Caspian Sea, the Baltic Sea, and the China Seas. Since the end of the Cold War, older and arguably more powerful patterns have come back into play. Studies measuring innovative capacity (measured by expenditure on R&D and production of patents) indicate that the emergent cohort of economic innovators (those that have appeared in the period since the late 1980s) are all littoral entities bordering these old sea regions. Porter and Stern (2000) point to major gains in innovative capacity made by Denmark, Finland, Singapore, Taiwan, South Korea and Israel. They predicted then that Ireland was in the process of joining this littoral group. It is also notable that three of the four countries (Japan, Sweden, Finland, and Germany) that have lifted their patentable level of innovative capacity consistently over the last quarter of a century are littoral states on the bounds of the Baltic or China Seas. Sharp observers have noted how with the demise of the Soviet Union "a new Hanseatic League" began to develop. This is "an emerging regional commercial trading zone, stretching as far as Hamburg and Copenhagen to the west, Oslo and Stockholm to the north". The "eastern anchor" of this zone is the "twin cities" of Helsinki and Tallinn, located a ferry ride across the Baltic Sea (McGuire, Conant, and Theil, 2002, 14). Such twinning or mirror cities are very typical of these powerhouse sea region groupings. As in the case of Israel, Finland, and other budding innovators, at the end of the twentieth century information technologies and telecommunications have played a leading role in the re-emergent zones. However, one should be careful not to over-identify formative power with any particular technology, system, or process.

In all of the cases deeper structural forces are at play. In all portal regions characterized by persistent and high levels of innovation, procedural rules and social hierarchies are (partly) displaced by aesthetic structures or tacit self-organizing forms of order. This is conditioned by the fact that portal societies are all involved in long-haul trade. Sea or riverine carriage, and long-distance trade, shapes the nature of portal regions by virtue of one telling condition: the greater distance is, the less effective are hierarchies and rules in ordering human transactions. One of the results of this is that knowledge in the strong sense of the aesthetic or art of systems has an incipient tendency to replace hierarchies and rules under portal conditions. This has important spin offs, one of the chief being that portal city regions are excellent milieus in which the arts and sciences develop.

This helps to explain the role of the arts and sciences in the political economy of portals, and the high level of creativity often characteristic of them. A classic case of this is historic Königsburg, on the far eastern side of the Baltic. This old port and university town not only produced Immanuel Kant but also Hermann Minkowski (the geometer who provided the mathematical basis for Einstein’s theory of “spacetime”), Theodr Kaluza (whose geometry laid the foundation for string theory in physics), and Hannah Arendt (one of the two or three great political philosophers of the twentieth century). Copernicus came from the nearby port town of Frombork. Think also of cases such as fifth-century

BCE Athens or twentieth-century New York City. Why do these places have such a high incidence of creativity? The phenomenon can be explained in part by the dense, unsocial, and mobile nature of portal cities and their populations of strangers who lack thick social ties. "Aesthetic" ordering, key to creative acts, is favored under such conditions. Political context also has implications for the power of aesthetic ordering.

The most crucial factor is that city-regions are not nations. To do what they do, they must operate at least to some extent outside of national-territorial procedural institutions and network systems, and equally also outside of the bureaucratic hierarchies of patrimonial states. Hong Kong's special administrative status vis-à-vis the People's Republic of China is a classic example of the latter. The Pearl River Delta today produces 10% of China's GDP and 40% of its goods for export. This is directly a function of Hong Kong's special—that is, "odd"—status. Portal city regions flourish where the states or legal systems that they are embedded in are "odd", at least in contrast with conventional nation states and patrimonies. Often these are states that are federations, commonwealths, or "unions" of states. Examples range from the 17^{th}-century Dutch Republic and the United States to United Arab Emirates and its mercurial portal of Dubai. Such states are based on devolved power, divided power, or separated power. In other cases, the power of portal states is enigmatic. They rely on tacit "unwritten" constitutions (like Great Britain) or on a pervading sense of "anonymous" power (like Japan)—or else they are states that are cities (historic Venice, Singapore); states that have been divided in half (South Korea); or states that are claimed as provinces of another state (Taiwan). In some case, portal city regions, like Japan's Kobe-Osaka-Yokahama-Tokyo conurbanation, dominate the surrounding nation state.

In short, powerful portals are "different". They obey the law of the state, yet have a life that is quasi-independent of it. Portals, though, don't just replace one kind of law for another. What makes portals truly different is their capacity to replace social rules and hierarchies with an intuitive aesthetic order. This has enormous consequences, not least because the resulting morphology of portal city-regions typically embodies an emphatic sense of form, and this in turn encourages visual, intuitive, and pattern-style cognition that is essential for high-level creative action. Let us examine how such aesthetic order emerges.

EMERGENT FORMS

When a portal city begins to act as an intermediary between its manufacturers and foreign cities or between its countryside and foreign cities, or simply between foreign cities, it becomes a "foreign commerce" city. People bring their goods to the intermediary—to the portal—rather than trading directly because of the *concentration of intelligence* in the portal city. A classic example is the cotton trade in the American South before the Civil War. By 1830, 40% of the receipts of that trade flowed to New York City for freight, insurance, commissions, and interest (Miller, 1968, 156). This is a consequence of the fact that in any production or distribution system, organizational capacity, logistics, and inventiveness over time acquire a progressively greater role in contrast to land, labor, energy, and physical capital. Portals concentrate such capacities. Intelligence in the most general sense means the capacity to make "better than chance" choices. Portal cities are "intelligence centers". Portals function as intelligence centers in a number of different ways, ranging from the simple to the complex. Let us consider briefly these "levels" or "stages".

(a) At the first “level” or “stage”, portals collect and disseminate information about prices, environmental conditions, availability of transport, assessments of political risks, maps, stories of expeditions, warnings of invasions, and so on. Such information is a response to uncertainty. The more uncertain the world, the greater is the demand and the need for information.

(b) Uncertainty creates contingency—possible or alternative ways of acting are projected in order to meet uncertain conditions. Intelligence at the second “level” or “stage” is the ability to think effectively about contingencies, and to evaluate possibilities (“what might be done”), without fear or panic or irrational exuberance. Limited intelligence, typical of societies with thick cultures, assumes a more or less fixed number of alternatives. Expansive intelligence, typical of societies with thin cultures but high cognitive thresholds, encourages unconventional conceptions of what might be done.

(c) The third “level” or “stage” intelligence rests on the capacity to be able to locate events, contingencies, and choices in the context of large-scale and long-range patterns and structures. Contextualization relies on pattern recognition. This requires *theōria*—the ability to be able to step back and think “theoretically” about events and contingencies, which means being able to “intuit” the deeper structural forces and morphologies that shape surface events and contingent situations.

(d) The fourth “level” or “stage” of intelligence is innovation/creation. This kind of intelligence is not to be confused with reflexive projection and evaluation of contingencies. “Future thinking”, involved in puzzling about contingencies, underpins adaptability to contextual change. But changing actions or the rules of action to master contingencies is not the same as fundamental creation/innovation.

Fundamental creation/innovation is a function of emergent forms. The highest "level" or "stage" of intelligence is *the capacity to give form*. This is the most difficult and the most mysterious kind of intelligence. It is very powerful, but rarely in evidence. It is the kind of intelligence that is called upon when social systems are threatened with chaos. This kind of intelligence creates new scientific, technological, economic, social, organizational, intellectual, and cultural forms. The creation of new forms is rare, but extraordinarily important (Castoriadis, 1997).

Where do such forms come from? That is a difficult question to answer. But one thing is clear: portals have played an exceptional role in the history of creation. In antiquity, the Mediterranean ecumene was a generator of a remarkable array of forms. The Silk Roads-Caspian Sea ecumene was the incubator of the most vital developments in Arab and Islamic thought. The China Seas ecumene today produces the most enterprising of Asian social forms. The Baltic Sea was a driving force of commercial innovation during the European Middle Ages (Parker, 132-150). The Mediterranean revisited its massive formative power during the Renaissance and early modern era. The North Sea-Baltic Sea ecumene became the crucible of European and global modernity in the sixteenth, seventeenth, eighteenth, and nineteenth centuries.

The greatest form-generating powerhouse in the nineteenth century was the Great Lakes-Hudson ecumene that linked Chicago and New York City. In the second half of the twentieth century, this leading role gravitated to the coastal ecumene that linked San Francisco's Bay Area with Los Angeles and San Diego. Much of the enduring strength of the United States derives from its unprecedented command of not one or even two but of multiple portal city regions ranging from the Baltimore-Boston Seaboard through the

Great Lakes-Hudson region, the Californian Coast, and the cross-border Seattle-Vancouver ecumene to the liquid arteries of the vast Mississippi-Gulf of Mexico-Floridian Peninsula zone. Notably, whenever one of these regions declines, another rises in its place. As the power of the post-1945 post-industrial economies of the California Coast and Puget Sound dipped around 2000, the slack was already being taken up by Florida and Texas, as flows of population and investment accelerated toward the inverted Y centered on Houston and Miami.[4] The signature of this shift was the growth of intellectual capital concentrations in the southern U.S. littoral relative to California or the North-East.

The dynamic of portal cities is well exemplified by Chicago, on the Great Lakes (Miller, 1996). In the nineteenth and early twentieth century, Chicago created a startling array of new economic, social, and intellectual forms. These included "futures trading" in commodities, the modern office (based on a combination of telegraph, filing cabinet and typewriter), the assembly line packing plant, the iron-frame skyscraper and the modern vertical city, the balloon frame for domestic housing, the mail-order business,[5] modern marketing techniques (the introduction of "the sale" and "the bargain", and active stimulation of customer trust and loyalty), the idea of the city as a conference center, and the first truly great school of American sociology (the Chicago School). Chicago also co-created the only species of indigenous American philosophy (Pragmatism). In the twentieth century its premier university, the University of Chicago, was domicile to over seventy Nobel Laureates, mainly in physics, chemistry, medicine, and the economic sciences.

The movement from information through contingency, order, and innovation can be thought of as “the life cycle of intelligence” in the portal. Two additional conditions, however, are pre-requisites for the concentration of intelligence in the portal. Both of these are spatial in nature. The first is *topography*. Portal cities typically arise in locations that are poor for agriculture or don’t have sufficient raw materials for self-sufficient manufactures. These are cities built on thin strips between coast and hills, on deltas, drained marshes, or on islands. They arise in topographically difficult places. The development of collective intelligence is a compensation, and substitution, for the lack of conventional resources or factors of production. The portal creates advantage out of disadvantage.

The second ulterior condition of the concentration of intelligence in the portal is that such cities have a strong sense of “the sculptural”. The denizen of the portal city is inclined to see the world as a *plastic place*. Portals are characterized by a distinctive combination of lightweight media and of plastic media. The “life cycle” of information, contingency, order, and innovation is driven by a response to the human condition of uncertainty. Let us call this the cybernetic cycle. Much of this process unfolds through the kind of lightweight media whose creations are portable and ephemeral—as one might expect where the driving force of the process is uncertainty. However, towards the higher end of the life cycle, as order and structure become more central to outcomes, plasticity and sculptural qualities becomes an increasingly important driver of collective intelligence. At this point, the “civic” and “architectonic” qualities of the portal emerge as a central feature of the cybernetic cycle.

INFORMATION AND UNCERTAINTY

Information is a response to uncertainty. Human beings seek out information when they are uncertain.[6] Thus, a traditional village has a relatively low need for information. Its members typically never travel outside a radius of fifteen or twenty miles, and their lives are ruled by the local forces of custom and the seasons. Of course from time to time such societies will be subject to unpredictable events like wars and invasions, about which they will want to gather reports. But in the traditional agrarian society of this kind, such contingent "events" are exceptional whereas in the case of a long-distance mercantile society, the need to respond to such "events" is an everyday occurrence. On a spectrum of societal types—from the agrarian to the industrial to the long-distance trading society—the latter has the highest demand for information simply because it experiences higher levels of doubt on a regular basis, and has to master the resulting ambiguities and contingent choices. The wider the habitual scope of the transactions and traffic of a society, the greater is the experience of uncertainty and contingency. A society that conducts a high proportion of its transactions and traffic over long distances—either on a regional or global scale—multiples its exposure to sources of uncertainty. Not all or even a majority of these uncertainties will be negative. However, simply by virtue of being uncertainties, they produce information needs. If stock markets plummet, war is declared, if there is a virus outbreak, or some business teeters on the brink of bankruptcy, such "events" generate uncertainty. Demand for the production and transmission of information follows such events.

Information is an attempt to answer the question: "how can I orientate myself in this situation?" This kind of question has a high cognitive weighting. In contrast, in the village society, uncertainty generates questions with a high affective content. Uncertainty in other words triggers both affects (fear, alarm and panic) and cognitive emotions (curiosity, interest and attention). In traditional settings, uncertainty is ultimately resolved by the assertion of hierarchical order (often in the form of patrimonial structures). In modern societies, uncertainty generates demand for procedural guarantees—rules governing "how we proceed". The model of such rules or methods emerges from the regulation of movement or "procession" across space. Thought anticipates ("plans for") "events". It constantly seeks information so it can make plans. Plans are possible because events can be correlated—on the X and Y axis of a Cartesian graph. "If X happens, then we can do Y to compensate." Uncertainty in this case is resolved by being able to think about the paths of things through space as they cross and cause events in time. Methods, like the railway network timetable or the television network schedule, emerge to regularize these crossings. Procedural institutions, from government departments to commercial corporations, take shape around these methods.

In the case of portals, uncertainty tends to be resolved in part through methodical network correlations, but also sometimes by the very opposite of the methodical approach—that is to say, uncertainty is resolved by paradox instead. Paradoxes are a path through complex or ambiguous situations in which the ambiguity of tension-filled contingencies is resolved into the ambidexterity of living with opposites. Paradox is a way of dealing with contingency. Thinking by paradox means that emphasis is placed less on "if then" rules and methods—and more on the conceptual union of opposites. Immanuel Kant, in the conclusion of his *Groundwork of the Metaphysics of Morals,* (1964, 123-124) observed that the most demanding kinds of thought end in paradox. More specifically, he was arguing that there was no ultimate distinction between freedom and necessity. This is the mentality of the portal—for what it imports, it exports. Its thought is "revolutionary"—circular like a paradox. We begin with freedom and end with necessity that leads us back to freedom.

Information is raw material for such "Tao-like" path making.[7] The greater that the scope of human action is, the greater is the demand for information. Demand for information is a response to uncertainty caused by the enlarging the ambit of action. Information can be produced and transmitted in a vast array of genres—letters, documents, news reports, memoranda, analytic reports, commentary, official reviews, legally-prescribed reports, and so on. Such information can also be produced and transmitted by electronic means. Electronic means of transmission have existed since the invention of the telegraph in the middle of the nineteenth century. Wireless media (broadcast radio, television, mobile devices) and wired media (the Internet) in the twentieth century expanded the scope of instantaneous transmission, but not its fundamental nature.[8] Alternatively, information can be transmitted physically like any other commodity. Books are shipped, hard copies of documents are couriered, letters are carried by the postal system, and government reports are warehoused.

The carriage and storage of information creates an economy. The foundation of this economy is uncertainty. Thus, much—perhaps most—of what is produced and disseminated by this economy has little lasting value, and indeed much is redundant before it is ever stored or transmitted. Information is created and carried in response to an "event", or a series of "events". After an "event" is reported or analyzed, it is rare that anyone at a later time returns to the report or the analysis. Indeed, often the real value of information lies not with any particular item of information but rather in the way that the process of its production and distribution satisfies the demand for information, and does so independently even of the content of the information. The board of a company in financial crisis will commission a strategic review, or a government faced with failing military power will commission an inquiry. But little beyond the executive summary of these documents will ever be read, and even those abstracts will not necessarily or even normally be acted on. In such cases, the process of creation and distribution of information satisfies demand for information without anyone ever caring what the report or document says.

Looked at from this perspective, information is an index or measure of uncertainty in social situations. It is a bell-weather of social anxiety and social curiosity. The demand for information is a response to the unknown or the unpredictable. To produce a statement that it will not rain tomorrow in the desert is a statement that has little or no information value. We already know that there is little "risk" of this happening anyway. Rain is a random event that can and does occur in a desert. But such an event occurs within a known probability distribution. It is possible but the probability is low that it will rain in the desert tomorrow. On other hand, if someone reports that tomorrow it is likely to rain in the desert then that is a statement that deals with an "event". Such a statement has some value, albeit it of an ephemeral nature. The more the world is surprising or unpredictable, and the more it is filled with irregular "events", the greater the demand for information. A world in which deserts were swamped with rain, and the tropics were parched, and temperate zones froze, and the icecaps melted is a world that was starting to border on chaos. Such a world would be filled with the maximum amount of information, but this is not a world we would want to live in. Yes, artists from time-to-time play with the idea of the chaosmos, but this is a thought experiment. Those facing uncertainty demand information in the expectation of reducing uncertainty and with it the prospect of chaos.

CONTINGENCY AND ORDER

How does information, generated by uncertainty, reduce uncertainty? It does so by helping to establish what has happened (report), and what has caused what has happened (analysis). Information conveys something not already known. Information does not always in itself alleviate the feeling that the world is chaotic. Reports of the free-fall of a stock market may induce a strong perception that the world is disordered. But information does nonetheless provide the "raw material" for the production of orientative knowledge—knowledge for devising a pathway around an unexpected "event", and subsequently for understanding the causality of events and the way in which most events (that about which we are uncertain) are not purely random but have structural causes. To understand the structural causes of events, we must understand structures. We need to be able to show how events and actions take on recognizable patterns, shapes, and figures.

Let us consider the first aspect of orientative knowledge—that of finding strategic pathways through and around events. It may surprise us to find out that it is raining in the desert. Possessing this item of information does not change the surprising nature of the "event", but it does prompt us to formulate "yes"/"no" responses to the situation—to treat the event as something that poses contingencies that we have to decide between. Physical events, market events, political events cause us to re-orientate the course of our actions. If we hear reports of rain, we might have to decide whether or not to continue our planned journey into the desert until the "event" is over. Information—as the apprehension of uncertainty—presses us towards the formulation of contingencies. It does this because information is always an answer to an implied or actual question (query). An answer to a question carries information to the extent that it reduces the questioner's uncertainty. A report that "it is raining" carries an implied question: *viz.*, when will the "event"—the departure from regularity—be over ("when will the rain finish?"). When we pose that question to ourselves, we also pose the question of contingency—"either we will stay put or we will continue with our trip". Contingencies are alternatives, or choices, that we must decide upon. We can plan for contingencies ("it might rain even in the desert—what do we do if it does rain?"). But the "what if?" question—entertaining as that question is—rarely anticipates actual "events". So we are left with surprises in light of which we have to formulate new or adaptive courses of action.

Portal societies are faced with contingent choices all of the time. In a metaphorical sense, any society that interacts with temperate, tropic, desert, and arctic zones at a distance is bombarded with surprises to the point where surprises are no long surprising. In such societies, orientating quickly and devising pathways that reduce both uncertainty and the flow of incoming information that results from uncertainty is at a premium. If uncertainty is not reduced, chaos results, both at the level of social and economic action and at the level of information (too much information creates it own uncertainty, *viz.* "which item do I choose to read first when I have limited time?", "which items shall I ignore?").

As important as the ability to make contingent choices in response to uncertain situations is, there is still a yet more important operation that must accompany this at a higher level. This is the capacity for *pattern recognition*. Pattern recognition allows us to determine whether “events” belong to an underlying pattern. In performing this operation, we answer questions such as “Is rain in the desert an anomaly, or is it consistent with known probabilities, or is it indicative of a long-term change in climatic patterns?”

What pattern recognition supposes is that physical, social-historical, and even divine events have an underlying order—that is, they are organized into systems. This does not preclude a-systemic behaviors. Unpredictable physical events occur, political events remain surprising from time to time, markets on occasions rise and fall erratically, and fate can be arbitrary. However, the human capacity for pattern recognition is built on the natural fact that surprise is the exception rather than the rule, and that the world is fundamentally orderly. More perplexing is the fact that the world may be orderly even when it does not appear to be so. The sudden death by suicide of a loved one may be a shocking event that “makes no sense”, but the joyless science of sociology nonetheless may well tell us that the person who has taken their life was a member of an “at risk” group characterized by high levels of suicidal behavior.[9] That may be little comfort to those who have lost a loved one, but it nonetheless underlines the fact even events to which the labels “surprise” and “shock” are attached often belong to probabilistic or normative orders that are actually quite deterministic. The world has its stochastic and existential moments, and possibly even its miraculous moments, but we do not live in a stochastic world. Such a world would be chaotic and ultimately entropic. We cope well with, and even do interesting things with, occasional stochastic events. Some theories of artistic and personal freedom rate stochastic behaviors very high. But in reality it is the human capacity for perceiving order and producing emergent forms that is the real foundation of human freedom and creativity.

To experience the world as chaotic is ultimately not a liberating or productive experience, except in small doses or at historically decisive junctures. Significant continuing levels of disorder generate entropy, and decreasing levels of social and physical energy. In short, disorder is exhausting. Structures, on the other hand, are energizing. Though of course many so-called structures are nothing of the kind, and are in fact chaos in the making. But where there is real order, which is characterized by beautiful, elegant, and economic forms or systems, brilliant things can be produced. Order should not be confused with rules or norms, protocols or procedures, customs or rituals—any more than knowledge can be equated with information. Rituals and rules at some level are generated or shaped by the forms that give us structure and order. They are the secondary or tertiary phenomenon of this order. Order can be best understood as an abstract figure or design, as a pattern. Order is the shape around which social structure and organization is built up.

SOCIAL GEOMETRIES

From a social-historical point of view, order allows us to act in the world, to anticipate how we will act, and to understand retrospectively how we have acted. Referring strictly to the social-historical domain, I am going to distinguish between three fundamental kinds of order—order based on hierarchies, networks, and navigations.[10] These orders reflect different degrees of extension. Navigational orders extend the greatest distance, networks less far, and hierarchies least far.[11]

Hierarchy is a one-dimensional order. We can sketch a hierarchy by penciling a series of vertical dots and connecting the lines between them, and then branching further dots and lines (nodes and paths) from the initial set. We can build up a complex social and organizational structure around that diagram. In the social-historical domain, traditional, customary, and patrimonial orders are species of hierarchical order. We all recognize such social forms, even in their adaptive modern versions, where organizational hierarchies have largely though not completely replaced personal and traditional kinds of hierarchies. From the consensus-producing hierarchies of the Japanese company to the party bureaucracies of mainland China, from the patron-client hierarchies of most of the world's poorer states to the Fordist hierarchies of the modern procedurally-driven departmentalized corporation, most societies still order many, and in some cases most, of their activities in an up and down manner.

Yet, hierarchy is not the only kind of order. In the modern age, two-dimensional social geometrical forms have partially overtaken one-dimensional forms. Imagine that we take lines (paths) connecting dots (nodes), and we connect together those lines. We thereby create two-dimensional plane figures, representing things such as fields, windows, and tables. Field, window, and tabular images are central to the modern imaginary.[12] The pervasive late twentieth-century metaphor of "windows", which accompanied the spread of information technologies, is an apotheosis of this kind of order. That is to say, not tree hierarchies but plane figures are the most common way that moderns have of both ordering and representing figuratively the world around them. Windows, mirrors, frames, maps, and facades dominate the modern social geometrical imagination. They do so because they embody the equality of the plane surface. They are structured not in the manner of “up and down” the levels of a hierarchy, but “from side to side” as if on the plane surface of a billiard table.

One of the early historical examples of the planar type of order was the ethos of the seventeenth-century English “levelers”. This was followed in the eighteenth century by the imagining of the world in two-dimensional longitudinal and latitudinal terms. The introduction of new “world views” is always a slow process. For example, convincing English royal science of the day of the validity of the planar representation of space proved quite difficult—because it conflicted with the hierarchical impulse to want to look upwards to the stars (the heavens). Navigators liked the idea of longitude, but science preferred an implicit hierarchical order of steering by the stars. In this case, the planar conception eventually won out over the stargazers. But hierarchy never disappeared as a fundamental ordering principle. It merely took on new appearances.

Hierarchies imply tight connections with powerful forces. The type of connection over plane surfaces is less intense. Plane surfaces are conducive to network connections. As things move across a plane surface in different directions, they cross paths, eventually composing a net-like pattern across the plane. In social action, such interactions on a field are organized by “rules” or “plans” for proceeding. This is what modern law does; it is also what democratic and organizational procedure does. They allow for orderly interaction on a field. They establish coordinate relations across planar surfaces. These relations mirror the “equality” of the planar surface as opposed to the “hierarchy” of an ascending-descending “chain of being”. The methods of “flat organization”, “one vote, one value”, and “one law for all” are all expressions of such planar equality.

These images of order permeate the world. Take technology as an example. The "desk top" of a contemporary computer is without rank order, while the hard disk of a computer is normally organized around arboreal tree structures and nested hierarchies, as are the information architectures of institutional local area networks. Yet if we take a step beyond this level, and look at the technologies of inter-networked computing, we discover a different kind of order—the order of reconnaissance or navigation—where one cannot move using hierarchic cues or planar directions because of the scale of inter-networked worlds. Navigational order as a consequence dominates the world of inter-networked technologies. The "nature" of this order is to encourage movement "in and around". Its key technologies are search technologies. Its organization is neither linear nor planar. It has a kind of "plastic" character—or at least, in the informational realm, the virtual equivalent of three-dimensional plasticity (Murphy, 2005b). To understand this, imagine if we take a number of plane surfaces and bolt them together. In doing so, we create stereometrical objects (three-dimensional objects) that bodies (other three-dimensional objects) move around. We also create three-dimensional spaces that bodies move through. This is the essence of a navigational order.

Hierarchical orders operate most effectively at high intensity over short distances. Network orders operate most effectively, at lesser intensity, over medium distances—such as within the borders of a nation-state. Navigational orders operate with minimum force over long distances. We can think of this in geopolitical terms. Hierarchies are most effective over localities. Correspondingly, big-scale hierarchies often have difficulty administering what is most distant from the "root" of the hierarchical structure.[13] Networks seem best disposed to national or continental scales. If we think of modern network building—the railroad and telegraph, later telephone and broadcasting networks—their natural scope seems to be medium-scale territorial space.

Hierarchies generate strong, but limited, connections, often of a personal kind and often regulated by ritual, custom, or loyalty, as well as by command. Network orders generate wider but less stringent connectivity. Network orders cluster human beings into associations rather than communities. Associations put human beings together in a lateral rather than vertical manner. They rely less on ritual, custom and command than hierarchies do, and more on legal rules, procedures, and indicative guidance ("policy"). Modern organizations are frequently a hybrid of hierarchy and association. Modern organizations appear once systems have to be managed over national scale distances. Before that, family or patrician or party hierarchies could effectively coordinate actions. As and when these failed to translate satisfactorily to national or global scale, bureaucratic hybrids emerged. Modern bureaucratic hierarchy is a compromise between hierarchical and network forms.[14] It allows action at a distance to be combined with smaller scaled features such as personal affiliation to bosses. Employees remain governed by local hierarchical structures while, at the same time, operating at large through contractual, contact, professional, peer, cross-departmental, inter-organizational, and strategic-coalition networks.

The network society is not a recent development.[15] Modern oceanic empires (the Dutch and the British) were effective in part because of their ability to develop functioning networks across the face of the globe. The purest example of the network society developed in the United States (Murphy, 2004). This society has a strong lateral, associational dimension underpinned by legal and procedural norms. The network society is also a legalitarian society with strong planar characteristics. We see this inscribed in Thomas Jefferson's legal device to subdivide all U.S. territory into a gridiron pattern. This checkerboard geometry with its network of intersecting lines was infinitely expandable across two-dimensional space—the type of space of the U.S. Geological Survey mapmakers for example. Underlying this was a simple equation. Law plus grid equals a dynamic society.

As Jefferson anticipated, American power expanded from coast to coast, across the continent, and then beyond. It did so via networks. One of the greatest of these was the riverine network opened up by Jefferson's Purchase of the Louisiana Territory from the French. This enabled a commercial web that extended along the Mississippi River eventually from New Orleans to the Great Lakes, upwards to Gulf of St. Lawrence and downwards along the Hudson River to New York City. Land networks (the railroad and the telegraph) followed. Eventually, these networks began to expand across the oceans via civil communications (first cable, later wireless and satellite) and by the strategic "dotting" of U.S. military bases across the globe.

Networks are effective for coordinating action over the medium scale. Their effectiveness declines on the larger scale. A union of 50 states may constitute an effective federal network over a continental scale—but a union of 500 states over a global scale is inconceivable. It would simply be entropic. Even with its strategic networks and its networked alliances, U.S. military intervention worldwide can be effective only intermittently and for short or medium-term durations. Similarly, think of the example of the original networking of computers in the ARPANET project of the 1960s.[16] That was a very powerful extension of network geometry to computing. However, in the era of internetworking, when networked computing was extended (through the amalgamation of networks) beyond a continental scope, a new logic overtook that of networking—this was the logic of navigation, where searching and reconnaissance began to supercede the practice of strict networking.[17] Navigational logic is not primarily a logic of status ("here is my place") or one of reasoning ("if X, then Y") but rather one of morphology. It is an aesthetic logic. Successful searching through a google-sized quantum of data requires being able to recognize patterns. In a parallel sense, human creation (and quite probably natural creation as well) take forms (aesthetic patterns) and trans-forms them (Thompson, 1961, 260-325).

A word of caution: there is nothing new about navigational order. It is as old as port cities. If we think of a society as a vertical branching line that converges on a root; or a network as grid, or lattice, or hatching of lines spread over a plane surface, a navigational order in contrast has a third dimension—that of depth. Navigational space is full of "bays". It is convex/concave space. It is plastic space—space that is moved through and around. It is space that is entered and exited. It is recursive space in the sense that it is rotated through. It is the space of "eternal return" (Murphy, 2001b).

Navigational orders are called "navigational" because of the load that they place on cognitive orientational competencies and emotions. In a hierarchical or network order, it is relatively easy to find one's place. The symptom of the breakdown of an order is the systemic inability of agents to find their place. Hierarchies have lines running through connecting nodes from top to bottom. Webs, lattices, grids, and other network structures have high levels ("redundant" levels) of connectivity. Navigational orders happily employ elements of hierarchical and network forms. But they do not rely as heavily on "connectivity" as the other two do.[18] To orientate and to structure movement, they use devices that are more abstract in a plastic sense. Navigational orders use high-level "design" features to structure movement and orientation. These are features such as scale, proportion, contrast, symmetry, rhythm, and balance. These are pattern-forming geometric properties that the human brain readily recognizes even when it cannot necessarily describe the geometric properties underlying the forms. Knowledge of these features is usually tacit rather than explicit, but no less powerful for that.

Scale, proportion, contrast, symmetry, rhythm, and balance apply to all aspects of the world—linguistic, visual, auditory, tactile, olfactory; aesthetic, intellectual, social, economic, political; organizational, associational, and customary. These pattern-forming properties play a role in hierarchical and network orders. Hierarchies can be structured to branch symmetrically; the grid is an example of the highly (almost inertly) symmetrical organization of a web. But it is under conditions of three-dimensional order that pattern-forming geometric properties take on an emphatic role. Think of the everyday act of walking down the street. We move through ("navigate") a world that is filled with solid geometrical objects. We may know we are walking along a grid because we are used to looking at maps of gridiron streets, but we actually orientate ourselves by observing around us the literally thousands of patterns created out of scale, proportion, contrast, symmetry, rhythm, and balance (and the calculated departures from these).

RECURSIVE OR CIRCULAR KNOWLEDGE

Exactly the same thing applies to knowledge. When we take the simplest of data and start to structure it, we create objects that we have to navigate. Taped voice messages, video clips, letters, reports, indeed any information-carrying entity has to navigable if it is to have any “force”. Its “force” is its navigability, and its navigability is the effect of its “lucidity”, the power of the patterns from which it is composed. Take the example of one informational object—the document. The document is the basis of modern governance. We can build tree hierarchies of documents, and we can link documents into web-like patterns.[19] But when we move around the object itself, these types of orderings are helpful only in a limited way. To navigate the object we need other cues, such as visual symmetry, scale, and proportionality. All information objects, from the microscopic to the macroscopic level, can be organized in such patterns. The letters on a page are made up of contrasting dots against blank space organized in regular ratios. Text on a page is organized symmetrically, or with deliberate departures from symmetry. The size of headings, subheadings, and text on a page is scaled—large, medium, and small size. More complex page layouts utilize the same tacit geometries. Space is divided into scales, ratios, and rhythms allowing the eye to easily navigate the page. All of this is conditioned by the fact that the space between the readers’ eye and the surface of the page is three-dimensional space.

Exactly the same applies to larger intellectual, organizational, and social systems. Systems can be formed on the basis of properties that allow movement and orientation through space without strong connections. In hierarchies and network models, when connections break, systems fail. To ensure connectivity, systems need sanctions or the enforcement of some kind of law or policy or protocol or law-like agreement. Peer, coalition, contractual, and other network relations are underpinned by rules and protocols. At the same time, the transactions possible for any one node in a network depend on the connection strengths and activity of its correspondents. When correspondents are too close, "personal qualities" (trust, loyalty, pre-verbal understandings) are much more effective than networked association. On the other hand, beyond a median point, the greater the distance a system must cover, the more connection strengths will be strained. Thus, for action outside of the middle ground, a paradox presents itself: *how can we have interaction without connection?*

Interaction without connection was the basis of the first markets[20]—when unaffiliated tribes began to trade without actually meeting one another. Fearful of strangers, but wanting goods available outside their kin structure, the first market traders would leave goods at their tribes' boundaries; these would be collected anonymously and other goods left in their place (Brown, 1990, 39). Hermes was the god of this silent trade in archaic Greece.[21] Hermes was the god of the boundary-crossers (those engaged in various kinds of silent trade) in societies that had strong near-to-closed boundaries. Silent trade began out of the fear of strangers. Ironically, the spaces where it was conducted—at boundaries and crossroads—eventually became hubs filled with strangers conducting silent trade. Eventually these strangers would create their own society—the portal society.

Silent trade has taken on many forms through the history of mercantile and cultural traffic. Consider the impact of electronic means of communication in the late twentieth century. The electronic linking of documents stored on networked computers enhanced the degree of lateral access to documents. This was a conventional effect of networking. But electronic linking also expanded the potential for silent trade both in a commercial and intellectual sense. It created asynchronous transactional structures that enabled agents to act and react on the basis of information, while machines mediated their transactions. This created a form where agents could act and react not just on the basis of information that they provided each other, but also on the basis of knowledge they acquired of the collective patterns of action and reaction of persons involved in these transactions. Data logged as a result of machine-to-machine transactions made it possible to analyze the characteristics of anonymous agents and mine for statistical correlations indictaing behavioral patterns—"persons who read document X who also read document Y" or "persons who purchase commodity N who also purchase commodity P", and so forth. What the aggregation of such data establishes is not the boundaries of a "community" (of trust) or an "association" (of peers) but the existence of anonymous collectives of usage, transaction and type. This offers self-reflexive and self-monitoring understandings of silent trade based on interaction without connection.

"Decision markets" (Surowiecki) are yet another contemporary example of silent trade. These are markets where individuals are required to make a judgment independently of each other. This might be to decide "how many jelly beans are in a jar?", "who will win the next election?", "which stock will perform best?" The mean of these judgments is uncanny in predicting the right answer. Well-run stock markets and elections have a similar propensity to "get it right". One of the reasons this is so is that decision markets mobilize knowledge without this knowledge being distorted by persuasion. The earliest theories of knowledge, developed by the ancient Greeks, harbored the suspicion that persuasion, far from enhancing collective decision-making, often degraded it. It was "sophistic". Arbitrary factors—such as who speaks first or who speaks loudest, as well as the desire to be liked by others or the fear of offending others—deform discursive reasoning. Bad judgments, as well as good ones, communicate well.

There are always good reasons for doing bad things. The best, collective decisions occur where decision makers have the greatest independence of each other. The mean of a set of independent judgments is more likely to "hit the mark" than the communicative consensus of experts, pundits, or committees. Decision markets—such as betting on an election or institutions structurally akin to them, such as voting in an election—may occur against a discursive background, but the market itself is silent. Such decision markets in practice are a lot more accurate in predicting outcomes, and probably a lot better at securing outcomes, than any consensus of experts is. The strength of decision markets lies in the paradox of interaction without connection.

Interaction without connection has always been of particular interest to small states, especially city-states based on portal trade, and to economic regions that occupy extra-territorial space (particularly sea space) between large states. Unless they acted imperially, portals and city-states traditionally lacked the ability to administer or control the trade networks that they were dependent on. Some city-states, such as Venice, were forced into empire building to protect and augment their networks.[22] But even when they did so, they also relied on their capacity for interaction without connection. To do so, they had to create transport, trading, and other systems that were self-steering.

Self-steering supposes that a system acts in response to information. The result of this action generates new information that in turn generates a new response and new action. Information comes from external and internal sources. As these kinds of self-steering loops become more sophisticated, information is archived, and that (accumulated, objectivated) information becomes part of the way of generating new or modified behaviors. The most effective looping of information and action occurs under conditions where information is treated as patterns. Stories, documents, protocols, news reports each have their own generic structural patterns. Beneath their literary surfaces they all suppose some patterned relationship between events. The greatest city-states and portals have been those that excel at *theōria*—at high-level pattern recognition and production.

Self-steering is a species of autonomy. City-states and city regions are interested in autonomy because, more often than not, if they are not able to self-steer (interact without connection), they will be assimilated into some larger hierarchical structure or spatial network. A condition of their existence is to be very good at self-steering. This means to be able act in response to external conditions and contingencies without their actions being set in motion by either the "unmoved mover" (the root node) of a hierarchy, or by the correlation of forces produced by distributed networks. One of the reasons why the ancient Greek city-states resisted federalism (even though they invented the idea) was likely that it subtly impinged on their self-steering capabilities.

Self-steering systems internalize causation.[23] They don't rely on the teleology (the final cause) of the unmoved mover, or on the convergence of multiple efficient causes of network agents, to drive them. Instead they loop, which is simply another way of saying that they are autonomous or self-regulating. Causation is enacted in time. Causation creates or regulates a succession of events or actions in time. To say that a social action "is caused" is simply to say that social movement or action occurs in time in a manner that belies a discernable underlying pattern. In a hierarchical order, causation functions to drive movement "up and down" branching lines—from the top to the bottom, from the bottom to the top. Everything is set in motion by the root node. In a planar order, causation generates movement across a plane, "from side to side"—from "coast to coast" for example. Intersection between nodes, or the convergence of efficient causes, drives this kind of movement. In a navigational or portal order, in contrast, causation is primarily "formal". It relies heavily on pattern recognition and production. Formal properties are the pre-eminent cues for steering, which is the fundamental act of navigation. Steering drives movement "in and out, around and about". The typical pattern of motion is the circular movement of opening and closing, arriving and departing, "through and around". This type of causality is almost a-causal. In a circular or rotational pattern, the strict difference between cause and effect is blurred or obliterated. The navigator is constantly taking on board tiny bits of pattern-information, and adapting actions accordingly.

Pattern production is the highest "level" or "stage" of intelligence. To create forms is the most demanding and the most difficult of all intelligent functions. The historical incidence of formative power is not evenly distributed. A relative handful of times and places are responsible for the largest quantum of form-creation. As has already been noted, sea regions and portal cities are in turn responsible for the largest portion of this quantum. The classic cases are the ancient Greek and Roman Mediterranean-Black Sea region; the medieval Silk Road-Caspian Sea ecumene; the Renaissance Mediterranean; the early modern Baltic Sea-North Sea; the modern China Seas; and the nineteenth century Great Lakes-Hudson ecumene. Athens-Piraeus, Rome-Ostia, Alexandria, Constantinople, Bukhara, Venice, Florence, Amsterdam, London, Stockholm, Shanghai, Chicago, and New York City have all played a vastly disproportionate role in form-creation—in artistic, scientific, economic and social creation.

One possible reason for the coincidence of form-creation and portal activity is that the portal city and the sea region are navigators' domains. This is meant not just in the obvious sense that these places are mariners' domains, but also in the more complex sense that these are by their nature places for the organization of long-distance traffic and logistics, mercantile and cultural interaction. Such things of course can and are organized by bureaucratic hierarchies and network organizations. Yet, the effectiveness of these stands in an inverse relation to the distance over which they operate. The further away we move, the less compelling is the power of contractual or peer networks. Under these conditions, the "silent" trade of interaction without connection becomes more important.[24] Portals provide sophisticated versions of this because they are "cities of turnover". The churn of these cities is conducive to interactions without connectivity. These are interactions that are supported not by hierarchic connections or networked associations but by abstraction. Portals of course have hierarchies and networks in abundance, but they have something additional—plastic milieus through which is it easy for itinerants and strangers to move, and which are crucibles for the emergence of material, technological, and inter-cultural forms.

Aristotle proposed that ideally a city-state should be self-sufficient. To modern ears, that idea sounds like a proposal for a closed society. It sounds like China in the 1960s or Burma in the 1990s. But that was not what Aristotle had in mind. Sparta was not his idea of a normal city. Rather, self-sufficiency meant something like self-steering. In fact, *kybernetes*, the steersman, was a common Greek metaphor for the state. Self-steering was paradoxical. The city of Aristotle's acquaintance had extensive contact with the world but it arranged its affairs such that it was not beholden to the world. This is a difficult balancing act. It is only possible because portal societies are intensely interested in the world but without being suborned to hierarchic loyalties and planar networks. Knowledge plays a special role in the portal city's adaptation to the exigencies of the world. The more closed a society is (the Spartan model), the more tight-knit it is, the more it relies on local affinities of loyalty and trust, and the more suspicious it can be, as well as the more hostile to aliens and strangers.[25] An "open society" (a liberal network society like the United States) in contrast has loose boundaries. The cost of entry to the network is low. An open society depreciates local affinities for networks that are infinitely extensible. These, though, have diminishing power or efficacy beyond the medium scale.

The portal, by contrast with this, is paradoxical. It has a strong capacity to create boundaries—to demarcate itself from its environment—and yet it is porous—goods, people, or information freely flow in and out of it. Great portal cities, for instance, engender strong civic identification and patriotism ("a strong sense of place") but, at the same time, attract large numbers of outsiders to settle there and still larger numbers to pass through. To be both "open" and "bounded" is a powerful condition. Its power arises from its paradox. Cities of turnover that encourage and attract those who act and see the world not in terms of personal affiliation or networked association but as structure, form and pattern have a subtle advantage. Such persons can engage in the *quid pro quo* of trade and traffic without the transactions being dependent on mutual consent or on face-to-face attachment. A place where large numbers of such people congregate is likely to be capable of producing emergent forms. That people do congregate in such places is a function of the need of portals to organize action at a distance. Such organization is optimally achievable when systems are self-organized through forms rather than via networks of co-efficient causality or by the directing action of the unmoved mover of a hierarchy.

MANAGEMENT OF KNOWLEDGE

The largest companies in the world, almost without exception, are headquartered in portal cities. As the maps in Slater (600-601, 2004) indicate, most of the headquarters of Fortune 500 companies are located (in Asia) in the Japan archipelago and the South Korean peninsula, (in the United States) in the East Coast Great Lakes Mississippi California Coast Gulf of Mexico zones, (in Europe) in southeast England, the Ile de France, and the Rhine-Danube zone. To indicate just how difficult it is to escape this logic, 2-3 Fortune 500 companies are headquartered in territorial Beijing, but Taipei, the capital of the island of Taiwan, has the same number.

The dominance of portals is because these cities (i) maximize access to information (and most especially information summarized in prices); (ii) constitute nodes in the most important distributive networks in the world; (iii) excel at generating forms and accumulating knowledge of forms. Of all of the many functions of the firm, the generation of productive forms, in the long run, is the most important. Firms compete on price. They also accumulate market power (market share) through supply chains and distributive networks. But the most successful firms are “art firms” or “science firms”. They compete on the design of products and systems. They compete on “quality”.

All firms and institutions have scarce resources. The better the use of these resources is, the more viable the company or organization will be. It is here that "aesthetic" knowledge comes into play. For, ultimately, efficiency and economy are a species of beauty. If a technologist figures out how to reduce the power consumption of a refrigerator by a factor of ten (which is what technologists achieved during the 1990s), this will be a more marketable fridge than one that is simply cheap. From the science angle, the technologist who does this is always finding more elegant solutions to technical problems, just as the commercial designer who finds the most elegant touch pad arrangement to work the device does from the art angle. The same applies to economies. When looked at closely, the economy of Mainland China in the 2000s appears much less like the nirvana of growth that journalists routinely have touted and much more like a nightmare of gross inefficiency. When we observe China use seven times the energy of Japan, six times the energy of the United States, and three times the energy of India to produce the same unit of output, the overriding importance of technical design becomes clear.

Design plays an ever-growing role in consumption as well as production. Indeed the most sophisticated consumers make purchasing decisions based on aesthetics not price. These may be the aesthetics of the product or of the shopping centre where it is purchased. But aesthetics is not just wrapping. It is implicated in the very heart of creative production, and this has enormous implications for wealth generation. Simply put, a company that develops a new pharmaceutical is better placed than one that produces existing drugs more cheaply. This is essentially what a knowledge economy is. It is an aesthetic economy. It is propelled by firms that compete through design—be it the design of a tin can, a drug, a piece of software, a highway, or a book. The implicit idea behind a design always belongs to the human commons. But the work of teasing out what is implicit, and making it explicit, can be turned into property. Increasingly much of what makes the most valuable firms valuable is such intellectual property.

Portal city regions have long been social laboratories of design. Venice built its economy on the design of better boats. Portals like Venice also invest heavily in the design of the built environment. This is not a matter of luxurious ornamentation or conspicuous consumption. Rather beautiful cities provide the most intensive exposure of their denizens to form. They thereby inspire and encourage designing intelligence of all kinds. There is strong evidence that human neurology is open-ended. Neurological structures are not a genetic inheritance but are formed through the interaction of the human mind with its environment by creating its own artificial environment. The built environment of the city has long been a key to nurturing the architectonic structures of human intelligence (Allen, 2004). Unsurprisingly then high quality arts and sciences have had an historic propensity to concentrate in portal cities that have invested massive wealth in the building of city squares, churches, museums and campuses. From London and Edinburgh to New York and Hong Kong, from Athens to San Francisco, Rome to Chicago, this has been true. All of this has implications for the management of knowledge.

First, the management of knowledge occurs on macro, meso, and micro levels. Great firms take an interest in their city regions—they invest in them through their building and sponsorship programs, just as the Renaissance guilds did in Venice and Florence. The macro and meso levels of city region and firm cannot be entirely separated.

The commons of the city is the necessary complement of the private domain of the firm. One produces ideas, other produces intellectual property. There is not a fire wall between. Common wealth and private wealth are mutually implicated. One advances or retreats with the other. Striking the balance between them is difficult, but achieving it is enormously productive.

Second, knowledge that has it roots in the commons should not be confused either with information about contingency or with the protocols of connectivity that typify distributed networks. Rather the core of knowledge management is concerned with enhancing the art and science of an organization. For sure, such management is invariably conditioned by the imperatives of contingency and connection. When the old Soviet Union triggered an explosion of American space science—with the news of its Sputnik flight—this set off the accelerated development of the high tech Gulf of Mexico-Floridian Coast space economy. But a certain sign that knowledge is more than a response to contingency, and more than a function of the proliferation of connections, is illustrated by the first great organization of the space economy, the National Aeronautics and Space Administration. NASA developed as a typical Fordist organization. It combined bureaucratic hierarchy with a national network artfully distributed across politically-powerful states.[26] It had great successes and great failures. Its greatest failure, the Space Shuttle Columbia disaster, encapsulates the limits of knowledge management in such organizations. The day before the shuttle's break-up, NASA's engineers were to be found busy debating hypothetical contingency scenarios of "what would happen if" the Shuttle's heat-shield tiles failed.[27] Such prescience was spooky. Good engineering can be tested by if-then reasoning. But, in the end, such testing cannot overcome bad design, and this was the Shuttle's problem. Fundamentally from the beginning it was a poor design.

Information can't substitute for good design. Another way of putting this is that the logic of knowledge is different from the logic of contingency, or for that matter from the logic of networks. Contingency generates lots of reporting—on risks and possible responses. Networks require a large amount of time to maintain linkages—relations between different offices and campuses. Most of this activity, though, is secondary to the art or science of design. "If then" reasoning, and its endless demand for information, has a lot less good effects in the world than might be supposed. This is not just because, as economists have long know, information in the real world is "imperfect" but simply because "good design" (= beautiful form) in the first place is often a better way of obviating risk than incessant "planning" for it. "Intelligence failure" is inherent in projecting scenarios of highly uncertain environments (such as warfare or space voyage). What is important is not so much that bad things occur, but that good system design allows recovery when the unpredictable but inevitable dire event happens.

Once we understand the limits of contingency management, we also understand why it is that so many firms and organizations rely so much on branding. A brand is a simple visual abstraction (an iconic design) that binds individuals and agencies across distance irrespective of location. A brand is a visual form that communicates silently. This is also what knowledge, albeit in a much more complex sense, does. Knowledge, understood as the art of systems, creates effects without relying on bureaucratic hierarchy or procedural negotiation. Knowledge spreads without time-consuming transactions between agents. This is because it is "shape like". In our imagination, the virtual realm par excellence, we can "see", "hear" and "touch" the shapes of knowledge. Think for example of DNA—it is a double helix. Grasping the shape was the key to unlocking the knowledge of the genome. Knowledge acquisition in organizations is similar. Its most powerful media are morphological. This is true, ironically enough, of the knowledge of hierarchy and networks as much as anything else. Before we describe them or enact them, we "see" them. But hierarchies and networks are not necessarily the most interesting or even the most robust of cognitive-aesthetic structures. Structures like symmetry, balance, rhythm, and proportionality—and shapes like those of skeletons, sponges, interfaces, tiles, and cells—abound in art and science. The challenge of knowledge management is to help create contexts where reasoning and imagining about these are not overwhelmed or over-determined by the imaginary of hierarchies and networks.

A related challenge, then, is to turn the management of knowledge into the knowledge of management. In the simple sense, this means to find ways of using the art of systems to redefine management away from the overworked imaginary of hierarchy and network to one that begins to explore a larger morphological universe filled with other reliable structures like skeletons, sponges and interfaces. Endless instructions down the hierarchy, and repeated negotiations across networks, are not the sign of successful firms or organizations. Knowledge in the strong sense, on the other hand, is a deep repository of cognitive-aesthetic forms.

CONCLUSION

Cognitive-aesthetic knowledge is found everywhere. But, in its most developed forms, it clusters. Notably, as has been observed, it clusters in portals. Most people are shocked when they first meet New Yorkers on the street. They are "rude"—their address is bluff, gruff and short. The stories told about Venetians in the old days, or about denizens of Shanghai today, are pretty much the same. This is not surprising. Portals, by their nature, are ecumenical. They harbor a multitude of languages, nationalities, faiths, and customs, and they put them together in one, usually tiny, place. In such places, communication works best when it is aesthetic. Irrespective of language, nationality and faith, people understand beauty. Beauty is silent. Beauty is the essence of a good system. Beauty is the paradigm of economy and efficiency. From Venice to New York, Shanghai to San Francisco portals have developed aesthetic form as the complement of, and sometimes substitute for, rules and hierarchies. In this world, the art of systems flourishes as the medium of silent trade and of interaction without connection over distance.

Thus we end where we began, with a singular proposition: the most interesting and most efficacious kind of culture from the perspective of fundamental innovation is the meta-culture of the city. Cities, in this department at least, trump nations. The art-knowledge of the city is the acme of human knowledge. No matter how much human beings mobilize religious or national norms in economic life or organizational behaviors, it is art-knowledge or pattern knowledge that shapes the most important breakthroughs in production and distribution, organization and governance. Irrespective of whether it is the engineers in Houston's space administration or the designers of assembly-line robots for a Japanese car manufacturer based in Tokyo, the same basic fund of pattern knowledge is drawn on. It is to this kind of knowledge, and its concentration in great cities, that we owe the most far-reaching experiments in economy making and organizational development. For this reason, the capacity to manage pattern knowledge, to understand its dynamics and its mimetic distribution, is essential.

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Notes

[1] In the cases of post-1400 Europe and post-1800 North America, this intellectual geography is vividly mapped in Murray, 301-306.

[2] On beauty's role in machine and product development, see Gelertner, 1998.

[3] On the Australian case, see Murphy, in press.

[4] In 2000-2005, the largest seaports in the United States were New Orleans ("South Louisiana") and Houston. These were ranked fourth and sixth internationally—competing with Rotterdam (first), Singapore (second), Shanghai (third), and Hong Kong (fifth). See Geohive, Largest Seaports in the World http://www.geohive.com/charts/charts.php?xml=ec_seaport&xsl=ec_seaport. The election of Texas Governor George W. Bush as U.S. President in 2000 was driven by population growth in Florida and Texas. This population growth was matched by a flow of businesses from California, the dominant economy of the 1990s. On the export of business and people from California to Florida, see Kotkin (2005).

[5] This invention possessed virtually all of the structural features of electronic commerce that appeared a little more than a century later. These features included purchase at a distance based on selections from distributed catalogues, the central warehousing of commodities, placement of orders via a communications network (the post office in the nineteenth century case), distribution of goods via post offices, reliance on customer trust to purchase goods "sight unseen", and a-synchronicity between payment and delivery of goods.

[6] This is not to say that they necessarily seek out challenging information. Indeed, probably most often they look for information that is reassuring or comforting in the light of uncertainty.

[7] The question of where the next concentration of intellectual capital might emerge was raised in Pauleen and Murphy (2005). The legacy of Taoism, especially its feeling for paradox and its geographical footprint, gives some hints about the cognitive mapping of the future. This theme is taken up in Murphy 2005c and in Murphy and Hogan, 2005d.

[8] Think of the innovative use of the combination of telegraph, filing cabinet, and typewriter in the emergent form of the modern office in Chicago in the 1870s and 1880s. The office computer of the 1990s was only a fusing of these three functions (digital transmission, electronic file, and keyboard) into one machine.

[9] Contemporary methods of data mining do exactly the same. They can predict that a customer who has certain financial and credit history, and a particular social profile, and who buys a certain garment at a particular time in the cycle of the financial year, has a high probability of defaulting on their credit payments.

[10] See also Murphy (2003). This schema extends the typology of hierarchical, dynamic, and civic orders developed Murphy (2001a).

[11] On the ethics of navigational orders, see Murphy, 1999, 87-94.

[12] Correspondingly, many of the radical critiques of modernity end up being re-statements of the logic of plane surfaces. See, for instance, Deleuze and Guattari (1987).

[13] The classic examples are the collapse of pre-modern empires into feudal hierarchies or else into competing warlord ruled territories.

[14] Professional worlds are a similar hybrid. They encourage lateral transactions—e.g. the "national conference"—but jealously guard tacit hierarchies of authority in the guise of reputable sources, journals, speakers, and the like.

[15] This is contrary to the view of Castells (2000). Castells regards the network society as a product of the explosion of information technology in the latter part of the twentieth century. The fact, though, is that this explosion piggy-backed on existing network technologies (the U.S. and British phone networks in the first instance) which themselves descended from nineteenth-century American and British models of communication and municipal utility networks.

[16] The U.S. Defense Department's Advanced Research Projects Agency (ARPA) funded projects in the 1960s to network university computer labs. The principal figures in this research were J.C.R. Licklider and Larry Roberts. They worked out how to connect machines over a telephone network, solving especially the routing problems involved because of the large number of connections opened up by even a simple

network. Paul Baran from the RAND corporation and British telecom engineer Donald Davies worked out the idea of sending messages around these networks not via continuous analogue channels but via discrete, re-routable, non-continuous "packages" of digital information.

[17] In the 1970s, Vinton Cerf and Robert Kahn devised the Transport Control Protocols (TCP) for networking different networks.

[18] A parallel can be drawn here with debates about the functioning of the human brain. Connectionist models of the brain explain cognitive functioning in terms of neural networks. Hebb's 1949 rule stated that learning is dependent on changes in the brain caused by correlated activity between neurons. When two neurons are active together, their connection is strengthened; when not, the connection is weakened. Intelligence is located in the connections between neurons. In response, Fodor and Pylyshyn identify a feature of human intelligence that they call systematicity. Systematicity is something that connectionists cannot account for. The systematicity of language refers to the pattern nature of language behavior. It accounts for the fact that the ability to produce or understand some sentences is tied to the ability to produce or understand others of related structure. See Fodor and Pylyshyn (1988).

[19] This was the motivating schema of Tim Berners-Lee in the early 1990s, when he devised his URL, HTTP, and HTML protocols for linking documents stored on networked computers. See Tim Berners-Lee (1999).

[20] I am assuming here Karl Polyani's distinction between local exchange and market exchange. Market exchange is carried on over a distance and outside of a given society. See Polyani (1977).

[21] This kind of trade was known in many societies. It was probably the first actual instance of global trade in the modern era. As the Portuguese began to pioneer oceanic trade routes, the trade carried on between the Portuguese and populations on the African west coast was conducted initially by silent trade techniques. According to Herodotus (*Histories*, Book 5), the Carthaginians used similar techniques when they were trading with "a race of men who live in a part of Libya beyond the Pillars of Heracles". The asynchronous and anonymous nature of the exchange seemed to generate very good outcomes. "There is perfect honesty on both sides; the Carthaginians never touch the gold until it equals in value what they have offered for sale, and the natives never touch the goods until the gold has been taken away." It is actually possible that some of the tensions of loyalty and network transactions are simply avoided by this system.

[22] Antiquity was a model for this. The Attic, Hellenistic, and Roman Empires all married hierarchic command structures with lateral networks. The Romans for example were brilliant road builders; and they put in place a very effective postal system that carried mail long distance across sea and land. But to control networks, and protect them from enemies, and drive their extension, the Romans turned to imperial techniques. This did not mean that Rome lost the capacity for lateral organization. It just combined that capacity with hierarchical structures.

[23] This was the basic point of Norbert Wiener's theory of cybernetics. The term cybernetics was a play on the Greek word for "steersman". When a steersman of a boat moved a rudder, the craft changed its course. If a steersman detected that the previous change of course had overshot the mark, the rudder was moved again to correct the boat's drift. See Wiener (1948).

[24] For archaic examples of "silent" trade, see Grierson (1903).

[25] The Chicago School sociologist, W.I. Thomas, made the observation about how the ties and feelings of locality, or what he called the "primary group", are projected onto larger-scale organizations and spaces. "The Polish peasant uses a word, *okolica*, 'the neighborhood round about', 'as far as the report of a man reaches', and this may be taken as the natural external limit of the size of the primary group—as far as the report of a member reaches—so long as men have only primary means of communication. But with militancy, conquest and the formation of a great state we have a systematic attempt to preserve in the whole population the solidarity of feeling characterizing the primary population. The great state cannot preserve this solidarity in all respects—there is the formation of a series of primary groups within the state—but it develops authoritative definitions of 'patriotism', 'treason', etc., and the appropriate emotional attitudes in this respect, so that in time of crisis, of war, where there is a fight of the whole nation against death, we witness, as at this moment, the temporary reconstitution of the attitude of the primary group." W.I. Thomas (1966, pp. 169-170).

[26] With headquarters in Washington D.C., and Centers in California, Ohio, Maryland, Texas, Florida, Virginia, Alabama, and Mississippi State.

[27] "E-mails show NASA engineers predicted Columbia disaster. By The Associated Press

(2/27/03- WASHINGTON) — Newly disclosed e-mails inside NASA showed senior engineers worried a day before the Columbia disaster that the shuttle's left wing might burn off and cause the deaths of the crew, a scenario remarkably similar to the one investigators believe actually occurred. The dozens of pages of e-mails describe a broader, internal debate than previously acknowledged about the seriousness of potential damage to Columbia from a liftoff collision with foam debris from its central fuel tank. Engineers never sent their warnings to the National Aeronautics and Space Administration's brass. Engineers in Texas and Virginia fretted about the shuttle's safety during its final three days in orbit. One speculated whether officials were 'just relegated to crossing their fingers' and another questioned why such dire issues had been raised so late. 'Why are we talking about this on the day before landing and not the day after launch?' wrote William C. Anderson, an employee for the United Space Alliance LLC, a NASA contractor, less than 24 hours before the shuttle broke apart Feb. 1 while returning to Earth. NASA said those messages—including the few that were hauntingly prescient—were part of a 'what-if' exercise by engineers convinced the shuttle would land safely despite possible damage from foam that struck insulating tiles on the spacecraft's left wing at liftoff. 'It was a surprise to us when the 'what-if' scenario played out,' said Robert Doremus, head of the mechanical systems group in Mission Control. 'We were not expecting that.'" http://abclocal.go.com/ktrk/news/22703_nat_shuttleemail.html Accessed July 2005.