Embeddedness, Organizations, and Language Games

by

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Introduction.

Modern-day economists are taught to take it for granted that, for the smooth running of an economic system, each economic agent needs to know all there is to know and no agent should know something another doesn't. The slightest bit of imperfect information is enough to derange the elegant optimality of the Arrow-Debreu equilibrium, and even a touch of asymmetric information can induce all manner of partial-equilibrium pathology. In mainstream economic theory, knowledge is like a Big Mac: you want it to be the same everywhere.

It is perhaps well to remember, however, that the founding conception of economics was entirely otherwise. The central point of the *Wealth of Nations* is that the progressive fragmentation and differentiation of the knowledge agents possess is precisely what fuels the engine of economic growth. The division of labor implies — indeed, to Smith, it causes — the division of knowledge. As the extent of the market expands, each agent knows a smaller and smaller fraction of all there is to know, and each agent comes to know things that are quite different from what his or her neighbor knows. Far from impeding the smooth functioning of the economic system, such division is responsible for the overall growth of knowledge on which a prosperous economic system depends. In real life, knowledge is like fine wine: you want it to be complex and differentiated in time and place.

Of course, modern-day economists understand this point, at least within an isolated partition of the brain. Many have read F. A. Hayek (1945) on the marvel of the price system, which is able to coordinate tacit and widely dispersed knowledge far more effectively than any system of central planning. Some may actually try to convey Hayek's vision to their introductory students — right before explaining, rather incongruously, that economics is all about the optimal allocation of known and given scarce resources. "The most significant fact" about the price system, in Hayek's view, "is the economy of knowledge with which it operates, or how little the individual participants need to know in order to be able to take the right action" (Hayek 1945, p. 527).

This may be a marvel, as Hayek put it; but it's not magic. What allows the decentralized system to coordinate dispersed knowledge and action is that *some* knowledge is in fact shared. "The whole acts as one market," says Hayek, "not because any of its members survey the whole field, but because their limited individual fields of vision sufficiently overlap so that through many intermediaries the relevant information is communicated to all" (Hayek 1945, p. 526). How does this happen? In modern terminology, we might say that the market system is a relatively well decomposed *modular system* (Langlois 1999) in which participants interact largely (though by no means exclusively) through the standardized "interface" of the price system. The price system provides an

abstract, anonymous, and minimalist apparatus of shared knowledge, and it is this apparatus that provides the necessary "overlap."

But pointing to the price system does not completely resolve the puzzle of coordination in a world of disparate knowledge. At least since Ronald Coase (1937) pointed it out, economists have understood that much economic coordination takes place not through a minimalist price system but through (sometimes large) organizations like firms. As Alfred Chandler (1977) famously put it, such large organizations replace the invisible hand of the market with the visible hand of managerial control. Surely these large organizations make use of the division of knowledge. But how do they achieve coordination in the absence of the price system? One implicit answer, encouraged by Coase himself, has been to see firms (or other organizations) as instances of small-scale central planning.[1] That is, the firm, unlike the market, is an example of conscious coordination: the constituent minds within the firm are brought together and harmonized by some single mind, or at least by some tightly overlapping set of cognitive frames within the minds of a handful of managers.

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[1] "[I]n economic theory we find that the allocation of factors of production between different uses is determined by the price mechanism. … Yet in the real world, we find that there are many areas where this does not apply. If a workman moves from department Y to department X, he does not go because of a change in relative prices, but because he is ordered to do so. Those who object to economic planning on the grounds that the problem is solved by price movements can be answered by pointing out that there is planning within our economic system which is quite different from the individual planning mentioned above and is akin to what is normally called economic planning." (Coase 1937, pp. 387-88.)

If we are speaking about the *origins* of the firm, this may be exactly the right picture. There is a recent but growing literature suggesting that entrepreneurship consists in the successful imposition of one individual's cognitive frame on cooperating others through persuasion, leadership, and the exercise of what Max Weber called charismatic authority (Langlois 1998; Witt 1998; Yu 1999). Such entrepreneurial behavior is called for whenever a systemic reorganization of production or a novel recombination of capabilities is necessary to respond to a profit opportunity (Langlois 1992; Langlois and Robertson 1995). But this does not describe the mature "going concern." One could well argue that large organizations are not unified by a single cognitive frame, but are in fact systems energized by disparate knowledge not concentrated in any center. Such organizations are arguably as much "spontaneous orders" as is the market (Langlois 1995). Like Harriet Beecher Stowe's Topsy, nobody made them — they just growed.

This paper is an attempt to make progress toward understanding how disparate bits of knowledge are used and coordinated not only within the larger price system but also within the organizations that inhabit the interstices of the price system. We do this by attempting to generalize the properties of the price system — or at least to look at them in a different way — and to apply that alternative view to both firm and market (and to other structures in between).

We do this by drawing on a concept we call language games (Koppl and Langlois 1994; Koppl 2000), an idea cribbed from the philosopher Ludwig Wittgenstein (1953). A language game is a set of rules about how to talk, think, and act in various situations. At the level of action (what we call *agent-practice*), agents follow rules or routines. But agents also have theories or models to explain their own actions to themselves (*agent-theory*) as well as ways of explaining their actions to others and persuading those others to cooperate (*agent-rhetoric*). As rule-like patterns of behavior, individual language games are subject to a selection process within the larger society, and that process determines how the various distinctive language games fit together into a coordinated whole. It is here that the question of knowledge overlap becomes central. Drawing on the theory of modular systems, we explore the ways in which different patterns of knowledge can be fit together in a coordinated system.

Although this effort is both preliminary and conceptual, we do offer one clear — and perhaps surprising — conclusion. Contrary to the standard view, the coordination of knowledge within a firm does not require that all agents share a common "mental model" or interpretation of the world. Indeed, coordination is sometimes maintained by persistent differences of interpretation. Coordination without agreement becomes more important as firms grow. With growth, relatively formal internal governance structures supplant charismatic

authority. And, using principles of modular design analogous to but different in detail from those of the market, the growing firm is able to profit from the wide variety of language games its members play.

Language games.

As we have indicated, we view action as a skilled performance subject to the publicly known rules of some language game. A language game, we said, is a set of rules about how to talk, think, and act in different situations. The language game is not the unfolding of actions and reactions; it is not the play. The language game is the set of rules governing action and reaction.

Shopping for shoes is a skilled performance constrained by publicly known rules. One must greet the staff and ask to see a selected item in one's size. While the clerk looks for the right box, one must sit quietly. Singing opera and jogging in place violate the rules. We follow the rules of shoe buying even if we do not know that we are doing so. Shoe buyers "know how" to follow the rules even when they do not "know that" they are doing so. You do not need to be able to state the rules in order to follow them.

Action is subject to rules. An action has a purpose, an end. The purpose is achieved by some means. As Schutz (1951) has shown, these ends and means will be familiar to you and to others. They are familiar because they fit a pattern. They follow a rule. Even the most novel action is recognizably similar to previous examples in its class. Picasso's *Les Demoiselles d'Avignon* of 1907 is

sometimes considered the first cubist painting. It is novel and creative. It was a radical innovation. But in 1907 it was already recognizable as a work of art. The painting followed the old rules closely enough to be understood. Every face had the expected number of eyes (one) on each side of the nose.

The rules are publicly known. Each social action is aimed at some group or others, large or small. They are the public that must recognize the meant meaning of the act. They must know the rules. One hundred years earlier, Picasso's painting would have been considered a mistake, a scribble, or an exercise. It would not have been recognized as art. Every language game corresponds to a group of persons who know the rules of that game. They are an "in-group." The rules of a language game are "publicly known" only to the members of the relevant in-group.

Many actions that might seem to be perfectly private are subject to the publicly known rules of a language game. Consider the owner of a small business who calculates a profit. The calculation is not to be seen by others; it is for his benefit alone. To "calculate a profit," one must first have a cost figure and a revenue figure. If the cost figure were arrived at by sufficiently bizarre means, such as by selecting a figure from a table of random numbers, we would deny that the activity is an example of "calculating a profit." Many actions that we might at first wish to think of as perfectly "private" are, in fact, subject to the publicly known rules of some language game. (This argument is similar to

Wittgenstein's argument that there can be no private language.) It is probably does not matter if there is some class of private actions ungoverned by public rules. The social sciences study social action.

Any action is a skillful performance. Action is a performance within the context of the rules of the operative language game. It requires skill. Shoe buying requires skill. You must know how to greet the clerk and how to switch from browsing to sampling. You must know whether bargaining is allowed or expected. The performance can be difficult for someone who does not speak the local language. A foreign tourist might create embarrassment or offense by an inappropriate attempt to bargain. Or he might leave dissatisfied, unaware that the stated price is a bargaining position, not a final offer. Ordinary activities in daily life require rich skill sets that we generally take for granted. We are often not conscious of the skills we use.

The rules of a language game are constraints, not marching orders. The rules of chess constrain us. Only certain moves are allowed. But the moves we make within the constraints are freely chosen. One's strategy is chosen through "instrumental rationality." Good players typically adopt rules of thumb, however, to guide their choices. Depending on the purposes of the analyst, these rules, too, may be thought of as a part of the operative set of language games governing play of the game. Heuristics constrain our choices just as surely as

formal rules. But, like the formal rules, they leave room for free choices made within the constraints they create.

We may look at the rules of a language game from at least three different perspectives. The rules tell us what to do. They constrain our actions. When viewed from this perspective, we have the *agent-practice* of the language game. The agent-practice describes the agent's possible actions without detailed reference to his or her thoughts and ideas. It gives an "objective" account of them. In the sociology of Alfred Schutz, the agent-practice of a language game corresponds the "objective meaning" of an action. (See Schutz, 1932, pp. 132-136).

The description of an agent-practice may not resemble the agent's self-description. The businessman may say that he prices by adding a fixed markup to average cost. Careful questioning may reveal, however, that the "fixed" markup changes with demand. In such case, the economist could describe the agent-practice as equating marginal cost and revenue, even though the agent sincerely denies it. (See Machlup 1946.)

The rules tell us what to say. They constrain our speech. When viewed from this perspective, we have the *agent-rhetoric* of the language game. Most social actions include the use of language. Even in the exceptional cases, symbol systems are at work. Language games regulate our use of language and other symbol systems. Each social situation is governed by its own rules about

appropriate speech. The proper greeting for the clerk in a shoe store is not appropriate for a priest or a loved one.

Entrepreneurs persuade. The founder of a new enterprise must enlist the support of others, especially venture capitalists. He must persuade suppliers, workers, and customers to do business with him. Job applicants must persuade employers of their merits. Below, we view the founder of a new venture as a charismatic leader who puts his vision to work by persuading others.

The rules tell us what to think. They guide our thinking. When viewed from this perspective, we have the *agent-theory* of the language game. The agent-theory describes the agent's possible actions with detailed references to his thoughts and ideas. It gives a "subjective" account of them. In the sociology of Alfred Schutz, the agent-theory of a language game corresponds the "subjective meaning" of an action. (See Schutz, 1932, pp. 132-136.) The theory of a language game is the "shared mental model" of Denzau and North (1994). Theorists who emphasize the embeddedness of action typically refer to agent-theories.

The agent-theory plays a different role in the agent's life and the scientist's theory.[2] If I want to explain a race riot, I had better make reference to the agent-theory that men are divided into "races," that the racial categories into which they divide people are enduring, and that this concept of "race" is perfectly coherent and unambiguous. I must do so even if I think the concept of "race" is

shifting, vague, and incoherent. I must do so even if I think the concept of race effects no sensible partition of humanity. The scientist's theory will not ignore the concept of "race." Nor will it naively accept the concept. It will contain a model of the rioter's race theory. The rioter will be represented as someone who employs the concept of race in judging himself and others.

The nesting structure of language games

Language games are arranged in a kind of nesting structure. The same action may be described in several different ways depending on the level one chooses in that nesting structure. Koppl (2000b) constructs a simple set theory model that explains this nesting structure. His model is meant only for that purpose. It omits or distorts many important features of language games.

Koppl assumes a set of elementary actions and defines $R^{(0)}$ as the set of all rules governing them. $R^{(0)} = \{r_0^{(0)}, r_1^{(0)}, r_2^{(0)}, \ldots\}$. He defines the set of "first-order elementary language games," $E_0^{(0)}$, as a subset of the power set of $R^{(0)}$. The elements of $E_0^{(0)}$ are rule sets. Koppl defines the set of "second-order elementary language games," $E_1^{(0)}$, as a strict subset of the power set of $E_0^{(0)}$. The elements of $E_1^{(0)}$ are groups of rule sets. Notice that the member of $E_1^{(0)}$ contains members of $E_0^{(0)}$. There is a nesting structure to language games.

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[2] Most of this paragraph is lifted from Koppl 2000a.

Koppl goes on to build the sets $E_2^{(0)}$, $E_3^{(0)}$, $E_4^{(0)}$, up to $E_n^{(0)}$ in the same way. Their union is $E^{(0)}$, the set of elementary language games. $E^{(0)}$ contains the language games whose rules never refer to other language games.

Some language games contain rules about choosing among language games. Koppl defines $R^{(1)}$ as the set of such rules, plus $R^{(0)}$. The set of "first-order secondary language games," $E_0^{(1)}$, is a strict subset of power set of $R^{(1)}$. (Including $R^{(0)}$ in $R^{(1)}$ lets $E_0^{(1)}$ include members with both kinds of rule sets so far considered. It is stipulated that $E_0^{(1)}$ exclude all members of $E^{(0)}$.) Koppl then builds up to the set, $E^{(1)}$, of secondary language games. $E^{(1)}$ contains the language games with at least one rule referring to language games in $E^{(0)}$. Koppl then builds up the sets $E^{(2)}$, $E^{(3)}$, $E^{(4)}$, up to $E^{(N)}$. The union of the sets $E^{(i)}$ is the set of language games, S.

The point of the exercise is to show that an action can be correctly described as falling under the rules of any of several language games, depending on the purposes of the analyst. "A given action might be described as falling under, say, the third member of the set $E_7^{(0)}$, the eighth member of the set $E_4^{(7)}$, or the fourth member of the set $E^{(12)}$" (Koppl 2000b).

The scientist cannot pick just any description of an action. The actor chooses his action, not the observer. But the action automatically falls into more

than one member of S. It defines a subset of S. Only in this sense does the actor determine the boundaries of his act. He does not determine one "true" description of his action, only a subset of S. The observing scientist is free to choose any member of that subset. This freedom matters. The analyst's purpose dictates his choice of description. A different scientific purpose may imply a different description of the same action. Idle bickering over the "true" description of an action should be avoided.

Language games and embeddedness

The language-games framework helps us to see how the problem of embeddedness can be mitigated. Embeddedness seems to trap us between theory without context and context without theory. Nothing will make the problem disappear. As a rule, the greater is the importance of context, the lower is the value of theory (Koppl 1998). But the language-games framework gives us two reasons to think that embeddedness is less of a threat than we might have imagined. First, actions can be described in many ways. Second, language games are subject to natural selection.

Multiple descriptions of action

Action can be described in many ways. This point has been made above. The set-theory model we reviewed is illustrative. Some further considerations along the same lines may be worth discussing.

A man is chopping at a tree. We may describe his action in a highly objective manner. The ax is swinging and chips are flying. We may add some details about what it means to him. He is trying to chop down the tree. This highly objective meaning has some subjective content. More detail might show that he is teaching his son how it is done. Further details reveal that the lesson is part of a larger project to induce in his son a love of woodsy activities. More of the subjective meaning is revealed if we discover that what lies behind the project, perhaps, is childhood memories of a beloved wood. Deeper levels of meaning would create a richer psychological portrait of the man.

Several different descriptions of the same action are possible. Some descriptions are relatively objective. They do not tell us much about the actor. He is a relatively "anonymous" ideal type. The relatively subjective descriptions tell us more about him. He is a relatively "concrete" ideal type. The concrete ideal type has more details of psychological programming. (More details of another sort, say institutional structure, do not necessarily correspond to a more concrete ideal type, although they often do.)

In the language-games framework, agent-practices are relatively objective descriptions. They reveal relatively little of an action's subjective meaning. Agent-theories are relatively subjective descriptions. They reveal more about an action's subjective meaning. Objective and subjective meanings exist on a continuum (Schutz 1932, pp. 135-136). But we may say intuitively that agent-

practices looks at action "from the outside," while agent-theories looks "from the inside."

Embeddedness looks from the inside. It is the context in the actor's mind. That context is always quite rich in particulars. To require every scientific description of action to reveal the full context of action, would be to prohibit the use of anonymous ideal types. Such "embedded" descriptions should not always be required. The theory of inflation provides an example.

The cost-push theory of price inflation blames a vicious cycle. Workers seek and receive higher wages. Costs of production go up as do output prices. Facing higher prices, workers seek and receive another round of wage hikes. And so on. The story ignores money holdings. Implicitly, it says money holders are willing to let their real cash balances dwindle away. This implication is not subjectively plausible. Money holders do pay attention to the purchasing power of their money holdings.

To show that the cost-push theory is mistaken, it is not necessary to consider the full context of each money-holder's market activities. We know that money holders pay attention to the real value of their money holdings even though we know very little about most of them. An anonymous model of the money-holder suffices. Embeddedness is beside the point. A different scientific problem, however, might require a different level of anonymity. An economic historian, for example, might wish to compare the Weberian "rationality" of two

groups of money-holders, say, large firms in 20th-century America and merchants in 13th Century Venice. The two groups have different techniques for deciding how much money to hold. This scientific problem requires a close attention to context. For it, embeddedness matters.

We said that two considerations mitigate the apparent threat to theory posed by embeddedness. The first consideration has been raised. Some descriptions of action are more detailed than others. The second consideration is that language games are subject to natural selection.

Natural selection of language games

Language games are subject to process of natural selection. Natural selection has three parts, variation, selection, and retention. Selection operates over objects that vary from time to time. In biology, the objects were traditionally organisms. More recently, genes are the main objects of selection. Variation occurs in each generation. Variation implies that the array of objects present at any time is heterogeneous. In biology, the individuals of any species differ from one another. The heterogeneity of objects implies that some are more fit than others for the current environment. Thus, some objects will have more "success" than others. They are more likely to be "selected" by the system; others will be more likely to be rejected or weeded out. In biology, greater fitness once meant the probability of differential reproductive success. Today, biologists use Hamilton's

(1964) concept of "inclusive fitness." Retention is memory. In order to survive, the selected variations must persist somehow. In biology, retention is achieved mostly through genes, though cultural evolution is not completely absent.

In economics, the objects are language games. Variation occurs through entrepreneurship. ("Entrepreneurship" is just a useful label for the human capacity to innovate.) Selection will typically occur through the realization of profit and loss. Of course, as in biology, chance plays a role. Retention is achieved by many mechanisms including, memory, habits, and the use of goods produced in the past. There are many reasons to use coal rather than wind to produce electricity. One of them is the presence of many coalmines, storage facilities, and coal-generating plants inherited from the past.

In economics, the most important selection mechanism is the filter of profit and loss. This filter can be tight or loose. If it is tight, profits are unlikely to come to actors who choose inappropriate actions; losses easily strike those who stray from globally optimal actions. If the filter is loose, profits are only slightly more likely to come to actors who choose wisely; losses frequently rain on the optimal and suboptimal alike. Following Langlois (1986), we will say that when the filter of profit and loss is tight, actors are under a tight *system constraint*. In the other case, they are under a loose system constraint. The perfectly competitive wheat farmers of undergraduate lectures operate under a tight

system constraint. The protected monopolist operates under a loose system constraint.

When the system constraint is tight, the economist can use an anonymous ideal type. Precisely because the filter of profit and loss is tight, the particulars of the operative agent-theories do not matter very much. Whatever agents may be thinking, the system constraint ensures that only those agents whose actions are about right will survive. In such cases, embeddedness does not matter.

Modularity and Language Games.

Modularity.

Modularity is not about cutting a system into parts. All systems are already made up of parts. Modularity is about how parts are grouped together and about how groups of parts interact and communicate with one another. In fact, what most people have in mind by modularity is actually what Herbert Simon (1962) called *decomposability*, the grouping of parts so as to minimize the interactions among the groups. In a nondecomposable system, the behavior of any part may affect with high probablity the working of any other part in the system. Nondecomposability encourages unintended and unpredictable interactions among the parts, especially when the system is complex. Moreover, nondecomposable systems are highly vulnerable to breakdown, as damage to any one part can ramify throughout the system (Simon 1962 [1981, pp. 200-205]).

By contrast, a decomposable system is one in which the behavior of a part affects with high probability a subset of parts within its own group or module but affects with only low probability the activities of any parts outside the group. Activities within a module are hidden from other parts of the system and protected from unplanned interference.[3]

In decomposing a system, one implicitly establishes an *architecture*, what Baldwin and Clark (1997, 2000) call a set of *visible design rules*. The architecture specifies how the parts are to be grouped and details the *interfaces* or connections through which groups may interact with one another. The architecture, the interfaces, and the standards used to judge compliance with the design rules are all elements potentially known and visible to all parts of the system. By contrast, what goes on inside any module are *hidden design parameters*. Other parts of the system need not — in general should not — know about the activities within the module, nor should they be permitted to interfere with those activities. This enforced ignorance among the parts is essentially the concept of *information hiding* that is central to object-oriented software design (Parnas 1972).

Modularity in Organizations

By breaking a large system into relatively self-contained pieces, modular decomposition increases the possibilities for experimentation and rapid trial-

[3] Decomposability is similar to the notion of *viscosity* in models of biological interaction. See Knudsen and Foss (1999) and references cited there.

and-error learning. When interfaces become standardized, modules become generic or nonspecific; and many modules, all substitutes for one another, can compete for docking space. In the phrase popularized by Bill Gates, standardized interfaces "commoditize" the modules. Competition among modules allows parallel-path experimentation, the simultaneous trying out of many different sets of hidden design parameters.[4]

Decomposing a system is not without its costs, of course. First, the process of decomposition itself may absorb resources. In a consciously designed system like a complex manufactured product, for example, one has to know a great deal about the system in order to formulate a decent set of visible design rules. The investment in creating those rules represents a fixed cost that designers of a comparable interconnected system would not have to bear (Baldwin and Clark 1997, p. 86). In the language of freshman economics, a modular design strategy has high fixed costs but low variable costs, whereas a nonmodular strategy has low fixed costs but variable costs that rise

[4] In contrast to the dominant economics literature on standard setting, which focuses exclusively on the demand-side effects of standards, Langlois and Robertson (1992) stress the importance of these supply-side learning benefits of *modular innovation*. Recently, Baldwin and Clark (2000) have given added oomph to the supply-side argument by associating it with the concept of real options. The economic prospects of a technological system represent a real option, in that the owner of the option benefits if the system is successful but loses only the option price if it fails. Modularization potentially transforms a single option on the whole system into a set of options on the modules, which raises the value of experiments at the module level (Baldwin and Clark 2000, pp 266-267). As finance theory teaches, a portfolio of options is more valuable than an option on a portfolio.

exponentially with the complexity of the system. For testimony on this last point, see Brooks (1975).

Most of the literature on modularity has been inspired by, and has concentrated on, modularity in the design, manufacture, and use of technological artifacts. The concept applies equally, however, to modularity in organizations and in society (Langlois 1999).

Language Games as Modular Systems

Systems of language games may be decomposable. They may be modular systems. The criminal justice system is a modular system of language games. Conversations between the defendant and his attorney are hidden from everyone else, as are the deliberations of the jury. The defendant can speak to the jury only through the interface of sworn testimony in open court. Some systems of language games are nonmodular. In the children's playground, for example, any two children may interact.

Social roles produce a kind of modularity of social life. The occupant of a social role must behave in certain more or less stereotyped ways. He or she interacts with other persons whose stereotyped behaviors are required by their social roles. The more impersonal the relationships among the occupants of these social roles, the more rigidly stereotyped their reciprocal behaviors will be. Because of this stereotyped rigidity of behavior, the occupants of the various

social roles are somewhat interchangeable. In completely anonymous interactions, the occupants may be perfectly interchangeable. Riding a bus is an example.

Bus passengers are not interested in the identity or personality of the driver. The driver, in turn, is not interested in the identities or personalities o fhte passengers. The passengers are not interested in how one becomes a bus driver. That information is hidden from them. The bus driver is not interested in how the passengers made it to the bus stop or why they are getting on. That information, too, is hidden. The example generalizes. We interact with strangers through the interface of social roles. The social system of cooperation with strangers is a modular system of language games.

During carnival, the usual modularity of social life is set aside. Music, masks, alcohol, and the general spirit of revelry let people interact outside of the usual interfaces imposed by the distinctions of class and social role. Any two persons in the community may interact on equal terms. Briefly, the society becomes an amorphous and nondecomposable system.

The professions are an important subsystem of language games. The professional relations among, say, physicians are of relatively little interest to the public. Changes in medical knowledge are communicated through standard interfaces, namely, doctors' offices, newspaper reports, and the Today Show. Most of the information about how these changes occurred is hidden. Indeed,

the physician's profession itself is modularized (Savage 1994; Langlois and Savage 2000). Most physicians do not know how new therapies or diagnostic techniques are discovered. (Journal articles, when read, reveal only a fraction.) Most or all professions, even the relatively informal and unorganized professions, are modules in the social system. Any socially recognized expertise within the division of labor introduces an element of modularity and information hiding.

Social roles and professions make the division of labor a modular system. The modularity imposes some rigidity upon the interactions between people. The interface is standardized. This fact can make certain kinds of interactions difficult. But the same limits on interaction permit large numbers of strangers to cooperate successfully. It also permits relatively easy recombination of agents and actions. Indeed, we may describe the division of labor as a recombinant system of language games.

A recombinant system is any collection of objects or "agents" that satisfies a few simple properties. The agents interact with each other or with an outside system. Each agent is composed of separate pieces that can be broken up and recombined. The behavior of the agent is governed by the combination of

separate pieces it is made of. In appropriate "fitness landscapes," recombination permits the emergence of agents more highly adapted to their environment.[5]

A recombinant system requires recombination. Recombination requires relatively rigid or formalized interfaces through which the components of the agent interact with one another to produce the agent's overall behavior. Social roles and professions provide such relatively formal interfaces. They allow the division of labor to be a recombinant system.

Coordination does not require shared mental models

Most of the literature on knowledge management takes it for granted that coordination of knowledge within a firm requires that everyone in the firm has the same interpretation of the firm, its goals, and its procedures. Good knowledge management leads to a shared mental model. This view may be about right for a startup. But it neglects the modularity of large bureaucratic enterprises. Information is hidden in modular systems. The components of each module may know different things and think different things. This cognitive diversity need not prevent the system from running smoothly. What is required for the smooth functioning of an organization is coordination of language games. This means that the various agent-practices must fit together. It does not require,

[5] See Kaufman (1993, pp. 112-117), who discusses the roles of both the fitness landscape and the number of "epistatic interactions."

however, that the various agent-theories fit together. Agent theories may contradict one another without necessarily threatening organizational coherence.

A dinner party illustrates the point. (The example is freely adapted from Menger 1934) You are giving a dinner party. You can seat five guests to a table. Some of your guests may be polite, others rude. Some of them may be thick-skinned and unfazed by rude people. Others may be thin-skinned and easily offended by rude people. Thus, there are four possible types, namely, polite thin-skinned, polite thick-skinned, rude thin-skinned, and rude thick-skinned. The third type is difficult. These people are rude to others, but cannot abide rudeness in others. Surprisingly, it is possible to have a successful dinner party even when people of each type are present.

Clearly, a table of polite people will get along, whatever the mix of thick-skinned and thin-skinned. A table of rude will get along if they are all thick-skinned. A mixed table of polite and rude guests will get along if they are all thick-skinned. Rude, thin-skinned guests can be accommodated if you seat each of them at a table full of polite thick-skinned people. The party will be a success if you have the right ratios of the four types. For example, you must invite four polite, thick-skinned guests for each rude, thin-skinned guest you invite.

The dinner party has a modular structure. Each guest has a high probability of interacting with the other guests at his table, but a low probability of interacting with guests at other tables. This modular structure lets thin-

skinned people share the room with rude people. Each table is a nonmodular system. But even within tables, certain combinations of diversity among guests are possible.

Now imagine our party is an organization. The tables are organizational modules, departments perhaps. Instead of polite people, we have people who are "cooperative." They have an ideology of collective effort. "We're all in this together." Instead of rude people we have people who are "competitive." They believe in individual achievement. They strive to outperform their rivals within the organization. Instead of thick-skinned people, we have easy-going people. They don't mind how credit assigned within an organization. Finally, instead of thin-skinned people, we have "hard-edged" people. They are very concerned about credit assignment.

This organization is structurally similar to the dinner party. A department of cooperative, hard-edged people, for example, will get along. Each member will try to be sure the department's collective effort succeeds. At review time, they will resist assigning credit to any one person. The whole department gets credit. A mixed department of competitive and cooperative people will get along if they are all easy-going. However credit is assigned, life goes on -- and so does work. A department filled with competitive hard-edged people, however, will be torn by strife. Each person will try to outperform the others. And each will try to take credit for any good results coming out of the department. You

can have competitive, hard-edged employees as long as they are in departments with cooperative, easy-going employees. The competitive, hard-edged employee will try to grab all the credit for good results. His co-workers will not mind if he gets it.

Menger's dinner party shows that the smooth functioning of an organization does not require a common ideology.

The growth of firms.

The modern economics of organization since Coase (1938) has concerned itself with explaining the firm. Why are there firms? When are activities undertaken inside firms and when outside, in "the market"? Fascinating as it has been, this inquiry has operated almost exclusively under the tacit presumptions of neoclassical theory: there exist certain unchanging entities — like firms — and the object of the game is to analyze how these unchanging particles work and how they interact with one another. But firms are not unchanging entities. They come in many varieties; moreover, each firm is itself many different firms over its life. An evolutionary approach to economics suggests that we adopt what Witt (1998a) calls a "developmental" perspective on the firm.

Whenever a problem involves economic change, Schumpeter is a good starting place. In the *Theory of Economic Development*, he takes as a baseline "the circular flow of economic life," in which economic agents follow habits and routines but also act with economic calculation, at least within a small sphere

carved out by habit and convention.[6] In the circular flow, language games are well adapted to each other. Moreover, the circular flow implies some particular decomposition of economic activity. Some parts of the system may be highly modular, others not; but the system is stable and works well enough. Schumpeter's focus, of course, is not on the circular flow itself but on how it is disturbed by economic change. And, in Schumpeter, the disturbing agent is the entrepreneur; and economic change consists — significantly — in the bringing about of "new combinations."

Some kinds of recombination affect individual language games but do not radically change the way language games fit together. Power saws made carpenters more productive, and spreadsheets on early personal computers made office workers more productive; but neither innovation changed fundamentally how carpenters or office workers fit into the larger system. The creative destruction of the Schumpeterian entrepreneur comes about when recombination also entails *remodularization*, that is, a change in the design architecture of the system not just improvements in the modules themselves. The moving assembly line and network computing changed work organization in a way that powered hand-tools and early personal computers did not

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[6] "The assumption that conduct is prompt and rational is in all cases a fiction. But it proves to be sufficiently near to reality, if things have time to hammer logic into men … [and if] precedents without number have formed conduct through decades and, in fundamentals, through hundreds of thousands of years, and have eliminated unadapted behavior" (Schumpeter 1934, p. 80).

(Langlois and Robertson 1995, chapter 4; Bresnahan and Greenstein 1997). These systemic recombinations required change both in individual language games and in how those language games fit together.

The moving assembly line rendered obsolete the decentralized network of parts supply on which Ford had initially relied. Indeed, in the beginning, it was a *demodularization*: production at Ford's Highland Park plant became a complex interconnected process as Ford engineers invented and refined the process of mass production. Ultimately, however, it became a remodularization once Ford understood the underlying design of mass production, and assembly modules were broken off and sent to various plants around the country in a way that emulated the decentralized structure that had existed before mass production (Langlois and Robertson 1995, chapter 4). The design of the IBM 360 series mainframe computer (and the redesign of IBM it entailed) was from the start a remodularization of computer design and production (Langlois 1997), one that reorganized and standardized virtually all aspects of computer production and sales.

Another way to remodularize a system is to start small and then slowly grow to displace the existing modularization (Baldwin and Clark 2000, p. 308). For example, the personal computer started as a niche item — a hobbyist toy in the beginning — with a very different modularization (in both technical and organizational terms) from the mainframe and minicomputer industries

(Langlois and Robertson 1995, chapter 5). Through a process of adding and improving modules, the modularization of the PC came eventually to displace that of the larger computers.

In both cases — whether it is large-scale systemic remodularization or the small-scale seeding of a new modularization — entrepreneurship is at work. The carrying out of new combinations requires a change not only in the practice of economic agents but also in their rhetoric and theory as well. Langlois (1992) has pointed to the "dynamic" transaction costs attendant on informing and persuading potential cooperating parties of the benefits of a systemic recombination. It is these costs that demand the entrepreneur, who, in Schumpeter's words, "'leads' the means of production into new channels" (Schumpeter 1934, p. 89). Recent work on the theory of the entrepreneurial firm has emphasized this neglected dimension of leadership (Langlois 1998; Witt 1998b; Yu 1999).

Overcoming dynamic transaction costs is a matter of organizational form. Putting assets in the hands of a single individual (or small group with aligned incentives) obviates the fear of opportunism that independent asset holders might have harbored. But there is far more involved than this. As we saw, the costs of remodularization — of change in the visible design rules — are far more problems of coordination than of misaligned incentives. In our terms, the practice elements of individual language games need to be realigned, that is, they

need to be made to work together in the new combination. It is the role of the entrepreneur as rhetor to inform and persuade complementary actors to cooperate in the recombination; and he or she does this by imposing on the complementary actors a common world-view or mental model. That is, the entrepreneur has to create a new, commonly shared language game in which agent-rhetoric and agent-theory complement the practice needed for the new combination.

The entrepreneur creates this new language game by engaging in what Max Weber called *charismatic authority* (Langlois 1998).

> The corporate group which is subject to charismatic authority is based on an emotional form of communal relationship. The administrative staff of the charismatic leader does not consist of "officials"; at least its members are not technically trained. ... There is no hierarchy; the leader merely intervenes in general or in individual cases when he considers the members of his staff inadequate to a task to which they have been entrusted. There is no such thing as a definite sphere of authority and of competence. ... There are no established administrative organs. ... There is no system of formal rules, of abstract legal principles, and hence no process of judicial decision oriented to them. But equally there is no legal wisdom oriented to judicial precedent. Formally concrete judgments are newly created from case to case and are originally regarded as divine judgments and revelations. ... The genuine prophet, like the genuine military leader and every true leader in

> this sense, preaches, creates, or demands *new* obligations. In the pure type of charisma, these are imposed on the authority of revolution [*sic*] by oracles, or of the leader's own will, and are recognized by the members of the religious, military, or party group because they come from such a source. (Weber 1947, pp. 360-361.)

As the sociologist James Coleman (1990, pp. 99-101) has noted, charismatic authority is not at all irrational, despite its association (in Weber and elsewhere) with religious and military fanaticism. Rather, charismatic authority is an ideal organizational form for solving the coordination problem associated with dynamic transaction costs. In a situation of "chaos" — that is, of systemic recombination — rights, roles, and responsibilities are in flux. All participants would prefer some structure or "constitution"; but the costs of coordination are high, as each is willing to constrain himself or herself to a new order only if many others simultaneously agree to do so. Charismatic authority cuts through these costs and establishes a structure based on the rhetoric and theory of the leader. Schumpeter would no doubt add that charismatic — entrepreneurial — authority is not merely an efficient response to systemic recombination but is in fact the principal generator of it.

In Weber's account, charismatic authority inevitably gives way to either traditional or "rational" organization as change and uncertainty subside. In our terms, this is a process of decomposition or remodularization of the organization

after the non-modular period of ferment under charismatic authority. Weber would see firms as becoming more rational, which for him meant more bureaucratic, as the members of the organization settle into established roles with increasingly well-defined spheres of authority and competence. Notice that bureaucratization implies the division of knowledge, which in turn means a progressive differentiation of the agent-practice of individuals. What is perhaps less obvious but no less necessary is that bureaucratization also implies a progressive differentiation of the agent-theories and even the agent-rhetorics of the participants. The rules and procedures of a bureaucracy create standardized anonymous interfaces through which agent-theories and agent-rhetorics seldom need — and are seldom allowed — to pass. Like the guests at Menger's dinner party, agents in a bureaucracy can cooperate without sharing a common interpretation of the enterprise.

In a classic study of research and development in industry, Burns and Stalker (1961 [1994]) illustrate a number of these points. Their well-known distinction between organic and mechanistic systems of management fits in well with the approach and thesis of this essay. Organic management is essentially nonmodular management. Participants share common goals and world-views; communication is horizontal rather than vertical and involves the transmission of useful information rather than commands; and spheres of rights and responsibility are not clearly demarcated. By contrast, mechanistic management

is essentially Weberian bureaucracy, which is a much more modular system. Tasks become abstract rather than tied to particular individuals; knowledge becomes more local; rights and obligations are well defined and governed by abstract rules; and the "interfaces" between participants become more anonymous and formal.

In their interviews with British firms conducting R&D, Burns and Stalker document our assertion that, in mechanistic organizations, participants can collaborate without sharing theories and rhetorics. This was particularly clear in the differences between the inhabitants of the laboratory and the denizens of the production department. Backgrounds, cultures, attitudes, and even hobbies were relatively homogeneous within the groups but strikingly dissimilar across them. What made these differences possible was the standardized "interface" through which the two groups communicated, namely the drafting office, which produced drawings based on instructions from the lab and passed those drawings on to production. It is a large part of the Burns and Stalker thesis that mechanistic forms, which may work well under static conditions, do not work well in situations of innovation or rapid change. In many of the cases they surveyed, the anonymous interface proved inadequate, and the draftsmen were unable to "translate" between the theory and rhetoric of R&D and the theory and rhetoric of manufacturing. "This 'tremendous gulf' was seen, rightly, as a linguistic problem" (Burns and Stalker 1994, p. 179).

Clearly, organic systems of management have much in common with Weberian charismatic authority. We might say that an organic management system is an extension, or perhaps a slightly more rationalized form, of pure charismatic authority.[7] As such, it is an effective mode of organization in situations requiring architectural change and recombination. By contrast, the mechanistic organization is better able to take advantage of disparate knowledge because it doesn't need to keep everyone on the same wavelength. We might thus conclude that, in the terminology of James March (1991), organic structures are best for exploration, whereas mechanistic ones are best for exploitation.

But this raises a question. Coase's question. If we agree with Hayek that the most effective decomposition — the ultimate modular system — for taking advantage of dispersed knowledge is the price system, should not the real end-state of Weberian rationalization be a pure form of "the market," namely anonymous spot contracts? We have a rationale for organic, charismatic, entrepreneurial firms as pure explorers. And we have a rationale for a finely articulated market system of contractors and subcontractors as pure exploiters. But why should there ever be anything in between — notably the large well-articulated corporations so beloved by Alfred Chandler?

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[7] Indeed, Burns and Stalker argue that, in successful innovative organizations, the managing director's position "can approximate very closely to 'natural' (charismatic) leadership" (p. 213).

There are two possible answers, not mutually exclusive. One is to invoke path dependency. Firms start out as charismatic recombiners, organized vertically in order to overcome dynamic transaction costs (Silver 1984; Langlois 1992). In some circumstances, especially when markets for components aren't well developed or when selection pressures aren't great, the initial vertical integration may create an organizational trajectory in which the division of labor develops internally, even though it might under other circumstances have developed to better effect externally. One possible example may be the American automobile industry, which persisted in high levels of vertical integration and control until competition from the Japanese forced American firms to use the modular interfaces of the market more effectively (Womack, Jones, and Roos 1990).

The second approach is to reject the life-cycle model implicit in Weber and to see the degree of "organicism" and "mechanism" in a firm as a strategic variable — or at least as a variable that differs among firms in cross section. Why? Because firms may always need to generate or respond to some degree of change in visible design rules. Even though large, well-articulated firms are less effective than markets in taking advantage of dispersed knowledge, they exist because a certain amount of architectural flexibility has survival value. Taking this answer too seriously would lead down the path of functionalism, of course,

and there are doubtless elements of both flexible adaptations and path-dependent vestiges in the population of real-world firms.

As Schumpeter has pointed out, what is efficient in a static system need not be efficient in a dynamic system. Spot contracts between anonymous actors are not always the best mechanisms for exploiting dispersed knowledge. One of the functions of organization is to increase dynamic efficiency at the expense of static efficiency. Unfortunately, no mechanism exists to ensure the perfect realization of this desirable function. The imperfections of evolutionary selection permit inefficient organizational forms to exist, some of them indefinitely.

Conclusion

The language-games framework lets social science give a unified picture of acting, thinking, and talking agents. It adds rhetoric and theory to the rule-following framework adopted by many others, including Nelson and Winter. Language games exist in modular systems such as professions and firms. The modularity of the system implies that knowledge is divided and information is often hidden. Information hiding promotes coordination among language games in a world of competing and incompatible interpretive frameworks.

The view of knowledge that emerges from our perspective is consistent with the early vision of Adam Smith. It challenges, however, current orthodoxy in economics and much of the literature in knowledge management. Past empirical work has given some support to the unorthodox, Smithian view of

knowledge. We hope to see new empirical results directly testing the different implications of the two different views of knowledge.

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