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Evolvability of Organizations and Institutions

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Abstract

One (not the only) way to operationalize this Forum's agenda of blending evolutionary theory with complexity theory is Padgett and Powell's *The Emergence of Organizations and Markets*. There "evolutionary theory" means "autocatalysis," and "complexity theory" means "dynamic multiple networks in regulatory feedback." Together (but not separately), these two theoretical building blocks can explain the sudden emergence or invention of novel forms of organizations not previously observed in history. This chapter draws on an empirical case study from the book, the emergence of international finance in medieval Tuscany, to illustrate the theory.

Framing Issues and Critiques

The charge of this Forum was to analyze whether complexity theory and evolutionary theory can contribute, especially in concert, toward a "reform" (economists would usually prefer to say "extension") of traditional economic theory. Within this mandate, the charge to our discussion group was: What can such a synthesis contribute to our understanding of the evolution of organizations and institutions?

As will be apparent to readers of my book coauthored with Woody Powell, *The Emergence of Organizations and Markets* (Padgett and Powell 2012), I am fully on board with both of these charges. I believe that a synthesis of complexity and evolutionary theories is the prerequisite for understanding historical change in economic institutions.¹ The problem that I perceive, however, lies

¹ The specific historical examples of economic institutional change that were analyzed empirically in this book included: (1) the emergence of early international finance in medieval Tuscany (chap. 5), (2) the transformation of that finance into the partnership system in Renaissance Florence (chap. 6), (3) emergence of the stock market and the joint-stock company in early-modern Amsterdam (chap. 7), (4) the construction of Germany under Bismarck (chap. 8), (5) the development of the central planned economy under Stalin's Soviet Union (chap. 9), (6) Chinese economic

not in the motivation or thrust of the initial charge, but rather in the fact that none of the core terms are well defined.² Everything depends upon how “complexity,” “evolution,” and “institutions” are operationalized.

It is fairly well understood at this point that “complexity theory,” in the singular, is a misnomer. Instead, there are a variety of “complexity theories”: measures of information entropy (Shannon 1949), dissipative systems (Prigogine 1962), nearly decomposable systems (Simon 1969), spin-glass models (Anderson 1994), genetic algorithms (Holland 1975), N-K models of Boolean genetic networks (Kauffman 1993), self-organized criticality (Bak 1996), small worlds (Watts 1999), power laws (e.g., Barabási 2002; Ijiri and Simon 1977), along with innumerable agent-based models. What this diversity of models has in common is their shared ontology of highly interactive networks of heterogeneous agents.³ Many of these models have shown that highly interactive networks generate nonlinear dynamics—not just in the “boring” senses of convergence to equilibria and S-shaped growth curves, but in the sense of “jumpy” dynamics: bifurcations, multiple basins of attraction, punctuated equilibria, superposed cycles, sometimes even persistent chaos. This insight connecting nonlinear system-level dynamics (especially of the discontinuous “jumpy” sorts) to highly interactive networks is foundational for anyone trying to understand such dynamics in empirical cases. The core message of complexity theory, central to both of the charges above, is that if one wishes to understand “jumpy” nonlinear dynamics, one must move beyond models of homogeneous (or “representative”) agents and mean-field (or “average”) approximations toward models of the evolving interactional structure itself.

Evolutionary biologists themselves understand well the similar point that “evolutionary theory,” in the singular, is an oxymoron.⁴ Social science consumers of Darwin frequently misunderstand this, attributing more monolithic

reform first under Mao and then under Deng (chap. 9), (7) the development of the Russian banking system under Yeltsin (chap. 10), (8) the development of the Russian telecom industry under Yeltsin (chap. 11), (9) the evolution of business groups in post-Communist Hungary (chap. 12), (10) the emergence of the American biotechnology industry (chaps. 13–16), (11) the cross-industry networks of patenting among inventors in Silicon Valley and Boston (chap. 17), and (12) the global emergence and decentralized organization of open-source computing (chap. 18).

² For that matter, “traditional (i.e., neoclassical) economic theory” is not a unitary whole either, even though it aspires to be so.

³ “Power laws” are such a broad class of models that they may or may not include the last “heterogeneous agents” component of this family definition.

⁴ “Evolutionary theory” is an oxymoron to the extent that the word “theory” is interpreted in a universalistic, ahistorical way. The principles of evolution—from autocatalytic networks of metabolites, to genetic regulatory networks of proteins and genes, to cells, to multicellular colonies of cells, to phenotypes, to group selection, to looser ensembles of ecological networks—have themselves evolved over (deep) historical time. I am not sure that evolutionary biology itself, especially the now old-fashioned “Modern Synthesis” of population genetics, has conceptually caught up with its own evolutionary move toward highly interactive networks and “jumpy” nonlinear dynamics.

coherence to the Darwinian approach than exists among contemporary practitioners in biology. This misunderstanding is based on equating the entirety of “evolutionary theory” with the so-called Modern Synthesis of the 1940s, now called population genetics. Such an oversimplification sweeps under the rug the liveliest areas of contemporary evolutionary research, such as genetic regulatory networks, the evolution of development (“evo-devo”), epigenesis, neutral drift, autocatalysis (in the origins of life), niche construction (the co-evolution of genetic and ecological networks), multilevel selection, the historicity of Stephen Jay Gould, etc. Given such exciting diversity at the frontier of contemporary evolutionary theories, it is by no means clear that “evolutionary theory” (in the singular) is stable enough to permit convergence. How “complexity theory” is to be integrated with “evolutionary theory,” in other words, depends enormously upon which elements out of these two loose clusters of concepts one draws.

The core social science word “institution” is even more variegated in its multiple meanings. The use of a single word to refer to many different things has created, in my opinion, more a Tower of Babel than an intellectual synthesis.

In the social sciences, there are three commonly used but quite distinct meanings of “rules” or “norms,” and hence of “institutions,” which are assemblages of such rules into “roles”:

1. Rules as external “rules of the game,” like in contracts or in law: Usually, but not necessarily, sanctions are attached to these instruments of bilateral or top-down control. When we say “formal institution,” this is the meaning we typically assume.
 - Economists like principal-agency theorists and neo-institutionalists (e.g., North 1981; Williamson 1975) typically build on this first meaning of the word.
2. Rules as decentralized programs of behavior: Such behavioral rules would be considered “institutionalized” if they clustered into clear reinforcing statistical patterns, giving rise to predictable expectations. (Here, the word “norm” is used in the sense of “normal,” not in the sense of “normative.”) When we say “informal institution,” often this is what we mean.
 - Historical institutionalists in political science often build on this second meaning, thereby turning “norms” into “conventions.”
 - Dewey’s pragmatism (Dewey 1922/2002) and Bourdieu’s “habitus” (Bourdieu 1977) as well as Dreyfus’s (1992) and Clark’s (1997) “extended mind” are nonrationalist variants of this second meaning. Those alternative psychologies assume congeries of learned and even unconscious habits.
3. Rules as symbolic corollaries of asserted identities: “Logics of appropriateness” are actions taken not to achieve goals, but “because they

are right”; that is, because they are consistent with (at least claimed) self-identifications. Normative legitimacy is the core concept in this third sociological or “culturalist” approach.

- Old-style sociological institutionalists following Max Weber (1905) emphasize the internalization of such identity-forming norms.
- Contemporary sociological neo-institutionalists, such as Meyer and Scott (1994), DiMaggio and Powell (1991), and March and Olsen (1989), emphasize ritual performance and signaling without necessarily implying internalization.
- Cultural anthropologists like Douglas (1986) are fellow travelers with the sociological approach when they use “institutions” in a linguistic sense to refer to shared cognitive classifications, especially of people. (“Norm” here means “normalized” or “naturalized.”)

A minority perspective worth mentioning is the postmodern position:

4. Rules as analysts’ fantasies. Wittgenstein (1953) famously gave the example of {2, 4, 6, ...}. No matter how straightforward it seems to impute a rule that generated this or any sequence, a huge number of other such rules could have been imputed. Rules are after-the-fact interpretations by observers, not before-the-fact determinants of behavior.
 - The U.S. constitution, in this perspective, is only the image of the current members of the Supreme Court. (Efforts by them to convince you otherwise are obfuscation.)

My own view is that it is a mistake to choose any of these definitions as the “right” one, because very different processual mechanisms underlie the production of “norms” variously conceived. Indeed, efforts to insist on one definition to the exclusion of others should be recognized for what they are: linguistic moves to assert hegemonic power over the conversation. In abstract equilibrium, it is theoretically possible for all three (or even four) of these meanings to line up. But in dynamic systems of historical change, substantial misalignments among these distinct phenomena frequently emerge; indeed, misalignments could be generating the change. As analysts, we throw away our own capacity to understand (or maybe even to observe) institutional change if we restrict our perceptual lens to any single definition. Even the otherwise admirable desire to develop synthetic “compromise” definitions are misguided, in my view, precisely because they are singular. Static equilibria are uninteresting from the point of view of explaining historical emergence and transformation of institutions.⁵ Contradiction, not consistency, across multiple overlapping

⁵ This is very far from saying that characteristics of the preexisting structures that break down are irrelevant to what emerges thereafter. As we state (Padgett and Powell 2012:2, 5): “Organizational genesis does not mean virgin birth....Invention in the wild cannot be understood

processes is what we should be looking for to explain nonequilibrium dynamics of historical change.

Below I shall briefly adumbrate the positive approach of Padgett and Powell to the challenging topic of explaining the emergence of organizational novelty, primarily in the domain of business and economic markets but also in the domain of political institutions as well. This approach synthesizes “multiple networks” from the complexity theory list with “autocatalysis” from the evolutionary theory list. The essence of this approach is to ground historical analyses of economic change not in model-based understandings from economics but in model-based understandings from biochemistry.⁶ Because this approach is unorthodox, compared even to other chapters in this volume, a few words are in order to explain why we eschewed the more incremental approach of modifying and extending the existing family of (admittedly diverse) traditional economic models.

Many non-neoclassical economists, including other social scientists in alliance with economics, exhibit an admirable desire these days to reach out to neighboring disciplines.⁷ What about “institutions”? What about “culture”? What about “history”? These questions absorbed most of the week’s discussion of our discussion group at this Forum. In the case of our group, these questions were welcome hands across the water, requesting dialogue. The problem is not this admirable motivation to be catholic.⁸ The problem is a learned incapacity among many economists to comprehend the answers that return, because of a commitment to a core set of axioms into which everything must be fitted. I illustrate this briefly with the three words in question.

Contracts fit easily into traditional economists’ tool kit, so for economists the word “institution” tends to be translated along these lines. But Max Weber and the sociologists following him have been studying institutions for a hundred years. Compared to them, economists are johnnies-come-lately to the study of institutions. When Weber said “institutions,” he was referring to

through abstracting away from concrete social context because inventions are permutations of that context. To make progress in understanding discontinuous change, we need to embed our analysis of transformation in the routine dynamics of actively self-reproducing social contexts, where constitutive elements and relations are generated and reinforced.”

⁶ This does not mean that we try to predict precise outcomes. Our understanding of “prediction” is to figure out the finite number of evolutionary trajectories latent in a given network structure, in the face of perturbations—not to assert which one of those will occur. Fontana (2005) calls this “the topology of the possible.” We argue that this open-ended understanding of “prediction” is identical to Darwin’s own metaphor of evolution as a branching bush. Science aims to understand the mechanisms of change, not the outcome of change. (Woody and I tell our students “theorize about verbs, not about nouns.”) This evolutionary understanding of prediction, of course, is inconsistent with the more precise point-prediction goal of physics, which most economists embrace. However it is closer, we argue, to the path-dependent structure of real history.

⁷ Whether that is for dialogue or for hegemony reasons is not always clear.

⁸ We all cooperated and “played nice” in the words of Sven Steinmo (pers. comm.). More than that, we genuinely respected each other’s divergent opinions.

things like the Catholic Church. Squeezing that into “contracts” makes clear what is lost through the economic definition. Not just in the context of our working group at this Forum, but far more widely, it is almost impossible to work definition #3 (above) into the conversation with definition #1.⁹ The net effect of constraining the definition of institutions to “rules of the game” is to throw away one hundred years of research, thereby creating the illusion of inventing new theory.

Beliefs and expectations also fit easily into traditional economists’ tool kit, so the word “culture” tends to be translated into that. But what about the symbol systems, rituals, and languages which other social scientists refer to when they use that word? By constraining the definition, the real experts on culture—cultural anthropologists and linguists—are frozen out of the purported conversation.

Likewise, “history” in the hands of economists too often gets translated into growth curves. What happened to the French Revolution? I am not saying that the study of growth curves is not valuable. But to call that “history” without coming to grips with the vast array of contingencies that professional historians spend their careers studying is misleading.

Padgett and Powell (2012) certainly have not absorbed and integrated all the diverse alternative perspectives just alluded to either. My point is only that definitions are terribly consequential for structuring both conversation and vision. Neoclassical economists’ aspiration (much less claim) for a single universal theory is sustainable in practice only by ignoring the achievements of other social scientists not in the conversation. Knowing what we do not know, we should eschew grandiloquent aspirations of a unified theory to explain it all.¹⁰ A more humble and pragmatic tool-kit approach to modeling is more useful to the social sciences than any chimerical singular vision. However, for such a “tool-kit approach” to avoid descending into mere eclecticism, it must be guided by an overarching vision, not so much of the answer but of the question. I propose that a shared focus on the overarching question of the emergence of novelty might be one fruitful way to break through and reorient the calcified conceptual boxes just outlined.

The Emergence of Organizations and Markets

Explaining choices, once alternatives exist, has not proven difficult for the social sciences. Explaining the discovery of alternatives is slightly more

⁹ It is hard enough, though not impossible, for definition #1 to be in dialogue with definition #2 (at least the #2a version).

¹⁰ For me, this conclusion holds as much for complexity theory and for evolutionary theory as it does for neoclassical economics. Hopefully this Forum is not trying to replace one unified field theory with another less well-developed one.

difficult, since the search space outside of current alternatives is sometimes not well defined. Explaining the emergence of true novelty, before alternatives even exist to be found, is the real challenge—for the social sciences as well as for biology. Darwin entitled his book *The Origin of Species* to signal his deep interest in speciation (as well as in the natural selection of species, once they had arisen), but arguably he never answered his own hard question.¹¹ Still, no full evolutionary argument can exist without attention to the origin of variation.

We (Padgett and Powell) study this hard question of the emergence of novelty in social systems at the level of “emergent actors”—mostly the emergence of new organizational forms of business and their associated markets,¹² but also the emergence of new types of biographies and people, and in some of our cases (the Netherlands, Germany, and the Soviet Union) the emergence of new forms of political states as well. In general, our approach to the emergent-actors question is this: In the short run, actors create relations, but in the long run, relations create actors. That is, on the short timescales at which people, organizations, and states can be considered to be fixed, we are as methodologically individualist as anyone. We never deny purposive agency. The central point is to emphasize the less studied other half of our mantra; namely, the long run, where “agency” itself becomes endogenous, through iterated learning, reproduction and selection of practices, and beliefs among actors over biographical time.¹³

More specifically, the two network processes we inductively have found to lie at the base of our numerous case studies of emergence of actors are *autocatalysis* and *multiple networks*. Neither process alone is sufficient to explain organizational speciation. Only coupled together can they explain the emergence of organizational novelty.

The starting point of the Padgett and Powell approach is that economic production and exchange together is a form of life. Not “life” in the population genetics sense of variation, selection, and retention,¹⁴ but “life” in the more primordial origin-of-life sense of an autocatalytic network of chemical reactions or transformations among units (chemicals) that reproduce themselves

¹¹ Even the population genetics synthesis of Darwin and Mendel never answered the question at the phenotype level at which Darwin had posed it. Contemporary research into genetic regulatory networks has undermined the previous “genes alone” population genetics answer, which relied on oversimplified one-to-one genotype-phenotype maps.

¹² See cases cited in footnote 1.

¹³ Sociologists are familiar with “Coleman’s boat,” where James S. Coleman defined a “methodologically individualist” explanation as one where macro → micro → micro → macro. Ninety-nine percent of research in Coleman’s own methodologically individualist tradition focuses on the last upward-causation “aggregation problem.” But our own less orthodox emphasis on the first downward-causation leg of Coleman’s “boat” is consistent with his characterization of “methodological individualism” (more broadly conceived than usual) as well.

¹⁴ The “economy,” of course, is not a unit of selection.

in the face of turnover or flux in these units.¹⁵ We point out that this chemical autocatalysis definition of life can be extended to social systems:

1. The economy can be seen as a form of life, in the sense of production autocatalysis where products reproduce each other through economic networks of technological transformations (like a Leontief input-output ecology).
2. Social networks can be seen as a form of life, in the sense of biographical autocatalysis where interacting social practices reproduce each other through networks of learning and teaching.
3. Language can be seen as a form of life, in the sense of linguistic autocatalysis where symbols-in-use reproduce each other through conversation (both oral and written).

Viewing “institutions” (however defined) as components in living systems means that they should not be reified into objects, but rather should be analyzed in terms of the (living) flows that they regulate.¹⁶ In Padgett and Powell (2012), practically speaking, this meant measuring and situating organizations and institutions in and among the multiple networks of human activity that crosscut and interpenetrated them. To rip institutions out of the fluid activity they are trying to regulate, we argued, is to deprive analysts of their leverage on explaining dynamic institutional change. Conceptualized as reified objects, change in institutions perforce appears from offstage, *deus ex machina*.

Figure 11.1 presents social structure as a network analyst sees it. Using as my example Renaissance Florence (Padgett and McLean 2006:1469), social structure in ensemble is portrayed as overlapping and interpenetrating domains of economic networks, political networks, and kinship networks. (Other domains are also possible, e.g., religion, military, science, etc., and make appearances in the book.) These functional domains of activity are linked by vertical lines, which represent people, who participate in multiple spheres of their lives

¹⁵ See Padgett and Powell (2012, chap. 2) for an extensive review of the literature and debate about alternative definitions of life and theories about the chemical origins of life. Thermodynamic “dissipative systems” are the self-organizing spatial patterns that emerge out of open-ended “far from equilibrium” energy throughput. Life is not that, but it builds on energy throughput as its material foundation. Autocatalysis adds reproduction to that. “Selection” as traditionally conceived (# babies) only emerges once chemical autocatalytic systems become embodied in cells (~ phenotypes). But chemical autocatalysis itself can be conceived as a type of “selection” in the sense of a positive feedback loop among reproduction rates that lifts the set of chemicals in such a loop out from their background of other chemical reactions. Autocatalysis is more like reproduction and selection at the level of ecologies, than it is like reproduction and selection at the level of functionally bounded subunits. The concept of “selection,” in other words, has different meanings depending on level of analysis. The current theoretical challenge is to figure out what selection means not at the level of gene frequencies, but at the evo-devo level of genetic regulatory networks, where genotype-phenotype mappings are complex, to say the least.

¹⁶ “Theorize in terms of verbs, not nouns,” Woody and I teach our students.

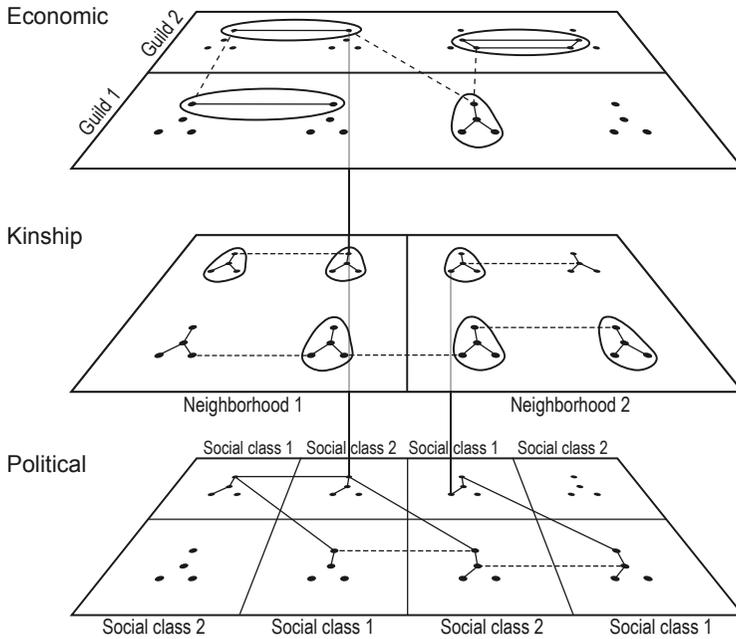


Figure 11.1 Multiple-network ensemble Renaissance Florence (after Padgett and Powell 2012:6).

(e.g., Cosimo de' Medici as a banker, as a politician, and as a father.¹⁷ All three types of reproduction autocatalysis are intertwined in each plane: dotted lines for production autocatalysis (products flowing as trades), solid lines for biographical autocatalysis (skills flowing through partnerships), and ovals for linguistic autocatalysis (names and legal statuses of partnerships). The central point of a multiple-network representation like this is that the economy, politics, and kinship are not separate domains: they interpenetrate and hence regulate each other through multifunctional people participating in all. Because of this trellis-like interpenetration, we as analysts should not intellectually segregate them. Networks act as catalysts for each other. This does not imply that formal hierarchies are useless for regulating this network self-organization, but it does imply that they are not necessarily a prerequisite.

“Innovation,” in our use of the word, is change in the nodes of this network. “Invention,” in our use of the word, is change in the topology of the networks

¹⁷ In a multiple-domain context, people do not have goals; roles have goals. Cosimo de' Medici, for example, does not maximize profits; Cosimo-as-banker maximizes profits (or may try to). Likewise the role of Cosimo-as-politician is concerned with power, and the role of Cosimo-as-father is concerned with status. Cosimo himself is a complex (and in his case contradictory) ensemble of multiple, not always consistent goals.

themselves, which reproduce the nodes. Innovation is like change in a product; invention is like change in an industry.

Innovations, in our empirical observations, are a dime-a-dozen; they happen all the time through people transposing and trying out new practices in their own local contexts.¹⁸ This does not mean that innovations are random. They have a directed stochastic drift to them, which derives from the topology of the networks through which they diffuse.¹⁹ In Figure 11.1, for example, say Cosimo de' Medici is having trouble in his bank, in the top plane. His simplest search strategy for potential solutions to his problem is to walk through his own personal network. In terms of his own multiple roles (vertical lines across planes): What if he runs his bank like he runs his own family, in the second plane? What if he runs his bank as he runs his own patronage networks, in the third plane? These may or may not be good ideas, but at least they are ideas. Or maybe Cosimo could take two-step searches through his own network: What if he runs his own bank like his brother runs his family? The point is that networks of production, biographical and linguistic autocatalysis can be easily repurposed into search for potential innovations to solve local problems. In the context of chemical networks, Walter Fontana calls similar matrices of mutation reachability "topologies of the possible" (Fontana 2005).

None of this transpositional search for innovation, of course, means that any of these (locally) new ideas are good ones. The essence of autocatalysis is repair: take away a handful of nodes through perturbation, and the rest of the autocatalytic network will (in time) reconstruct the missing nodes. Repair is the chemical meaning of resilience. "Innovation," from the perspective of the recipient network, is just a perturbation; hence the rest of the perturbed network will try to kill it. This could be called "resistance to change," but it could also be called "a healthy autocatalytic network." The whole point of autocatalysis, when it works smoothly, is to be resilient by stabilizing itself (i.e., its own reproduction) against inevitable perturbations. This is basically the definition of "selection" at the level of a network: if networks were not autocatalytic, they would not reproduce themselves vigorously enough through time for us to observe them. In this sense, most innovation (no matter how frequent) is bad and will be flushed.

"Inventions," on the other hand, are those rare events/perturbations where innovations percolate around to tip autocatalytic networks into new (also autocatalytic) configurations. Healthy autocatalytic systems resist reorganizations of themselves; hence there must have been some structural vulnerability beforehand, which permitted such a network to tip into neighboring basins of attraction. The word "resilience" is inappropriate for system tippings like this;

¹⁸ In this respect, we agree with pragmatists, who emphasize the local "creativity" of people.

¹⁹ This is similar to "neutral drift" theorists in evolutionary biology, who emphasize the non-random, path-dependent aspect of genetic mutations. Of course this emphasis in no way denies a (large) stochastic component as well.

“evolvability” is more apt. Evolvability is when systems discover new functions; that is, when they construct and connect to new networks. Renaissance Florence was not at all a resilient system of multiple networks, because it hardly ever stabilized itself (for more than a decade or two at least). It was, however, an extremely evolvable system, because its “jumpy” social, business, political, and artistic networks constructed new trajectories of development for themselves.

In the empirical cases of Padgett and Powell (2012), we often observe the structural vulnerability and rewirings entailed in organizational inventions to follow closely upon each other. This is not surprising because the temporal window of transient vulnerability is short in any healthy autocatalytic system; in other words, timing is everything. A shock—sometimes exogenous (like a war or a plague), sometimes endogenous (like a revolt or business collapse)—is often (not always) observed to scramble or weaken not just a single node but a whole subset of nodes, thereby creating temporary vulnerability in those nodes’ network’s reproduction.²⁰ The mechanics of constructive “rewirings” observed to transpire within such temporal and network windows of vulnerability, moreover, often involve transpositions of people and their network practices from one domain to another.²¹ Imagine in Figure 11.1, for example, not just the micro percolation dynamics already described for “topology of the possible” innovation diffusion, but rather some macro “hand” (or crisis) grabbing entire chunks of one network and transposing them into another network. Whether or not such hybridization or syncretism reproduces or self-destructs then becomes the autocatalytic (or selection) question. We do not argue that crisis-driven macro network rewirings are the only routes to organizational invention, just that such volatile dynamics are frequently observed in famous speciation events in human history.

More specifically in the empirical case studies described in Padgett and Powell (2012), eight organizational invention mechanisms of network rewiring are observed:

1. Incorporation and detachment (for medieval Tuscan banking)
2. Transposition and refunctionality (for Renaissance Florentine banking, and for contemporary biotechnology firms)
3. Anchoring diversity (for regional agglomerations of life-sciences research)
4. Migration and homology (for the emergence of joint-stock companies and the stock market in early-modern Amsterdam)
5. Conflict displacement and dual inclusion (for the consolidation of nineteenth-century Germany under Bismarck)

²⁰ This is a network version of Schumpeter’s “creative destruction” (Schumpeter 1942).

²¹ “Transposition and refunctionality,” for example, is innovation not in the sense of a new object for an old purpose, but in the sense of a new purpose for an old object.

6. Purge and mass mobilization (for the Great Terror under Stalin, for the Cultural Revolution under Mao, and for perestroika and glasnost under Gorbachev)
7. Robust action and multivocality (for the rise of Cosimo de' Medici in Renaissance Florence, and for Chinese economic reform under Deng Xiaoping)
8. Multifunctional business groups (for post-Communist Hungary)

Collectively, this set of case-based discoveries about network mechanisms for generating organizational novelty represents the inductive approach to science.²² In this chapter, I briefly illustrate only the first of these eight organizational genesis mechanisms.

Case of Emergence of International Banking in Medieval Tuscany

The word “corporation” has medieval, Latinate roots since *corpo* means body, as in the Body of Christ. Unlike a partnership but like a church, a society of merchants using this language was thereby conceived legally as having continuity through time above and beyond the continuity of its members. The organizational invention to which this metaphor referred was the so-called “rise of the sedentary merchant” in international banking in the thirteenth century. Here, roving bands of merchants who traveled to and from medieval fairs were replaced at high levels of international trade and finance by cooperative groups of Tuscan stationary merchants who wrote letters and bills of exchange to one another. The ultimate economic function of these stationary merchants evolved into clearing budding international markets in Western Europe, as liquidity/money between clients traveled through written instruments among bankers, instead of merchants themselves traveling with coins. Today we take corporations like this for granted. But that ultimate function was not the reason for the emergence of international banking in the first place.²³

Tuscan international merchant banks formed in the 1260s through the network transposition and rewiring mechanism that I call “incorporation and detachment” (see Figure 11.2). Pope Urban IV, a Frenchman from the Champagne region, continued his predecessor’s “Italian Crusades” war against the German

²² In contrast, chapters 2–4 in Padgett and Powell (2012) review and develop formal models of autocatalysis. Our point is not to argue that inductive methods are superior to deductive methods in the development of science. Clear science requires both, in dialogue. Our point is merely to insist on the high value of inductive/historical methods, as well as the currently more fashionable deductive/mathematical methods. Our role-model scientist remains Darwin.

²³ “Functionalism” is the explanation of causes from consequences. But that is almost always bad history. In all of our empirical cases, not just this one, the explanation for why something arose turned out to be quite different from the explanation of why it locked in after emergence. The more radical the invention, the more this unanticipated-consequences aspect is present, because true novelty, almost by definition, lay outside the consciousness of those who invented it.

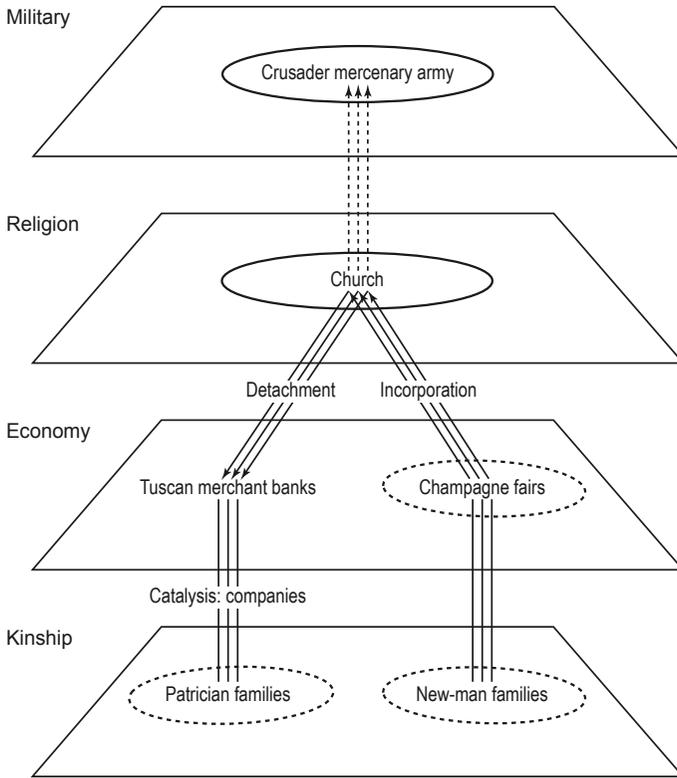


Figure 11.2 Emergence of medieval Tuscan international banking: incorporation and detachment (after Padgett and Powell 2012).

Emperor.²⁴ Pope Urban's state-finance innovation was to reach out to the transient Italian bankers in his hometown Champagne Fairs for long-term loans to pay his French mercenary, Charles of Anjou. Many small-time Italian bankers, really money changers, routinely traveled to and from the Champagne Fairs to finance and float the short-term (2–4 week) transactions (primarily textile sales) that took place there. To support their financial activity, Italian (mostly Genoese²⁵) bankers/money changers developed short-term credit instruments like simple bills of exchange.

Massive state-finance loans required pooling small-scale bankers into syndicates. Long-term loans (~20, 30, 40 years), far beyond the duration they

²⁴ Episodic wars between the Pope and Emperor dated back to the Investiture Controversy of 1095. Pope Urban's predecessor, Pope Alexander IV, had come up with the (religiously dubious) innovation of extending the "Crusade" idea to the "Anti-Christ" Emperor in Germany, beyond its usual target the Muslims in Jerusalem.

²⁵ Despite the numerical preponderance of Genoese money changers at Champagne, Pope Urban IV reached out to Tuscan, not Genoese, bankers not for economic reasons but because Tuscans were Guelf (i.e., politically aligned with the Pope against the Emperor).

were used to, required guarantee of repayment more secure than the Pope's word. The negotiated solution was "incorporation"; namely, to absorb Tuscan bankers into the tax collection machinery of the Church itself, so that they could extract repayment from the source, which were monasteries and dioceses all over Europe. Sitting in the offices of bishops and abbots, Tuscan bankers from Champagne absorbed the long-distance writing and "bureaucratic" administrative techniques of their Church sponsors. The first emergence of medieval international finance, in other words, was a hybridization of short-term mercantile techniques from the transient Champagne Fairs with longer-term administrative techniques of the sedentary Catholic Church—all of which was catalyzed by state finance of the Italian Crusades. One could call this the "marketization" of the Church or perhaps the "bureaucratization" of the market—both are really the same thing.

"Detachment" refers to what happened after the loans of the Crusades were repaid. Had nothing further occurred, Pope Urban's incorporation of the Tuscan bankers into his church would have qualified as an organizational innovation, but not as a systemic "market" invention. Loans would have been repaid, and everybody would have gone home. In historical reality, however, a series of multiple-network spillovers subsequently ensued, leading not just to the Italian Crusades but to a Commercial Revolution in Western Europe, with long-term unanticipated consequences for economic growth.

Figure 11.3 diagrams the subsequent system-level "invention" sequence, triggered by the original organizational state-finance innovation:

- In area (2), Tuscans (first from Lucca then from Florence) convinced the King of England to use their newly developed state-finance services, thereby inventing the English customs tax on wool crossing the English Channel as repayment. Implications for subsequent state centralization in England are enormous.
- In (3) and (4), repayment in wool enticed Florentine customs officials to redirect that wool back home to Florence, in order to develop a wool textile-manufacturing industry there. This became the primary economic employment base of Florence. Flanders, the previous European center of wool manufacturing in Europe, was eclipsed.
- In (5), previously small-time money changers rose in social status because of their newfound association with popes, bishops, and kings. They turned themselves into parvenue "noble" patrilineages, mimicking in family structure their previous feudal superiors. Instead of "company emerging out of family," the typical modernization story, the historical record in this case shows "family emerging out of company."
- Rising parvenue "noble" families in Florence politically allied through major guilds in 1282 to overthrow the previous consular state and establish the first Florentine Republic, governed by an elected city council.

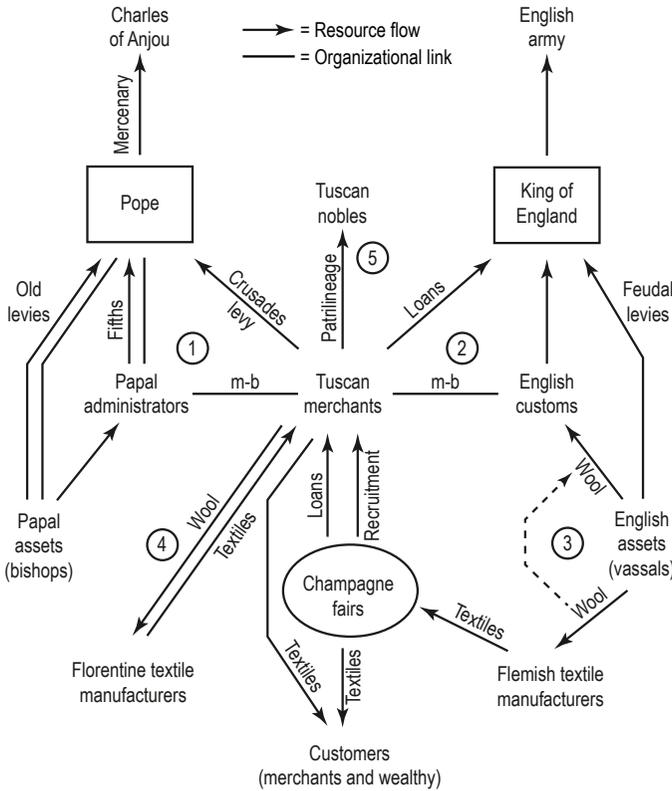


Figure 11.3 Spillover of Tuscan merchant banks into subsequent organizational inventions (after Padgett and Powell 2012).

The political invention of elections was the transposition of guild ways of selecting temporary and rotating leaders up to the city-state level.

The moral of this history, repeated in many other cases in Padgett and Powell (2012), is that the historical invention of novelty in economic organizations and markets is not a matter of endogenous logic within economic markets alone. How economic organizations and markets are situated within their cross-cutting multiple-network trellises of political, kinship, religious, military, and scientific networks shapes the “topology of the possible” evolutionary trajectories latent within them.

If complexity theory and evolutionary theory are to be mobilized in the service of understanding economic institutional change, autocatalysis and multiple networks are the conceptual approaches to analyzing history recommended by Padgett and Powell. Autocatalysis, taken by itself, is the mechanism behind resilience in all forms of life, including economic ones. Multiple-network spillover, in conjunction with the autocatalyses which consolidate it, is the mechanism behind evolvability and speciation.