John F. Padgett and Walter W. Powell, **The Emergence of Organizations and Markets.** Princeton & Oxford: Princeton University Press, 2012. 583 pp.

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This is a big book about a big topic – organizational innovation and invention. The work is panoramic, ranging over a vast array of theory, formal models, and case studies involving networks, markets, hierarchies, political systems, and still other complex organization forms. Sociology books this major come along only a few times in a human generation – and a case can be made that the last book of comparably far-reaching significance containing substantial mathematical sociology content was Coleman (1990). That work was fueled by a rational choice perspective on social phenomena, which the Padgett & Powell volume (P&P) is not.

In a world where established institutions often reward narrow projects, one should applaud P&P's grappling with a truly major, multifaceted, enormously messy puzzle – how socio-organizational innovation gets started and why, in a few cases, it sets off irreversible changes in a far larger social order. This problem is profoundly important in a world brimming with institutional ossification, worldwide, offset by a few bright spots of organizational openness and constructive change (among them, the biotech industry, at least early on). To a surprising extent, this problem is also a neglected one. P&P (p. 434) likens much social scientific work on institutions, eliding processes of innovation and invention, to a play that begins with the second act.

Significant flaws in P&P's intellectual architecture need to be noted at the outset. In many ways P&P is a group product (7 of 18 chapters are by Padgett and/or Powell alone; 6 are essays not coauthored by either, involving 13 other people) and exhibits the associated limitations. At close to 600 pp. (densely printed with two columns per page), P&P is also far too sprawling, often repetitive, and in need of drastic condensation and streamlining. If ever a sociology treatise needed a user's manual, P&P is it – and, in a Google-powered world of "skimmers," many potentially interested audiences are likely to shy away from engaging with P&P's numerous complex, nuanced, insightful lines of argument. That would be unfortunate for a work over 20 years in gestation. As a practical matter, there is need for a roadmap of key passages, few in number. Otherwise P&P is likely to remain next-to-impenetrable, with audiences falling back on capsule summaries.

<u>Roadmap of highlights</u>

P&P may be envisioned as four works packaged as one. Book 1 (pp. 1-29, 566-70) is an ambitious conceptual framework for thinking about organizational genesis and "emergence." Analysis starts by distinguishing (p. 5) between "innovation" (=improved way of doing something) and "invention" (=change in the ways things are done; see p. 9 for elaboration of this distinction from an autocatalysis viewpoint). Confusingly, this P&P usage inverts widespread usage of these terms (see P&P, p. 5).

Extending Padgett and Ansell's much-cited 1993 analysis of the Medici, p. 12 lists 8 mechanisms, qualitatively described, that may give rise to organizational genesis triggering innovation (which may in turn, through catalysis, become invention). This list, and the underlying analysis, represents a genuine advance over general systems or cybernetics motifs popular in the '50s and '60s, while retaining some of their appealing features. However, there is enough heterogeneity here to make one wonder what criteria of judgment hold the list of 8 together (e.g., the first entry is "Transposition and refunctionality"; another is "Purge and mass mobilization"). Positing that this list has potential to be extended, which extensions would preserve its spirit versus dissipating it? Despite a sprinkling of acute insights (e.g., p. 2: "In the short run, actors create relations; in the long run, relations create actors"), Book 1's discussion of these 8 mechanisms is not as clear and crisp as one would hope. Some of the clearest statements are actually located elsewhere (e.g., for the second mechanism, "Anchoring diversity," see p. 439 on anchor tenants).

The phenomena being tackled here are fundamentally dynamic systems ones, yet are being discussed on pp. 12ff. in verbal, not mathematical, terms. Given the level of "general theory" clearly being sought (e.g., one capable of providing a unified lens on diverse historical cases) such reliance on verbal exposition is perhaps unavoidable. However, achieving genuine clarity by this path is enormously tricky, for many of the same reasons that Keynes faced long ago. Keynes' *General Theory* actually faced a simpler task than P&P, since his subject matter was economics, not social dynamics cutting broadly across the Weberian value-spheres. Without first reading the case studies developed in later P&P chapters, many readers may have difficulty grasping exactly what constitutes the active ingredient of a particular mechanism. Plainly aware of this challenge, P&P make major use of diagrams (16 in Chapter 1 alone) in explaining their mechanisms. Their figures are generally helpful though often too schematic, thereby highlighting a difficult expository challenge that requires delicate titration of explanation and clutter-avoidance (Tufte, 1997).

Book 2 (pp. 31-114) focuses on models inspired by autocatalysis in chemistry, building on Eigen and Schuster's hypercycles work. A key result is that spatially constrained interactions may be conducive to emergence of complex technologies in a way that unstructured interactions aren't. This is, at the very least, a fine antidote to facile "death of distance" rhetorics in the globalization literature – and, more concretely, a possible source of important insight into spatial clustering tendencies widely observed in hitech communities. Book 2's focus reflects Padgett's creativity as a model-builder. The models, which are agent-based rather than classically mathematical, are carefully developed (e.g., p. 79 reports steps to confirm that the Hofbauer-Sigmund complexity barrier persists in Padgett's agent-based formalism). Importantly, there is a major effort to develop the models in directions that, transcending the formalism's roots in chemistry, engage with some of the distinctive features of human societies (among them, language and group names). The texture of these models (though not their specific substance) contains echoes of classic work of Jim March and coworkers on "garbage can" organizational choice (key parts

of which are likewise agent-based), though the flavor of paradox that looms so large in that earlier work is largely lacking in P&P. Above all, Book 2 holds welcome promise of fresh and imaginative frontiers for mathematical sociology.

At the same time (and again reminiscent of garbage can models) the Book 2 models remain too stylized to bear major applications weight. They are more inspirational than practical. The point is illustrated by Book 2's suggested tie-in to blockmodels (p. 113), which neglects the basic fact that blockmodels have a track record of shedding light on a wide range of complex *empirical* network datasets, whereas the Book 2 models have no such demonstrated capability. While Book 2 touches on numerous application topics (e.g., cities; playgrounds; primate kinship) treatment is often fleeting, uncoordinated with the thrust of the major institutional case studies later in P&P. Especially in light of P&P's recurring emphasis on the roles of biographical, career, and related population processes in "locking in" organizational innovation (e.g., pp. 11, 172, 268, 272, etc.), one would like see development of connections between the Book 2 formal models and traditions of formal demography and other population modeling (e.g., the Blau space concept pioneered by McPherson and Ranger-Moore, 1991).

Some of Book 2's less technical insights – e.g., alerting readers to reasons for the importance of multiple types of networks plus networks as vehicles for trans-formation, not just transmission – may be among its most useful "take home" lessons. Pp. 88-89 musters four general principles distilled from the formalism (among them, counterintuitively useful roles for "parasites" [defined on p. 78]). Because of its care in differentiating social from chemical networks, Book 2 also usefully challenges network science agendas that play up "one size fits all" ap-proaches to analyzing physical, biological, computer, social, and other networks (e.g., as contrasted with Simmelian or other distinctively sociological approaches to social network analysis).

Book 3 (pp. 115-373) is a set of case studies of major institutional change. Any evaluation of a book like P&P should focus heavily on the quality of the applications. The sheer diversity and heft of the case studies here raises enormously complicated and multifaceted issues of evaluation and comparison. Two basic questions are whether Book 3's case studies tangibly build on, first, Book 1's conceptual and, second, Book 2's modeling material. On the modeling side, the answer – unfortunately – is largely not. A basic P&P lacuna is absence of any explicit agent-based modeling applications in Book 3's case studies (importantly including the Florentine one). Such models need to be supplied for Books 1-3 to deliver on promise as an analytical package. A positive spin on this criticism is that there might be room here for future contributions as seminal as Schelling's famous agent-based model of housing segregation.

On the conceptual side, the verdict is more mixed and involves judgment calls foreshadowed by the fine title theme of Shubik (1987). Probably Book 3's most well-supported case studies, building on years of work by Padgett, are the two on

medieval plus Renaissance Italy. Pp. 178-192 is a key passage of manageable length which should be perused to draw one's own conclusions, up or down, regarding the specific value-added of an autocatalytic network viewpoint in one major case study. But the Dutch Revolt and Bismarck stories are also rich and well-told. A further case study, sole-authored by Padgett, concerns the politics of Communist economic reform focusing on Stalin, Mao, Deng Xiaoping, and Gorbachev. This work – grounded in Padgett's thoughtful nonspecialist reading of secondary sources (unfortunately Ezra Vogel's masterly 2011 biography of Deng Xiaoping seems to have appeared too late to be cited) – is a provocative, insightful synthesis. It shares with Eyal et al. (1998) a broadly structuralist perspective, but is otherwise so different from their Bourdieu-inspired approach as to invite in-depth future comparison with their analysis. A basic question is whether Padgett's analysis of Communist societies truly needs the larger chemistry-inspired autocatalysis framework – or whether as much (or more) light might be shed by building on previously extant strands of modeling, possibly in a new amalgam crafted, say, from organizational failure, dual hierarchy, social network structure, game theory, and demography literatures).

From a different angle, there is also intriguing potential for cross-fertilization between many of P&P's case studies and the area sometimes known as "grand strategy" (Liddell Hart, 1967, pp. 335-36). There is substance in Book 3 that might help propel grand strategic thinking to levels of depth beyond what the international relations field (its more usual anchor) typically offers, in part because of P&P's deeper engagement with actor identity plus network questions. In a 21st century world abounding in influential non-state actors of many kinds, this direction merits exploration.

Book 4 (pp. 375-565) is an additional set of major case studies geared around hitech (primarily biotech; some information technology). There is outstanding empirical work here, reflecting Powell's flair for in-depth sociological industry case studies (e.g., the profiles of pioneering biotech companies; analysis of nascent biotech clusters that failed to take off; analysis of the evolving elite "core" of the biotech organizations network, 1984-2002). The two basic analytical integration questions suggested in evaluating Book 3 arise here too. A short answer to one of them is that Book 4 connects with Book 2 via one specific agent-based model (pp. 500ff.), exploring whether or not science labs pursue patenting practices. This is not as much tie-back as one might wish, but avoids a "magic zero." Connectivity to the Book 1 framework is stronger, pivoting on a concept of "amphibious scientist-entrepreneur" (see also Fig. 13.1, identifying autocatalytic flows when science, commerce, and finance meet in biotech). Book 4 involves greater use of network analysis technical tools than does Book 3 (e.g., k-core decompositions [Moody and White, 2003]). There is also some effective network visualization. The pp. 393-94 adaptation of blockmodeling illustrates how even "low-tech" versions of network analysis, deftly applied, can sometimes shed useful light.

Albeit in strikingly different ways, Books 1-4 each represent advances in the state-of-the-art – and, to repeat, it is difficult to envision a more worthy set of

analytical targets. Mention should also be made of the many thoughtful excursuses and general observations scattered throughout P&P (sometimes in footnotes). See, e.g., p. 140: "other times and places may not parse 'the economic,' 'the political,' and 'the social' as we do." Or p. 439: "The more an idea or activity is multipurpose, the more perspectives from which it can be judged inferior." A key question running throughout P&P is the nature of the value-added provided by the "autocatalytic networks" framework: is it mainly useful as a heuristic stimulus to the research imagination; or is it more operational in a scientific sense (as are many of the structural tools of network analysis deployed in Book 4)? One focus for further reflection on this question is P&P's Amsterdam Bourse comments (p. 224), invoking "parasite" themes in hypercycle modeling to suggest that economic analysis tends to overstate free-rider and "cheating" problems.

The Harrison White connection

As noted in P&P front material – and symbolically expressed by P&P's dedication to Harrison White – both P&P and White (1992) have common roots in a seminar White and Padgett cotaught at Harvard in the 1980s. Although the research directions that emerged from this teaching collaboration developed in very different ways (and largely independently of one another), an informative perspective on P&P is as the "separated-at-birth" twin of Harrison White's identity-&-control (I&C) initiative (White, 1992, 2008, 2011 [the latter providing important new scholarly apparatus clarifying White's work]). It seems fitting that this Harrison White connection should be noted here. White's earliest sociology publication (coauthored with Vilhelm Aubert) was published in *Acta Sociologica* in 1959-60, a two-part essay exploring the sociology of sleep – an unconventional but remarkably rich topic, whose development in their essay presciently staked out intellectual terrain having resonance with both White's far later I&C work and themes of the 2010 film *Inception*.

These common roots suggest that understanding either P&P or I&C may be facilitated and deepened by familiarity with the other – and that further insight might flow from reconnecting them. One way that I&C can contribute to furthering P&P's research agenda is by providing a suite of concepts, having deep roots in sociology, that harmonize with that agenda yet are not so tightly bound to its master theme of multiple-network autocatalysis derived from chemical analogy. Beyond "identity" and "control," those concepts include White's three "disciplines" (mobilizer, arena, interface); three sources of social structure (institutions, networks, styles [Boorman, 2011]); "stories & story-sets" (bringing in human language); plus three additional multipurpose concepts (structural equivalence, coupling/decoupling, switching). Careful reading of P&P reveals instances of each of these concepts in action (often under other names), but much more could be done to develop their systematic application to P&P's subject matter, thereby broadening P&P's conceptual base in ways that don't necessitate bringing everything back to autocatalysis.

Conversely, P&P can offer I&C a focused analytical target the latter has lacked, pivoting on the problem of organizational innovation-cum-invention. This focus could help I&C avoid endemic tendencies of general sociology to become overbroad and diffuse. In addition, P&P offers a suite of major case studies to serve as a test-bed for further development and harmonization of White's I&C concepts. Illustrating the need, the most detailed historical example in White (1992) is a skeletal five pages on the Norman Conquest – scarcely on a par with what P&P provides.

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Standing back from details, it is worth suggesting that there is a counterpart in science to the fundamental military concept of "strategic exploitation of tactical success." Difficult as achieving tactical success may be, strategic exploitation is often harder still. In a scientific domain P&P achieves a variety of tactical successes. Strategic exploitation of those successes remains a task for the future, one that will also do much to clarify where the enduring parts of the P&P research initiative reside. To accomplish this, it is crucial to maintain research momentum, while also exercising judgment in navigating between overly expanding the research agenda (where White's existing I&C work probably overshoots) and unduly constricting it (which is a reason much valuable work by historians often falls short of its intellectual potential for sociology). In implementing the agenda, it seems unnecessary, indeed counterproductive, to keep producing huge books. In particular, in the case of P&P there is need for a far more accessible writeup of no more than, say, 75 pp.

In both P&P and White's work, advancing the relevant research agenda would ideally draw on at least four distinct (if overlapping) analytical traditions and skill-sets: formal modeling; historical analysis; organizational analysis; and strategic analysis (the latter centering on search for strategic principles to guide those, like Bismarck historically or some of the biotech pioneers, who seek to operate to best advantage in a complex tangle of autocatalytic networks prototyped on P&P's Fig. 3.1). Combining those four analytical strands is a task worthy of a new variety of what P&P (p. 375) call "amphibious" scientists. Finding (or developing) the necessary research personnel to do this demanding work is a task on which prospects for success of the coming generation of research will importantly pivot.

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